

# **SACRED HEART COLLEGE (AUTONOMOUS)**

## **Department of Aquaculture**

**MASTER OF AQUACULTURE AND FISH PROCESSING**

**Course plan**

**Academic Year 2018-19**

**Semester I**

**COURSE :- 1 16P1AQCT01: TAXONOMY & BIOLOGY OF COMMERCIAL AND CULTIVABLE FIN  
FISH AND SHELL FISH**

PROGRAMME	MASTER OF AQUACULTURE & FISH PROCESSING	SEMESTER	1
COURSE CODE AND TITLE	16P1AQCT01: TAXONOMY & BIOLOGY OF COMMERCIAL AND CULTIVABLE FIN FISH AND SHELL FISH	CREDIT	4
HOURS/WEEK	4	HOURS/SEM	72
FACULTY NAME	LEENA RAPHAEL & SANGEETHA.K.R.		

**Programme Outcome**

<b>Programme Outcome</b>	
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.

## MASTER OF AQUACULTURE AND FISH PROCESSING

PROGRAM SPECIFIC OUTCOMES	
PSO 1	Understand the taxonomy and biology of cultivable fin fishes and other organisms.
PSO 2	Understand the ecology and cultural practices of cultivable fin fishes, shell fishes, sea cucumber, seaweeds and various engineering principles applied to aquaculture structures.
PSO 3	Understand the harvest and post-harvest technology of aquaculture organisms.
PSO 4	Demonstrate their awareness of the Nutrition, physiology and pathology of aquaculture organisms.
PSO 5	Apply of statistical and computer tools in relevant research field pertaining to aquaculture.

### COURSE OUTCOMES

	COURSE OUTCOMES	PO/ PSO	CL
CO 1	Identify the commercially important fin fish and shell fish through taxonomic studies and their distribution in Indian waters	PO4, PSO1	Analyze
CO 2	Understand the structural , functional and physiological features of digestive system and associated glands in fin fishes and shell fishes	PO4 PSO1	Analyze
CO 3	Determine food and feeding habits of fin fish and shell fish	PO4 PSO1	Analyze
CO 4	Understand the structural and functional features of circulatory system in fin fishes and shell fishes	PO4 PSO1	U
CO 5	Understand the structural , functional and physiological features of respiratory system and accessory organs in fin fishes and shell fishes	PO4 PSO1	U
CO 6	Understand the structure , function and role of excretory organs in osmoregulation of fin fishes and shell fishes	PO4 PSO1	U
CO 7	Understand the structure and function of nervous system and endocrine system in fin fishes and shell fishes	PO4 PSO1	U
CO 8	Understand the structure and function of reproductive system in fin fishes and shell fishes	PO4 PSO1	U

CL\* Cognitive Level

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	PO 6	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1		2					3				
CO 2				1			3				
CO 3	2						3				
CO 4							3				
CO 5				1			3				
CO6				1			2				
CO7				1			2				
CO8				1			3				

### Mapping Strength

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

SESSION	TOPIC	LEARNING RESOURCES	VALUE ADDITIONS	COURSE OUTCOME
<b>MODULE I-Morphology and Taxonomy of fin fish and shell Fish</b>				
	MODULE I			
1	Study of external morphology of a typical elasmobranch	PPT	video	CO 1
2	Study of external morphology of a typical teleost	PPT/Lecture		CO 1
3	Study of external morphology of a typical bivalve	PPT/Lecture		CO 1
4	Study of external morphology of a typical gastropod	PPT/Lecture	e-resource	CO 1
5	Study of external morphology of a typical cephalopod.	PPT/Lecture		CO 1
6	Study of external morphology of a typical prawn	PPT/Lecture		CO 1
7	Study of scales	Lecture		CO 1
8	Study of skin	Lecture		CO 1
9	Study of teeth	Lecture		CO 1
10	Study of mouth	Lecture		CO 1
11	Study of fins	PPT/Lecture		CO 1
12	Uses of scales ,skin, teeth ,mouth &fins in taxonomy of fin fishes	PPT/Lecture		CO 1

