UNIVERSITY OF CALCUTTA

Notification No. CSR/ 12/18

It is notified for information of all concerned that the Syndicate in its meeting held on 28.05.2018 (vide Item No.14) approved the Syllabi of different subjects in Undergraduate Honours / General / Major courses of studies (CBCS) under this University, as laid down in the accompanying pamphlet:

List of the subjects

<table>
<thead>
<tr>
<th>Sl. No.</th>
<th>Subject</th>
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<th>Subject</th>
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<tr>
<td>1</td>
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<td>Mol. Biology (General)</td>
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<td>5</td>
<td>Bio-Chemistry (Honours / General)</td>
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<td>Physical Education (General)</td>
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<td>6</td>
<td>Botany (Honours / General)</td>
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<td>7</td>
<td>Chemistry (Honours / General)</td>
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<td>Political Science (Honours / General)</td>
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<td>9</td>
<td>Defence Studies (General)</td>
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<td>17</td>
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<td>Industrial Fish and Fisheries – IFFV (Major)</td>
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<td>French (General)</td>
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<td>Bachelor of Fashion and Apparel Design – B.F.A.D. (Honours)</td>
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<td>26</td>
<td>Human Development (Honours / General)</td>
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<td>Bachelor of Fine Art (B.F.A.) (Honours)</td>
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<td>B. Music (Honours / General) and Music (General)</td>
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<td>28</td>
<td>Journalism and Mass Communication (Honours / General)</td>
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</tbody>
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The above shall be effective from the academic session 2018-2019.

SENATE HOUSE
KOLKATA-700073
The 4th June, 2018

(Dr. Santanu Paul)
Deputy Registrar
UNIVERSITY OF CALCUTTA

INDUSTRIAL FISH & FISHERIES SYLLABUS FOR B.SC. (MAJOR)

Under

CBCS SYSTEM
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<td>Core T6- Fish seed production technology</td>
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<td>Core P6- Fish seed production technology</td>
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<td>Core T7- Brackish water aquaculture &amp; Mariculture</td>
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<td>Core P7- Brackish water aquaculture &amp; Mariculture</td>
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<td>Core T8- Aquarium Fisheries</td>
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<td>Core P8- Aquarium Fisheries</td>
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<td>Core T9- Fish Pathology &amp; Immunology</td>
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<td>Core P9- Fish Pathology &amp; Immunology</td>
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<td>Core T11- Fisheries Post Harvest Technology</td>
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<td>Core P11- Fisheries Post Harvest Technology</td>
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<tr>
<td>DSE B: B2 - Project Work</td>
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<td>5. Skill Enhancement Course (Any one)</td>
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<tr>
<td>SEC - A - Pearl Culture</td>
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1. INTRODUCTION

The syllabus for Industrial Fish and Fisheries at undergraduate level using the Choice Based Credit system has been framed in compliance with model syllabus given by UGC. The main objective of framing this new syllabus is to give the students a holistic understanding of the subject giving substantial weightage to both the core content and techniques used in Industrial Fish and Fisheries. Keeping in mind and in tune with the changing nature of the subject, adequate emphasis has been given on new techniques and understanding of the subject. The syllabus has also been framed in such a way that the basic skills of subject are taught to the students, and everyone might not need to go for higher studies and the scope of securing a job after graduation will increase. There is wide deviation in the infrastructure, be it physical or in human resource, in the form of teachers’ expertise and ability and aspiration of the students. Hence, University is free to choose the Electives as per their infrastructural strengths and offer at least 6 to 7 electives While the syllabus is in compliance with UGC model curriculum, it is necessary that Industrial Fish and Fisheries students should learn “Immunology” along with “Fish pathology” as one of the core courses rather than as elective. Also, an important discipline specific elective on “Fishery Microbiology” has been added. Project Work have been introduced instead of the 4th Elective with a credit of 6 split into 2+4, where 2 credits will be for continuous evaluation and 4 credits reserved for the merit of the dissertation.

2. SCHEME FOR CBCS CURRICULUM(CREDIT DISTRIBUTION ACROSS COURSES)

<table>
<thead>
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<th>SEC - B - Crab Culture</th>
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<td>6. Generic Elective (Any four)</td>
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<td>GE T1 - Choose From the CBCS Syllabus of Zoology/Chemistry/Botany</td>
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<td>GE P1 - Choose From the CBCS Syllabus of Zoology/Chemistry/Botany</td>
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<td>GE P3 - Choose From the CBCS Syllabus of Zoology/Chemistry/Botany</td>
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<td>GE T4 - Choose From the CBCS Syllabus of Zoology/Chemistry/Botany</td>
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<td>GE P4 - Choose From the CBCS Syllabus of Zoology/Chemistry/Botany</td>
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<td>Course Type</td>
<td>Number of Courses</td>
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<tr>
<td>Core Courses</td>
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<td>Ability Enhancement Course</td>
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3. SCHEME FOR CBCS CURRICULUM (Courses at a glance under semester)

3 A. COMPULSORY CORE COURSES

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<th>Compulsory Courses</th>
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<th>Fresh Water Aquaculture</th>
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<td>Fish Taxonomy</td>
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<td>Fish Biology</td>
<td>Brackish water aquaculture &amp; Mariculture</td>
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<td>Fish Genetic Engineering &amp; Molecular Biology</td>
<td>Fish Seed production technology</td>
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<td>Fish pathology &amp; Immunology</td>
<td>Fishing craft and gear Technology</td>
<td>Fishery Post Harvest Technology</td>
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<tr>
<td>Aquatic ecology</td>
<td>Fisheries Extension, Fisheries economics, Marketing &amp; Entrepreneurship development</td>
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3B. CHOICES FOR DISCIPLINE SPECIFIC ELECTIVES

