SACRED HEART COLLEGE (AUTONOMOUS)

Department of Aquaculture

MASTER OF AQUACULTURE AND FISH PROCESSING

Course plan

Academic Year 2016 - 17

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.		

COURSE OBJECTIVES
To identify the commercially important fin fish and shell fish through taxonomic studies and their distribution in Indian waters
To understand the structural , functional and physiological features of digestive system and associated glands in fin fishes and shell fishes
To dtermine food and feeding habits of fin fish and shell fish
To understand the structural and functional features of circulatory system in fin fishes and shell fishes
To understand the structural , functional and physiological features of respiratory system and accessory organs in fin fishes and shell fishes
To understand the structure , function and role of excretory organs in osmoregulation of fin fishes and shell fishes
To understand the structure and function of nervous system and endocrine system in fin fishes and shell fishes
To understand the structure and function of reproductive system in fin fishes and shell fishes

SESSION	TOPIC	LEARNING RESOURCES	VALUE ADDITIONS	REMARKS
	MODULE I-Morphology and Taxonomy of fin fish and shell Fish			
	MODULE I			
1	Study of external morphology of a typical elasmobranch	PPT	video	
2	Study of external morphology of a typical teleost	PPT/Lecture		
3	Study of external morphology of a typical bivalve	PPT/Lecture		
4	Study of external morphology of a typical gastropod	PPT/Lecture	e-resource	
5	Study of external morphology of a typical cephalopod.	PPT/Lecture		
6	Study of external morphology of a typical prawn	PPT/Lecture		
7	Study of scales	Lecture		
8	Study of skin	Lecture		
9	Study of teeth	Lecture		
10	Study of mouth	Lecture		

11	Study of fins	PPT/Lecture		
12	Uses of scales ,skin, teeth ,mouth &fins in taxonomy of fin fishes	PPT/Lecture		
13	Taxonomy of commercially important Penaeid species	PPT/Lecture		
14	Taxonomy of commercially important Metapenaeid species	PPT/Lecture		
15	Taxonomy of commercially important fresh water prawn species	PPT/Lecture		
16	Taxonomy of commercially important fin fishes of family - Clupeidae	PPT/Lecture		
17	Taxonomy of commercially important fin fishes of family - Engraulidae	PPT/Lecture		
18	Taxonomy of commercially important fin fishes of family:- Serranidae(grouper)	PPT/Lecture		
19	Taxonomy of commercially important fin fishes of family:- Percidae(perch)	PPT/Lecture		
20	Taxonomy of commercially important fin fishes of family:- Cyprinidae	PPT/Lecture		
21	Taxonomy of commercially important fin fishes of family: Pangaciidae	PPT/Lecture		
22	Taxonomy of commercially important fin fishes of family: Siluridae	PPT/Lecture		
23				
24	Taxonomy of commercially important fin fishes of family:Soleidae	PPT/Lecture		
25	Taxonomy of commercially important fin fishes of family:Cyanoglosidae	PPT/Lecture		
26	Taxonomic features of different lobsters	PPT/Lecture		
27				
28	Taxonomy of commercially important fin fishes of families of the orders: Scyllaridae	PPT/Lecture		
29	Taxonomy of commercially important fin fishes of families of the orders:Portunidae	PPT/Lecture		
	MODULE II-Biology of finfishes and shell fishes			
30	Structure and function of digestive system of fish	PPT/Lecture		
31	Physiology of digestive system and associated glands in fish	Lecture		
32	Structure and function of digestive system in shrimp and physiology of digestive system	Lecture		
33	Food and feeding habits of shrimp	Lecture		
34	Structure and function of respiratory system in fishes	Lecture		
35	Structure and function of respiratory system in shrimp	PPT/Lecture		
36				
37	Circulatory systems of shrimp : Structure and function	PPT/Lecture		