13	Taxonomy of commercially important Penaeid species	PPT/Lecture		CO 1
14	Taxonomy of commercially important Metapenaeid species	PPT/Lecture		CO 1
15	Taxonomy of commercially important fresh water prawn species	PPT/Lecture		CO 1
16	Taxonomy of commercially important fin fishes of family - Clupeidae	PPT/Lecture		CO 1
17	Taxonomy of commercially important fin fishes of family - Engraulidae	PPT/Lecture		CO 1
18	Taxonomy of commercially important fin fishes of family:- Serranidae( grouper)	PPT/Lecture		CO 1
19	Taxonomy of commercially important fin fishes of family:- Percidae( perch)	PPT/Lecture		CO 1
20	Taxonomy of commercially important fin fishes of family:- Cyprinidae	PPT/Lecture		CO 1
21	Taxonomy of commercially important fin fishes of family: Pangaciidae	PPT/Lecture		CO 1
22	Taxonomy of commercially important fin fishes of family: Siluridae	PPT/Lecture		CO 1
23				
24	Taxonomy of commercially important fin fishes of family:Soleidae	PPT/Lecture		CO 1
25	Taxonomy of commercially important fin fishes of family:Cyanoglosidae	PPT/Lecture		CO 1
26	Taxonomic features of different lobsters	PPT/Lecture		CO 1
27				
28	Taxonomy of commercially important fin fishes of families of the orders: Scyllaridae	PPT/Lecture		CO 1
29	Taxonomy of commercially important fin fishes of families of the orders:Portunidae	PPT/Lecture		CO 1
<b>MODULE II-Biology of finfishes and shell fishes</b>				
30	Structure and function of digestive system of fish	PPT/Lecture		CO 2
31	Physiology of digestive system and associated glands in fish	Lecture		CO 2
32	Structure and function of digestive system in shrimp and physiology of digestive system	Lecture		CO 2
33	Food and feeding habits of shrimp	Lecture		CO 3
34	Structure and function of respiratory system in fishes	Lecture		CO 5
35	Structure and function of respiratory system in shrimp	PPT/Lecture		CO 5
36				
37	Circulatory systems of shrimp : Structure and function	PPT/Lecture		CO 4
38	Blood, blood cells, plasma, plasma proteins in fishes	PPT/Lecture		CO 4
39	Excretory system of fish : structure and functions,	Lecture		CO 6

40	Excretory system of shrimp : structure and functions,	Lecture		CO 6
41	Nervous system in fishes	Lecture		CO 7
42	Structure and function of endocrine glands in fishes	Lecture		CO 7
43	Role of hormone in relation to reproduction in fishes	PPT/Lecture		CO 7
44	Structure and function of reproductive systems of fin fishes	PPT/Lecture		CO 7
45	Role of hormone in relation to reproduction in prawns	PPT/Lecture		CO 7
46	Structure and function of reproductive systems of fin fishes			CO 8
47	Neurosecretory cells in crustaceans	PPT/Lecture		CO 7
48	Neurohaemal organs in shrimp	PPT/Lecture		CO 7
49	True endocrine organs in shrimp	PPT/Lecture		CO 7
50	Sense organs in shrimp	Lecture	Quiz	CO 7
51	Structure of exoskeleton in shrimp	Lecture	Q & Ans Session	CO 1
52	Molting and its steps	PPT/Lecture		CO 8
<b>MODULE III-Distribution of commercially important finfish and shell fish in Indian waters</b>				
53	Definition of mud banks, wedge bank and parr. Upwelling and its importance to fisheries.	PPT/Lecture		CO 8
54	Distributional shifts of fishery stock	PPT/Lecture		CO 7
55	Climate change and its effects on fisheries	PPT/Lecture		CO 7
56	Seminar	Lecture	Q & Ans Session	
57	Seminar	PPT/Lecture	Q & Ans Session	
58	Seminar	PPT/Lecture	Q & Ans Session	
CIA II				
59	Seminar	PPT/Lecture	Q & Ans Session	
60	Seminar	PPT/Lecture	Q & Ans Session	
61	Seminar	PPT/Lecture	Q & Ans Session	
62	Seminar	PPT/Lecture	Q & Ans Session	
63	Seminar	PPT/Lecture	Q & Ans Session	
64	Seminar	PPT/Lecture	Q & Ans Session	
65	Seminar	PPT/Lecture	Q & Ans Session	
66	Seminar	PPT/Lecture	Q & Ans Session	

67	Seminar	PPT/Lecture	Q & Ans Session	
68	Seminar	PPT/Lecture	Q & Ans Session	
69	Seminar	PPT/Lecture	Q & Ans Session	
70	Seminar	PPT/Lecture	Q & Ans Session	
71	Seminar	PPT/Lecture	Q & Ans Session	
72	Seminar	PPT/Lecture	Q & Ans Session	

### INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines

	Topic of Assignment & Nature of seminar (Individual – Presentation )	Course Outcome
1	Lateral line system of fish	CO 7
2	Mechanism and biology of neuron co-ordination	CO 7
3	Hermaphroditism	CO 8
4	Eyestalk ablation	CO 8
5	Defence mechanism and healing in fishes	CO 7
6	Adaptive modification of digestive tract in fishes	CO 2
7	Structure and function of reproductive system in fishes	CO 8
8	Parental care in fishes	CO 8
9	Accessory respiratory organs in fishes	CO 5
10	Digestive system of bivalves	CO 2
11	Osmoregulation in marine fishes	CO 7
12	External morphology of a typical crab	CO 1
13	External morphology of a typical lobster	CO 1
14	Gametogenesis	CO 8
15	Spermatogenesis	CO 8
16	Nervous system in prawn	CO 7
17	Upwelling and its importance in fisheries	CO 8
18	Climate change and its impact in fisheries	CO 7
19	Food and feeding habit of fishes	CO 3

### References

1. J.R.Norman & W.P.C.Tenison.1963 History of fishes. Asian Publishing House ,Delhi
2. Munro I.S.R.(1982) The Marine and Fresh water fishes of India and Ceylon. Sony Reprints Agency, New Delhi.
3. Santhosh Kumar AND Manju Tembhe(1996)Anatomy and Physiology of fishes .Vikas Publishing co.

**4. Kotpal Mollusca**

**5. Kotpal Arthropodaschool manual-ICAR CIFT**

**Web resource references:**

<http://www.fao.org/3/w7192e/w7192e00.htm>

<https://www.biologydiscussion.com/invertebrate-zoology/phylum-arthropoda/study-notes-on-prawn/33417>

<http://www.biozoomer.com/2014/11/palaemon-respiratory-system.html>



**COURSE 2:- 16P1AQCT02: BIOPHYSICS, INSTRUMENTATION, MICROTCHNIQUES AND  
RESEARCH METHODOLOGY**

PROGRAMME	MASTER OF AQUACULTURE & FISH PROCESSING	SEMESTER	1
COURSE CODE AND TITLE	16P1AQCT02: BIOPHYSICS, INSTRUMENTATION, MICROTCHNIQUES AND RESEARCH METHODOLOGY	CREDIT	4
HOURS/WEEK	4	HOURS/SEM	72
FACULTY NAME	Dr.Jose Joseph		

**Programme Outcome**

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

	COURSE OUTCOMES	PO/ PSO	CL
CO 1	Understand the principles and operation of octoelectric equipment's in biological research	PO1 PSO2	U
CO 2	Create information on biophysics and instrumentation as applied to aquaculture	PO1 PSO1,PSO2	U
CO 3	Evaluate detailed anatomic studies with the help of micro techniques	PO1 PSO2	E
CO 4	Understand the basic principles of physiology as applied to aquaculture systems	PO4 PSO2	U
CO 5	Understand introduction to research methods as a prelude to research work at higher level.	PO1 PSO2	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	PO 6	PSO 1	PSO 2	PSO 3	PSO 4	PSO 5
CO 1	2										
CO 2	2						3	2			
CO 3	1							1			
CO 4				1				3			
CO 5	1							2			

### Mapping Strength

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

SESSION	TOPIC	LEARNING RESOURCES	VALUE ADDITIONS	COURSE OUTCOME
<b>MODULE I-Diffusion and Osmosis</b>				
1.	Diffusion, Kinetics of diffusion	PPT	video	CO 2, CO 4
2.	Concentration gradient and Fick's Law	PPT/Lecture		CO 2
3.	Diffusion coefficient	PPT/Lecture		CO 2
4.	Stocks-Einstein Equation	PPT/Lecture	e-resource	CO 2
5.	Electrical gradient & pressure gradient	PPT/Lecture		CO 2
6.	Graham's Law & Vant Hoff's Law	PPT/Lecture		CO 2
7.	Gibbs-Donnam equilibrium	Lecture		CO 2
8.	Facilitated diffusion , Osmosis	Lecture		CO 2, CO 4
9.	Seminar	PPT/Lecture	Q.A.	
10.	Seminar	PPT/Lecture	Q.A.	
11.	Osmotic concentration and osmotic pressure	PPT/Lecture		CO 2,CO 4
<b>Module II –Biophysics of cell membrane</b>				
12.	Physical and chemical properties of cell membrane	PPT/Lecture		CO 2,CO 4
13.	Conformational properties of membrane	Lecture		CO 2,Co 4
14.	Membrane receptors	Lecture		CO 2,CO4
15.	Factors affecting the passage of materials across cell membranes	Lecture		CO 2,CO4
16.	Seminar	PPT/Lecture	Q.A.	
<b>Module III- Instrumentation</b>				
17.	Calorimetry	Lecture		CO1 ,CO 2
18.	Mas spectroscopy	Lecture		CO1 ,CO 2
19.	Spectrophotmeter (infrared and double beam)	PPT/Lecture		CO1 ,CO 2
20.	pH meter & Oxygen probe	PPT/Lecture		CO1 ,CO 2
21.	Seminar	PPT/Lecture		
22.	Conductivity meter	PPT/Lecture		CO1 ,CO 2
23.	Salinometer and refractometer	PP T/Lecture		CO1 ,CO 2
24.	LC- MS	PPT/Lecture		CO1 ,CO 2
25.	Mas spectroscopy	PPT/Lecture		CO1 ,CO 2
<b>Module IV –Protein purification</b>				
26.	Chromatography	Lecture		CO1 ,CO 2
27.	Seminar	PPT/Lecture	Q.A.	
28.	Ion exchange chromatography	Lecture		CO1 ,CO 2
29.	Affinity chromatography	Lecture		CO1 ,CO 2
CIA I				
<b>MODULE IV-Protein purification</b>				
30.	Adsorption chromatography	PPT/Lecture		CO1 ,CO 2
31.	Partition chromatography	PPT/Lecture		CO1 ,CO 2
32.	Seminar	PPT/Lecture	Q.A.	