38	Blood, blood cells, plasma, plasma proteins in fishes	PPT/Lecture		
39	Excretory system of fish : structure and functions,	Lecture		
40	Excretory system of shrimp : structure and functions,	Lecture		
41	Nervous system in fishes	Lecture		
42	Structure and function of endocrine glands in fishes	Lecture		
43	Role of hormone in relation to reproduction in fishes	PPT/Lecture		
44	Structure and function of reproductive systems of fin fishes	PPT/Lecture		
45	Role of hormone in relation to reproduction in prawns	PPT/Lecture		
46	Structure and function of reproductive systems of fin fishes			
47	Neurosecretory cells in crustaceans	PPT/Lecture		
48	Neurohaemal organs in shrimp	PPT/Lecture		
49	True endocrine organs in shrimp	PPT/Lecture		
50	Sense organs in shrimp	Lecture	Quiz	
51	Structure of exoskeleton in shrimp	Lecture	Q & Ans Session	
52	Molting and its steps	PPT/Lecture		
MODULE III-Distribution of commercially important finfish and shell fish in Indian waters				
53	Definition of mud banks, wedge bank and parr. Upwelling and its importance to fisheries.	PPT/Lecture		
54	Distributional shifts of fishery stock	PPT/Lecture		
55	Climate change and its effects on fisheries	PPT/Lecture		
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)
1	Lateral line system of fish
2	Mechanism and biology of neuron co-ordination
3	Hermaphroditism
4	Eyestalk ablation
5	Defence mechanism and healing in fishes
6	Adaptive modification of digestive tract in fishes
7	Structure and function of reproductive system in fishes
8	Parental care in fishes
9	Accessory respiratory organs in fishes
10	Digestive system of bivalves
11	Osmoregulation in marine fishes
12	External morphology of a typical crab
13	External morphology of a typical lobster
14	Gametogenesis
15	Spermatogenesis
16	Nervous system in prawn
17	Upwelling and its importance in fisheries
18	Climate change and its impact in fisheries
19	Food and feeding habit of fishes

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 Tembhre(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, MICROTECHNIQUES AND RESEARCH METHODOLOGY

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

COURSE OBJECTIVES
To understand the principles and operation of octoelectric equipment's in biological research
To create information on biophysics and instrumentation as applied to aquaculture
To evaluate detailed anatomic studies with the help of micro techniques
To understand the basic principles of physiology as applied to aquaculture systems
To understand introduction to research methods as a prelude to research work at higher level.

SESSION	TOPIC	LEARNING RESOURCES	VALUE ADDITIONS	REMARKS
MODULE I-Diffusion and Osmosis				
1.	Diffusion, Kinetics of diffusion	PPT	video	,
2.	Concentration gradient and Fick's Law	PPT/Lecture		
3.	Diffusion coefficient	PPT/Lecture		
4.	Stocks-Einstein Equation	PPT/Lecture	e-resource	
5.	Electrical gradient & pressure gradient	PPT/Lecture		
6.	Graham's Law & Vant Hoff's Law	PPT/Lecture		
7.	Gibbs-Donnam equilibrium	Lecture		
8.	Facilitated diffusion , Osmosis	Lecture		,
9.	Seminar	PPT/Lecture	Q.A.	
10.	Seminar	PPT/Lecture	Q.A.	
11.	Osmotic concentration and osmotic pressure	PPT/Lecture		,
Module II –Biophysics of cell membrane				
12.	Physical and chemical properties of cell membrane	PPT/Lecture		,
13.	Conformational properties of membrane	Lecture		,
14.	Membrane receptors	Lecture		,
15.	Factors affecting the passage of materials across cell membranes	Lecture		,

16.	Seminar	PPT/Lecture	Q.A.	
Module III- Instrumentation				
17.	Calorimetry	Lecture		,
18.	Mas spectroscopy	Lecture		,
19.	Spectrophotmeter (infrared and double beam)	PPT/Lecture		,
20.	pH meter & Oxygen probe	PPT/Lecture		,
21.	Seminar	PPT/Lecture		
22.	Conductivity meter	PPT/Lecture		,
23.	Salinometer and refractometer	PP T/Lecture		,
24.	LC- MS	PPT/Lecture		,
25.	Mas spectroscopy	PPT/Lecture		,
Module IV –Protein purification				
26.	Chromatography	Lecture		,
27.	Seminar	PPT/Lecture	Q.A.	
28.	Ion exchange chromatography	Lecture		,
29.	Affinity chromatography	Lecture		,
CIA I				
MODULE IV-Protein purification				
30.	Adsorption chromatography	PPT/Lecture		,
31.	Partition chromatography	PPT/Lecture		,
32.	Seminar	PPT/Lecture	Q.A.	
33.	Seminar	PPT/Lecture	Q.A.	
34.	Seminar	PPT/Lecture	Q.A.	
35.	Seminar	PPT/Lecture	Q.A.	
Module V- Electrophoresis				
36.	General principles of electrophoresis	PPT/Lecture		
37.	Different gel materials used for electrophoresis	PPT/Lecture		
38.	Isoelectric focusing	Lecture		
Module VI-Microscopy				
39.	Principles of microscopy	Lecture		
40.	Bright field microscopy	PPT/Lecture		
41.	Dark field microscopy	Lecture		
42.	Phase contrast microscopy	Lecture		
43.	Seminar	PPT/Lecture	Q.A.	
44.	Seminar	PPT/Lecture	Q.A.	
45.	Fluorescence microscopy	PPT/Lecture		
46.	Microphotography	PPT/Lecture		
47.	Electron micrograph	PPT/Lecture		
48.	Principles of electron microscopy		PPT/Lecture	
49.	Ultra structure studies using electron microscopy	Lecture	Quiz	
50.	Fixation of invertebrate tissues and organs	PPT/Lecture		