33.	Seminar	PPT/Lecture	Q.A.	
34.	Seminar	PPT/Lecture	Q.A.	
35.	Seminar	PPT/Lecture	Q.A.	
<b>Module V- Electrophoresis</b>				
36.	General principles of electrophoresis	PPT/Lecture		CO 2
37.	Different gel materials used for electrophoresis	PPT/Lecture		CO 2
38.	Isoelectric focusing	Lecture		CO 2
<b>Module VI-Microscopy</b>				
39.	Principles of microscopy	Lecture		CO 2
40.	Bright field microscopy	PPT/Lecture		CO 2
41.	Dark field microscopy	Lecture		CO 2
42.	Phase contrast microscopy	Lecture		CO 2
43.	Seminar	PPT/Lecture	Q.A.	
44.	Seminar	PPT/Lecture	Q.A.	
45.	Fluorescence microscopy	PPT/Lecture		CO 2
46.	Microphotography	PPT/Lecture		CO 2
47.	Electron micrograph	PPT/Lecture		CO 2
48.	Principles of electron microscopy		PPT/Lecture	CO 2
49.	Ultra structure studies using electron microscopy	Lecture	Quiz	CO 2
50.	Fixation of invertebrate tissues and organs	PPT/Lecture		CO 3
<b>Module VII-Microtechniques</b>				
51.	Fixation of vertebrate tissues and organs	PPT/Lecture		CO 3
52.	Dehydration methods	PPT/Lecture		CO 3
53.	Embedding, clearing and sectioning	PPT/Lecture		CO 3
54.	Staining of sections	Lecture		CO 3
55.	Preparation of whole mounts	PPT/Lecture		CO 3
56.	Fixation and processing of tissues for electron microscopy studies	PPT/Lecture		CO 3
57.	Seminar	PPT/Lecture	Q.A.	
58.	Preparation of permanent slide	PPT/Lecture		CO 3
CIA II				
<b>Module VIII-Research methodology</b>				
59.	Meaning and importance of research	PPT/Lecture		CO 5
60.	Types of research-selection	PPT/Lecture		CO 5
61.	Different research designs, concepts relating to research design.	PPT/Lecture		CO 5
62.	Analysis of literature review, primary and secondary sources,	PPT/Lecture		CO 5

	web sources-critical literature reviews			
<b>Module IX- Data Collection and Analysis</b>				
63.	Selection of appropriate methods of data collection, data preparation, important steps	PPT/Lecture	Video	CO 5
<b>Module X-Interpretation and report writing</b>				
64.	Meaning of interpretation, techniques of interpretation, and precautions in interpretation	PPT/Lecture		CO 5
65.	Significance of report writing, different steps in report writing. Types of reports; technical and popular	Lecture	Debate	CO 5
66.	Lay out of research reports, preliminary pages, main text, and end matter. Reproduction of published materials-plagiarism-citation and acknowledgement, reproducibility and accountability.	Lecture		CO 5
67.	Seminar	PPT/Lecture	Q.A.	
68.	Seminar	PPT/Lecture	Q.A.	
69.	Seminar	PPT/Lecture	Q.A.	
70.	Seminar	PPT/Lecture	Q.A.	
71.	Seminar	PPT/Lecture	Q.A.	
72.	Revision			

#### INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines

	<b>Topic of Assignment &amp; Nature of assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc)</b>	<b>Course Outcome</b>
1	Permeability of membranes.	CO 4
2	Biological significance of osmoregulation.	CO 4
3	Types and techniques of electrophoresis.	CO1 ,CO 2
4	Acoustic and electronic equipment used for behavioral studies	CO 1
5	Properties of cell membrane.	CO 4

6	Protein purification.	CO 2
7	Methods and processing of tissues for electron microscopy.	CO 3
8	Methods of fixing tissues.	CO 3
9	Collection and analysis of data.	CO 5
10	Fluid mosaic model.	CO 2
11	Different types of microscopic techniques.	CO 2
12	UV- visible spectrophotometer with emphasis on the parts of the instrument.	CO 2
13	Histochemical stains for differentiation and location of macromolecules in cells.	CO 3
14	Principle and application of gel filtration chromatography.	CO 1, CO 2
15	Procedures of permanent slide preparation.	CO 2
16	Principle and working of HPLC.	CO 1, CO 2
17	Design and problems of research.	CO 5
18	SDS PAGE	CO 1 ,CO 2
19	AAS	CO 1,Co 2

## References

- 1. Roy.A.N.1996.A text book of Biophysics, New Central Book agency pvt.Lts.Calcutta.
- Das,D. 1991.Biophysics and Biophysical Chemistry .Academic Publishers, Calcutta.
- Hoppe, et.al.(Eds.)Biophysics. Springer Verlag,Berline

## Web resource references:

1. [http://www.ewingdigital.com/text\\_content/115875395635e9fee6bc8286.pdf](http://www.ewingdigital.com/text_content/115875395635e9fee6bc8286.pdf)

**COURSE 3:- 16P1AQCT03: BIOSTATISTICS AND COMPUTER APPLICATIONS**

<b>PROGRAMME</b>	<b>MASTER OF AQUACULTURE AND FISH PROCESSING</b>	<b>SEMESTER</b>	<b>1</b>
<b>COURSE CODE AND TITLE</b>	<b>16P1AQCT03: BIOSTATISTICS AND COMPUTER APPLICATIONS</b>	<b>CREDIT</b>	<b>4</b>
<b>HOURS/WEEK</b>	<b>4</b>	<b>HOURS/SEM</b>	<b>72</b>
<b>FACULTY NAME</b>	<b>Krishna Iyer and Tressa Shybe</b>		

**Programme Outcomes**

	<b>Programme Outcomes</b>
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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**MASTER OF AQUACULTURE AND FISH PROCESSING**

	<b>PROGRAMME SPECIFIC OUTCOMES</b>
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

	COURSE OUTCOMES	PO/ PSO	CL
CO 1	Application of statistical tools for experimental practices	PO1,PSO5	An
CO 2	Basic awareness on statistical tools in research and analysis of biological phenomenon	PO1,PSO5	An
CO 3	Computer knowledge are imparted as applicable to aquaculture practices	PO2,PSO5	An
CO 4	Computer knowledge at preliminary level for further studies	PO2,PSO5	U
CO 5	Appropriate use of internet and communication system	PO5,PSO5	U
CO 6	Sampling methods useful in estimation of marine fish landings	PO5,PSO5	U

#### CL\* Cognitive Level

- 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	2									3
CO 2	2									3
CO 3		2								3
CO 4		2								3
CO 5					2					3
CO 6					2					3

### Mapping Strength

0 - No Mapping strength

1 -Low

2 - Medium

3 - High

SESSI ON	TOPIC	LEARNING RESOURCES	VALUE ADDITIONS	COURSE OUTCOME
<b>MODULE I –Collection, compilation and analysis of the data</b>				
1	Primary and secondary data- formation of length and weight frequency distribution	PPT		CO 1, CO 2
2	Absolute and relative measures of dispersion.	PPT/Lecture		CO 1, CO 2
3	Mean deviation and standard deviation.	PPT/Lecture		CO 1, CO 2
<b>Module II-Correlation and regression analysis</b>				
4	Scatter diagram	PPT/Lecture		CO 1, CO 2
5	Karl Pearson's coefficient of correlation-	PPT/Lecture		CO 1, CO 2
6	Spearman's Rank Correlation coefficient	Lecture		CO 1, CO 2
7	Coefficient of determination	Lecture		CO 1, CO 2
8	Regression analysis	Lecture		CO 1, CO 2

9	Linear regression equations and their uses	Lecture		CO 1, CO 2
10	Length –weight relationship	PPT/Lecture		CO 1, CO 2
11	Von Bertalanffy growth equation	PPT/Lecture		CO 1, CO 2
<b>Module III-Probability and theoretical distribution</b>				
12	Frequency approach and Axiomatic approach to probability	Lecture		CO 1, CO 2
13	Mutually Exclusive and independent events	Lecture		CO 1, CO 2
14	Addition and Multiplication theorems	Lecture		CO 1, CO 2
15	Binomial and Poisson distribution	Lecture		CO 1, CO 2
<b>Module IV-Statistical quality control</b>				
16	Process control and product control	Lecture		CO 1, CO 2
17	Control chart for variables and attributes	Lecture		CO 1, CO 2
18	Mean and range charts	Lecture		CO 1, CO 2
19	Fraction defective chart	Lecture		CO 1, CO 2
20	('p' chart) and 'c' charts	Lecture		CO 1, CO 2
<b>Module V- Theory of sampling and interference</b>				
21	Null and alternative hypothesis	PPT/Lecture		CO1,CO 2
22	Two types of errors in testing of hypothesis	Lecture		CO1,CO 2
23	Large and small sample tests	Lecture		CO 6
24	Z' test	Lecture		CO 6
25	't' test	Lecture		CO 6