Module VII-Microtechniques				
51.	Fixation of vertebrate tissues and organs	PPT/Lecture		
52.	Dehydration methods	PPT/Lecture		
53.	Embedding, clearing and sectioning	PPT/Lecture		
54.	Staining of sections	Lecture		
55.	Preparation of whole mounts	PPT/Lecture		
56.	Fixation and processing of tissues for electron microscopy studies	PPT/Lecture		
57.	Seminar	PPT/Lecture	Q.A.	
58.	Preparation of permanent slide	PPT/Lecture		
CIA II				
Module VIII-Research methodology				
59.	Meaning and importance of research	PPT/Lecture		
60.	Types of research-selection	PPT/Lecture		
61.	Different research designs, concepts relating to research design.	PPT/Lecture		
62.	Analysis of literature review, primary and secondary sources, web sources-critical literature reviews	PPT/Lecture		
Module IX- Data Collection and Analysis				
63.	Selection of appropriate methods of data collection, data preparation, important steps	PPT/Lecture	Video	
Module X-Interpretation and report writing				
64.	Meaning of interpretation, techniques of interpretation, and precautions in interpretation	PPT/Lecture		
65.	Significance of report writing, different steps in report writing. Types of reports; technical and popular	Lecture	Debate	
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		
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 assignment (Individual/Group – Written/Presentation – Graded or Non-graded etc)
1	Permeability of membranes.
2	Biological significance of osmoregulation.
3	Types and techniques of electrophoresis.
4	Acoustic and electronic equipment used for behavioral studies
5	Properties of cell membrane.
6	Protein purification.
7	Methods and processing of tissues for electron microscopy.
8	Methods of fixing tissues.
9	Collection and analysis of data.
10	Fluid mosaic model.
11	Different types of microscopic techniques.
12	UV- visible spectrophotometer with emphasis on the parts of the instrument.
13	Histochemical stains for differentiation and location of macromolecules in cells.
14	Principle and application of gel filtration chromatography.
15	Procedures of permanent slide preparation.
16	Principle and working of HPLC.
17	Design and problems of research.
18	SDS PAGE
19	AAS

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

COURSE 3:- 16P1AQCT03: BIOSTATISTICS AND COMPUTER APPLICATIONS

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

COURSE OBJECTIVES
To know the statistical tools for experimental practices
To have an awareness on statistical tools in research and analysis of biological phenomenon
To know that Computer knowledge are imparted as applicable to aquaculture practices
To know the computer knowledge at preliminary level for further studies
To use internet and communication system
To know the sampling methods in estimation of marine fish landings

SESSION	**TOPIC**	**LEARNING RESOURCES**	**VALUE ADDITIONS**	**REMARKS**
	MODULE I –Collection, compilation and analysis of the data			
1	Primary and secondary data- formation of length and weight frequency distribution	PPT		,
2	Absolute and relative measures of dispersion.	PPT/Lecture		,
3	Mean deviation and standard deviation.	PPT/Lecture		,

Module II-Correlation and regression analysis				
4	Scatter diagram	PPT/Lecture		,
5	Karl Pearson's coefficient of correlation-	PPT/Lecture		,
6	Spearman's Rank Correlation coefficient	Lecture		,
7	Coefficient of determination	Lecture		,
8	Regression analysis	Lecture		,
9	Linear regression equations and their uses	Lecture		,
10	Length –weight relationship	PPT/Lecture		,
11	Von Bertalanffy growth equation	PPT/Lecture		,
Module III-Probability and theoretical distribution				
12	Frequency approach and Axiomatic approach to probability	Lecture		,
13	Mutually Exclusive and independent events	Lecture		,
14	Addition and Multiplication theorems	Lecture		,
15	Binomial and Poisson distribution	Lecture		,
Module IV-Statistical quality control				
16	Process control and product control	Lecture		,
17	Control chart for variables and attributes	Lecture		,
18	Mean and range charts	Lecture		,
19	Fraction defective chart	Lecture		,
20	('p' chart) and 'c' charts	Lecture		,