26	X <sup>2</sup> test	Lecture		CO 6
27	F-test	Lecture		CO 6
28	Analysis of variance Techniques	Lecture		CO 6
29	Revision			
<b>CIA I</b>				
<b>MODULE V-Theory of sampling &amp; interference</b>				
30	Single factor – ANOVA	Lecture		CO 6
31	Single factor – ANOVA	Lecture		CO 6
32	Population of sample	Lecture		CO 6
33	Determination of the sample size	Lecture		CO 6
34	Sampling techniques	Lecture		CO6
35	Sampling techniques	Lecture		CO6
36	Sampling techniques	Lecture		CO6
<b>Module VI - Introduction to computers</b>				
37	Functions and components of computers	PPT/Lecture		CO3
38	Characteristics of computers	PPT/Lecture		CO3
39	Computer system organization.	PPT/Lecture		CO3
40	Hardware	PPT/Lecture		CO4
41	Software	PPT/Lecture		CO4
42	Programming concepts	Lecture		CO 4

43	Computer memory	PPT/Lecture		CO 3
44	Recent developments in input-output devices	PPT/Lecture		CO 3
45	Commercially used storage devices-hard disc floppy disc	PPT/Lecture		CO 3, CO 4
46	Commercially used storage devices - CD & flash memory	PPT/Lecture		CO 3, CO 4
47	Advancements in microprocessor technology	Lecture	Quiz	CO 4
48	Operating system-a comparative study	PPT/Lecture		CO 4
49	Operating System - CUI and GUI	PPT/Lecture		CO 4
50	Introduction to Operating System: definition, functions	PPT/Lecture	Seminar Presentati on	CO 4
51	Working of OS; DOS and Windows	PPT/Lecture		CO 4
52	Working of OS; Linux and UNIX	PPT/Lecture		CO 4
<b>Module VII-Computer and communications</b>				
53	MS word	PPT/Lecture		CO3,CO 4
54	MS Word – Introducing Features and Uses	PPT/Lecture		CO3,CO4
55	MS Word – Creating, Editing and Formatting Documents	Guided Practice		CO3,CO4
56	MS Word – Essential features and Tools	Guided Practice		CO3,CO4
57	MS excel	PPT/Lecture		CO3,CO 4

58	MS Excel – Introducing Features and Uses	Guided Practice		CO3,CO4
<b>CIA – II</b>				
<b>Module VII-Computer and communications</b>				
59	MS Excel – Formatting Cells, Using Formulas	Guided Practice		CO3,CO4
60	MS Excel – Creating different graphs and charts	Guided Practice		CO3,CO4
61	MS power point	PPT/Lecture		CO3,CO 4
62	MS PowerPoint - Features and Uses	Guided Practice		CO3,CO 4
63	MS PowerPoint – Designs, Animations, Transitions	Guided Practice		CO3,CO 4
64	MS PowerPoint - graphs and charts etc...	Guided Practice		CO3,CO 5
65	Page Maker.	PPT/Lecture		CO3,CO 5
66	World Wide Web	PPT/Lecture		CO3,CO4,CO 5
67	Internet	PPT/Lecture		CO3,CO4,CO 5
68	Network	PPT/Lecture		CO3,CO4,CO 5
69	Web Servers, Uniform Resource Locators	PPT/Lecture		CO3,CO4,CO 5
70	Search Engines	PPT/Lecture		CO3,CO4,CO 5
71	Revision	Group Discussion		

72	Revision	Group Discussion		
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### INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines

	<b>Topic of Assignment &amp; Nature of seminar (Individual – Presentation )</b>	<b>Course Outcome</b>
1	Procedure for the estimation of marine fish landings in India.	CO 6
2	Measures of dispersion- merits and demerits.	CO 2
3	Experimentation- principles, designing and analysis.	CO 1 ,CO 2
4	Photoshop.	CO 5
5	Types of memory.	CO 3
6	Normal distribution.	CO 1,CO 2
7	Generations of computers.	CO5
8	Methods of survey.	CO 4
9	Spreadsheet.	CO 4
10	Procedure in testing a hypothesis.	CO 6
11	Different parts of the computer.	CO 3
12	Analysis of variance.	CO 6
13	Types of computers.	CO 3
14	General characteristics of computers.	CO 3
15	Measures of central tendencies-merits and demerits.	CO1,CO2

16	Working of various components of the computer system.	CO5
17	SPSS	CO 4
18	Programming languages.	CO 5
19	Methods of data collection.	CO 6

### References

- **Campell R.C. 1978. Statistics for biologists, Blackie and sons publishers , Bombay**
- **Caswell, F. 1982. Success in statistics , John Murray Publishers, Bombay.**
- **Agarwal. W.L. 1986. Basic statistics. New Age International pvt. Ltd. Publishers, New Delhi, Baily**
- **Jain. V.K., 1983. Computer fundamentals , BPB publishers , New Delhi**
- **Neswin D 1998. Microsoft windows at a glance .BPH publishers, New Delhi.**
- **Sebasta R.W. 1999. Concepts of programming languages , Addition-Wesely, Massachusetts.**