Module V- Theory of sampling and interference				
21	Null and alternative hypothesis	PPT/Lecture		,
22	Two types of errors in testing of hypothesis	Lecture		,
23	Large and small sample tests	Lecture		
24	Z' test	Lecture		
25	't' test	Lecture		
26	X^2 test	Lecture		
27	F-test	Lecture		
28	Analysis of variance Techniques	Lecture		
29	Revision			
	CIA I			
	MODULE V-Theory of sampling & interference			
30	Single factor – ANOVA	Lecture		
31	Single factor – ANOVA	Lecture		
32	Population of sample	Lecture		
33	Determination of the sample size	Lecture		
34	Sampling techniques	Lecture		
35	Sampling techniques	Lecture		
36	Sampling techniques	Lecture		
Module VI - Introduction to computers				

37	Functions and components of computers	PPT/Lecture		
38	Characteristics of computers	PPT/Lecture		
39	Computer system organization.	PPT/Lecture		
40	Hardware	PPT/Lecture		
41	Software	PPT/Lecture		
42	Programming concepts	Lecture		
43	Computer memory	PPT/Lecture		
44	Recent developments in input-output devices	PPT/Lecture		
45	Commercially used storage devices-hard disc floppy disc	PPT/Lecture		,
46	Commercially used storage devices - CD & flash memory	PPT/Lecture		,
47	Advancements in microprocessor technology	Lecture	Quiz	
48	Operating system-a comparative study	PPT/Lecture		
49	Operating System - CUI and GUI	PPT/Lecture		
50	Introduction to Operating System: definition, functions	PPT/Lecture	Seminar Presentation	
51	Working of OS; DOS and Windows	PPT/Lecture		
52	Working of OS; Linux and UNIX	PPT/Lecture		
Module VII-Computer and communications				
53	MS word	PPT/Lecture		,

54	MS Word – Introducing Features and Uses	PPT/Lecture		,
55	MS Word – Creating, Editing and Formatting Documents	Guided Practice		,
56	MS Word – Essential features and Tools	Guided Practice		,
57	MS excel	PPT/Lecture		,
58	MS Excel – Introducing Features and Uses	Guided Practice		,
CIA – II				
Module VII-Computer and communications				
59	MS Excel – Formatting Cells, Using Formulas	Guided Practice		,
60	MS Excel – Creating different graphs and charts	Guided Practice		,
61	MS power point	PPT/Lecture		,
62	MS PowerPoint - Features and Uses	Guided Practice		,
63	MS PowerPoint – Designs, Animations, Transitions	Guided Practice		,
64	MS PowerPoint - graphs and charts etc…	Guided Practice		,
65	Page Maker.	PPT/Lecture		,
66	World Wide Web	PPT/Lecture		,,
67	Internet	PPT/Lecture		,,

68	Network	PPT/Lecture		,,
69	Web Servers, Uniform Resource Locators	PPT/Lecture		,,
70	Search Engines	PPT/Lecture		,,
71	Revision	Group Discussion		
72	Revision	Group Discussion		

INDIVIDUAL ASSIGNMENTS/SEMINAR – Details & Guidelines

	Topic of Assignment & Nature of seminar (Individual – Presentation)
1	Procedure for the estimation of marine fish landings in India.
2	Measures of dispersion- merits and demerits.
3	Experimentation- principles, designing and analysis.
4	Photoshop.
5	Types of memory.
6	Normal distribution.
7	Generations of computers.
8	Methods of survey.
9	Spreadsheet.
10	Procedure in testing a hypothesis.
11	Different parts of the computer.
12	Analysis of variance.

13	Types of computers.
14	General characteristics of computers.
15	Measures of central tendencies-merits and demerits.
16	Working of various components of the computer system.
17	SPSS
18	Programming languages.
19	Methods of data collection.