### Web resource references:

- <http://web.stanford.edu/class/bios221/book/introduction.html>
- [https://www.tutorialspoint.com/basics\\_of\\_computers/basics\\_of\\_computers\\_in\\_troduction.htm](https://www.tutorialspoint.com/basics_of_computers/basics_of_computers_in_troduction.htm)

**COURSE 4:- 16P1AQCT04:AQUACULTURE ENGINEERING**

PROGRAMME	MASTER OF AQUACULTURE & FISH PROCESSING	SEMESTER	1
COURSE CODE AND TITLE	16P1AQCT04:AQUACULTURE ENGINEERING	CREDIT	4
HOURS/WEEK	4	HOURS/SEM	72
FACULTY NAME	Mathew.M.John		

**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.

**MASTER OF AQUACULTURE AND FISH PROCESSING**

PROGRAM SPECIFIC OUTCOMES	
PSO 1	Understand the taxonomy and biology of cultivable fin fishes and other organisms.
PSO 2	Understand the ecology and cultural practices of cultivable fin fishes, shell fishes, sea cucumber, seaweeds and various engineering principles applied to aquaculture structures.
PSO 3	Understand the harvest and post harvest technology of aquaculture organisms.
PSO 4	Demonstrate their awareness of the Nutrition, physiology and pathology of aquaculture organisms.



PSO 5	Apply of statistical and computer tools in relevant research field pertaining to aquaculture.
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### COURSE OUTCOMES

	COURSE OUTCOMES	PO/ PSO	CL
CO 1	Describe the criteria for selection of site for freshwater, brackish water and mariculture systems.	PO4 PSO2	U
CO 2	Understand the engineering principles which is helpful in design and construction of aqua farms	PO1 PSO2	U
CO 3	Evaluate the basic features of soil by sampling method for classification ,distribution and strength	PO4 PSO2	U
CO 4	Understanding the working of different aquaculture equipment including hand tools	PO 1 PSO2	U
CO 5	Understand engineering principles which is helpful in design and construction of hatcheries	PO3 PSO2	U
CO6	Understand preparation of aquacultural projects	PO1, PO 2, PO 5 PSO2	C
CO7	Understanding the management pond and hatcheries	PO1 PSO2	U
CO8	Understand the application of feeding systems in aquaculture	PO4 PSO2	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				3			
CO 2	2							3			
CO 3				2				3			
CO 4	2							3			
CO 5	1							3			
CO 6	3	3	2					2			
CO 7	1							3			
CO8				1				3			

### Mapping Strength

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

3- High

SESSION	TOPIC	LEARNING RESOURCES	VALUE ADDITIONS	COURSE OUTCOME
<b>MODULE I-Selection of site</b>				
1.	Selection of Site for freshwater aquaculture	PPT	video	CO 1
2.	Selection of Site for brackishwater aquaculture	PPT/Lecture		CO 1
3.	Selection of Site for mariculture	PPT/Lecture		CO 1
<b>Module II –Surveying and estimation of area</b>				
4.	Chain survey	PPT/Lecture		CO 2
5.	Plain table survey	Lecture		CO 2
6.	Contouring and leveling	Lecture		CO 2
7.	Calculation of area of land by trapezoidal and Simpsons rule	Lecture		CO 2
8.	Importance of engineering survey	Lecture		CO 2
<b>Module III-Design of farms</b>				
9.	Design and construction of aquafarms	PPT/Lecture		CO 2
10.	Type of ponds, shape, size and their orientation from meteorological point	PPT/Lecture		CO 2
11.	Design of peripheral dykes, secondary dykes,	PPT/Lecture		CO 2
12.	Design of feeder canals, drainage canals	PPT/Lecture		CO 2
13.	Water intake and outlet systems	PPT/Lecture		CO 2
14.	Calculation of earthwork for constructing ponds	PPT/Lecture		CO 2
15.	Requirement of water during water exchange	PPT/Lecture		CO 2
<b>Module IV-Soil</b>				
16.	Types of soil	PPT/Lecture		CO 3
17.	Soil sampling methods	PPT/Lecture		CO 3
18.	Structural and textural classification of soils	Lecture		CO 3
19.	Grain size distribution, bearing strength, prevention of erosion	Lecture		CO 3
20.	Methods of soil compaction and seepage reduction	Lecture		CO 3
<b>Module V-Design of modern aquaculture systems</b>				
21.	Design and construction of pens	Lecture		CO 2
22.	Design and construction of raceways	Lecture		CO 2
23.	Design and construction of flow through systems	PPT/Lecture		CO 2
24.	Design and construction of re-circulatory systems	PPT/Lecture		CO 2
25.	Selection of materials for mariculture facilities	PPT/Lecture		CO 1
26.	Sea farming	PPT/Lecture		CO 7
27.	Site selection for enclosure aquaculture	PPT/Lecture		CO 1
28.	Cage farming	PPT/Lecture		CO 7
29.	Selection of structures for enclosure aquaculture	PPT/Lecture		CO 1
CIA I				
<b>MODULE VI-Aquaculture equipment</b>				
30.	Equipment used for water treatment	PPT/Lecture		CO 4

31.	Role of aeration in culture ponds	Lecture		CO 4
32.	Methods of water disinfection	Lecture		CO 7
<b>Module VII- Aquaculture Automobiles</b>				
33.	Weed cutters and harvesters	Lecture		CO 4
34.	Bulldozers, excavators, rollers	PPT/Lecture		CO 4
35.	Refrigerated vans and mechanized fish harvesters	PPT/Lecture		CO 4
<b>Module VIII-Hatcheries</b>				
36.	Design of shrimp hatcheries	Lecture		CO 5
37.	Source of water and water treatment methods used in shrimp hatchery	Lecture		CO 5
38.	Disinfection, heating and cooling equipments in shrimp hatcheries	PPT/Lecture	Debate	CO 5
39.	Design of hatchery building	PPT/Lecture		CO5
40.	Water supply and drainage systems, inlets and outlets			CO 5
41.	Aeration grid, FRP tanks, cement tanks and waste water treatment	Lecture		CO 5
<b>Module IX-Aquaculture projects</b>				
42.	Preparation of aquaculture projects	Lecture		CO 6
43.	Estimation of efficiency of aquaculture project	PPT/Lecture		CO 6
44.	Management of pond and hatchery machineries	PPT/Lecture		CO 4
45.	New technologies in aquaculture engineering	PPT/Lecture		CO 2
46.	Tank basins and other closed production unit	Lecture		CO 2
<b>Module X-Feeding systems</b>				
47.	Feed control systems	PPT/Lecture		CO 8
48.	Dynamic feeding systems	PPT/Lecture		CO 8
49.	Adjustment of pH	Lecture		CO 7
50.	Removal of particles	PPT/Lecture		CO 4
51.	Ammonia removal	PPT/Lecture		CO 7
52.	Seminar	PPT/Lecture	Q.A.	
53.	Seminar	PPT/Lecture	Q.A.	
54.	Seminar	PPT/Lecture	Q.A.	
55.	Seminar	PPT/Lecture	Q.A.	
56.	Seminar	PPT/Lecture	Q.A.	
57.	Seminar	PPT/Lecture	Q.A.	
58.	Seminar	PPT/Lecture	Q.A.	
CIA II				
59.	Seminar	PPT/Lecture	Q.A.	
60.	Seminar	PPT/Lecture	Q.A.	
61.	Seminar	PPT/Lecture	Video	
62.	Seminar	PPT/Lecture	Q.A.	
63.	Seminar	PPT/Lecture	Q.A.	
64.	Seminar	PPT/Lecture	Q.A.	

65.	Seminar	PPT/Lecture	Q.A.	
66.	Seminar	PPT/Lecture	Q.A.	
67.	Seminar	PPT/Lecture	Q.A.	
68.	Seminar	PPT/Lecture	Q.A.	
69.	Seminar	PPT/Lecture	Q.A.	
70.	Seminar	PPT/Lecture	Q.A.	
71.	Seminar	PPT/Lecture	Q.A.	
72.	Revision			

### INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines

	Topic of Assignment & Nature of seminar (Individual – Presentation )	Course Outcome
1	Different types of aerators used in aquaculture system	CO 4
2	Different classes of pumps	CO 4
3	Merits and demerits of cage culture	
4	Textural classification of soil	CO 3
5	Criteria for site selection for a shrimp hatchery	CO 1, CO 5
6	Uses of blowers and compressors	CO 4
7	Main components of an aquaculture farm	CO2
8	Different methods of discharge measurements	CO2
9	Different materials used for enclosures in a pond	CO 2
10	Fouling and their control	CO 7
11	Types of channel lining employed in aquaculture	CO 2
12	Different fish feeding equipments used in aquaculture	CO 8
13	Layouts of different farms and their advantages	CO 2
14	Rack culture and its merits	CO 7
15	Different steps involved in construction of ponds	CO 2
16	Physico-chemical properties of soil in the construction and maintenance of ponds	CO 3
17	Importance of site selection in aquaculture engineering	CO 1
18	Different disinfection methods of water	CO 7
19	Importance of engineering survey	CO 2

### References

1. Thomas B Lawson. Fundamentals of Aquaculture Engineering
2. Wheaton ,F.W. Aquaculture Engineering 1942 Wiler Interscience publication
3. Bose et.al. Coastal Aquaculture Engineering
4. Pillay, TVR and Kutty.M.N. Aquaculture : Principles and Practices

Web resource references:

<http://www.fao.org/3/x5744e/x5744e00.htm>

<http://www.fao.org/3/E7171E/E7171E00.htm>

<http://www.fao.org/3/AC003E/AC003E00.htm>