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.Basc 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_introduction.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		

COURSE OBJECTIVES
To describe the criteria for selection of site for freshwater, brackish water and mariculture systems.
To understand the engineering principles which is helpful in design and construction of aqua farms
To evaluate the basic features of soil by sampling method for classification ,distribution and strength
To understand the working of different aquaculture equipment including hand tools
To understand engineering principles which is helpful in design and construction of hatcheries
To understand preparation of aquacultural projects
To understand the management pond and hatcheries
To understand the application of feeding systems in aquaculture

SESSION	TOPIC	LEARNING RESOURCES	VALUE ADDITIONS	REMARKS
MODULE I-Selection of site				
1.	Selection of Site for freshwater aquaculture	PPT	video	
2.	Selection of Site for brackishwater aquaculture	PPT/Lecture		
3.	Selection of Site for mariculture	PPT/Lecture		
Module II –Surveying and estimation of area				
4.	Chain survey	PPT/Lecture		
5.	Plain table survey	Lecture		
6.	Contouring and leveling	Lecture		
7.	Calculation of area of land by trapezoidal and Simpsons rule	Lecture		
8.	Importance of engineering survey	Lecture		
Module III-Design of farms				
9.	Design and construction of aquafarms	PPT/Lecture		
10.	Type of ponds, shape, size and their orientation from meteorological point	PPT/Lecture		
11.	Design of peripheral dykes, secondary dykes,	PPT/Lecture		
12.	Design of feeder canals, drainage canals	PPT/Lecture		

13.	Water intake and outlet systems	PPT/Lecture		
14.	Calculation of earthwork for constructing ponds	PPT/Lecture		
15.	Requirement of water during water exchange	PPT/Lecture		
Module IV-Soil				
16.	Types of soil	PPT/Lecture		
17.	Soil sampling methods	PPT/Lecture		
18.	Structural and textural classification of soils	Lecture		
19.	Grain size distribution, bearing strength, prevention of erosion	Lecture		
20.	Methods of soil compaction and seepage reduction	Lecture		
Module V-Design of modern aquaculture systems				
21.	Design and construction of pens	Lecture		
22.	Design and construction of raceways	Lecture		
23.	Design and construction of flow through systems	PPT/Lecture		
24.	Design and construction of re-circulatory systems	PPT/Lecture		
25.	Selection of materials for mariculture facilities	PPT/Lecture		
26.	Sea farming	PPT/Lecture		
27.	Site selection for enclosure aquaculture	PPT/Lecture		
28.	Cage farming	PPT/Lecture		
29.	Selection of structures for enclosure aquaculture	PPT/Lecture		
CIA I				
MODULE VI-Aquaculture equipment				
30.	Equipment used for water treatment	PPT/Lecture		
31.	Role of aeration in culture ponds	Lecture		
32.	Methods of water disinfection	Lecture		
Module VII- Aquaculture Automobiles				
33.	Weed cutters and harvesters	Lecture		
34.	Bulldozers, excavators, rollers	PPT/Lecture		
35.	Refrigerated vans and mechanized fish harvesters	PPT/Lecture		
Module VIII-Hatcheries				
36.	Design of shrimp hatcheries	Lecture		
37.	Source of water and water treatment methods used in shrimp hatchery	Lecture		
38.	Disinfection, heating and cooling equipments in shrimp hatcheries	PPT/Lecture	Debate	
39.	Design of hatchery building	PPT/Lecture		
40.	Water supply and drainage systems, inlets and outlets			
41.	Aeration grid, FRP tanks, cement tanks and waste water treatment	Lecture		
Module IX-Aquaculture projects				
42.	Preparation of aquaculture projects	Lecture		
43.	Estimation of efficiency of aquaculture project	PPT/Lecture		
44.	Management of pond and hatchery machineries	PPT/Lecture		
45.	New technologies in aquaculture engineering	PPT/Lecture		
46.	Tank basins and other closed production unit	Lecture		

Module X-Feeding systems				
47.	Feed control systems	PPT/Lecture		
48.	Dynamic feeding systems	PPT/Lecture		
49.	Adjustment of pH	Lecture		
50.	Removal of particles	PPT/Lecture		
51.	Ammonia removal	PPT/Lecture		
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)
1	Different types of aerators used in aquaculture system
2	Different classes of pumps
3	Merits and demerits of cage culture
4	Textural classification of soil
5	Criteria for site selection for a shrimp hatchery
6	Uses of blowers and compressors
7	Main components of an aquaculture farm

8	Different methods of discharge measurements
9	Different materials used for enclosures in a pond
10	Fouling and their control
11	Types of channel lining employed in aquaculture
12	Different fish feeding equipments used in aquaculture
13	Layouts of different farms and their advantages
14	Rack culture and its merits
15	Different steps involved in construction of ponds
16	Physico-chemical properties of soil in the construction and maintenance of ponds
17	Importance of site selection in aquaculture engineering
18	Different disinfection methods of water
19	Importance of engineering survey

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