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<td>1. Fishery Microbiology (DSE A:A1)</td>
<td>2. On the Job Training (DSE B:B1)</td>
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### 3 C. CHOICES FOR SKILL ENHANCEMENT COURSES

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### 3 D. CHOICES FOR GENERIC ELECTIVE COURSES

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<th>Core course –XI Theory</th>
<th>Fisheries Post Harvest Technology(CT 11)</th>
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<td>Fisheries Post Harvest Technology Lab (CP 11)</td>
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<td>Fishery Microbiology Lab (DSE A:A1 - P1)</td>
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<th>Core course –XIII Theory</th>
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SEMESTER I

ABILITY ENHANCEMENT COMPULSORY COURSE I: ENGLISH COMMUNICATION

CORE THEORY1 (CT1)       FISH TAXONOMY
CREDITS 4; CLASS 50; MARKS 50

Unit 1: Systematics: Definition, component, importance.

Unit 2: Taxonomy: Definition, component, importance, stages of taxonomy, Zoological Nomenclature.

Unit 3. Classification: Definition and types of classification. Classification of Crustaceans, Molluscs and Fishes.

Unit 4: Species concept- Biological and typological. Mechanism of Speciation. Subspecies and other intraspecific categories. Type concept.

Unit 5: Origin & Evolution of fishes.

[Note: Classification of Sub phylum Crustacea and Phylum Mollusca according to Ruppert & Barnes(1994) should be followed. On the other hand classification of Grade- Pisces according to Nelson(2010) should be followed.]

Examination Pattern

Time: 2 Hour                  Full Marks: 50
(40 Theory + 10 Internal Assessment)

Question are to be set from entire syllabus; 4 question (out of six) of 2 marks each(2x4=8), four question (out of six) of 4 marks each(4x4=16), and two question ( Out of two) of 8 marks each(8x2=16), are to be answered.

Reference Books:

CORE PRACTICAL 1 (CP1)       FISH TAXONOMY LAB   2 CREDITS

LIST OF PRACTICAL
1. Identification of fresh water Fish
2. Identification of brackish water fish
3. Identification of marine water fishes.
5. Laboratory Note Book
6. Internal Assessment
   Note: Systematic position as per the theory syllabus

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<th>Question Pattern</th>
<th>Full Marks: 25</th>
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<td>Time: 2½ Hour</td>
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<tr>
<td>Identification of two fresh water Fishes (Item No.1) 4x2=8</td>
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</tr>
<tr>
<td>Identification of one brackish water fish (Item No.2) 4x1=4</td>
<td></td>
</tr>
<tr>
<td>Identification of one marine water fishes (Item No.3) 3x1=4</td>
<td></td>
</tr>
<tr>
<td>Identification of one Prawn/Shrimp, Lobster, Bivalves, Cephalopods (Item No.4) 2x1=2</td>
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<td>Laboratory Note Book= 2</td>
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<td>Internal Assessment= 5</td>
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</table>

**SEMESTER I**

**CORE THEORY2 (CT2) **

**CAPTURE FISHERIES**

**CREDITS 4; CLASS 50; MARKS 50**

**Unit 1: Riverine fisheries:** Major river system in India. Fishing methods, representative ichthyofauna, and recent catch statistics. Problems encountered in fisheries development of major rivers.

**Unit 2: Cold water fisheries:** Cold water fisheries resources of India. Ecological characters of cold water bodies of India. Representative species of fishes of cold water bodies of India. Present status, Prospect, Problems and development of cold water fisheries in India.

**Unit 3: Reservoir and Lacustrine fisheries:** Definition and ecological features of reservoirs and lakes. Major reservoirs and lakes in India with emphasis on capture fisheries. Development of reservoir fisheries in India.

**Unit 4: Estuarine fisheries:** Definition and classification of estuaries, capture fisheries-resident and migrant species, fishing methods, recent catch statistics. Fisheries of brackish water lake and backwaters. Problem of brackish water fishery.

**Unit 5: Marine fishery resources in India:** Marine capture fishery resources at inshore, offshore and deep sea. EEZ, PFZ and continental shelf, maritime states in India.
Biology and fisheries of Oilsardine, Hilsa, Pomfret, Bombay duck, Mackerel, ribbon fish, sole fish, eel, catfishes, prawns, lobsters, mollusks. 

**Unit 6: Conservation of marine fishery resources:** Deep sea fishing policies of India. Problems of overfishing. Conservation and management of marine fishery resources. Application of remote sensing technology in capture fisheries.

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**Examination Pattern**

**Time: 2 Hour**

**Full Marks: 50**

*(40 Theory + 10 Internal Assessment)*

Question are to be set from entire syllabus; 4 question (out of six) of 2 marks each(2x4=8), four question (out of six) of 4 marks each(4x4=16), and two question ( Out of two) of 8 marks each(8x2=16), are to be answered.

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**CORE PRACTICAL 2 (CP2)  CAPTURE FISHERIES LAB  2 CREDITS**

**List of practical**

1. Analysis of Data, Drawing of Graphs, Charts, Histograms in relation to abundance and catch particular of fish.
2. Field visit of any places of east coast and west coast of India in respect of marine fisheries.(Compulsory)
3. Laboratory Note Book.
4. Viva Voce
5. Internal Assessment

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**Question Pattern**

**Time: 2½ Hour**

*(20 Theory + 5 Internal Assessment)*

1. One question from item no. 1 (10x1)=6
2. Submission of field note book: 8
3. Laboratory Note Book: 2
4. Viva Voce: 4
5. Internal Assessment: 5
SEMESTER I

GENERIC ELECTIVE THEORY 1 (GET1)

4 CREDITS; CLASS 50; MARKS 50

Choose from the CBCS syllabus of Zoology/Chemistry/Botany

SEMESTER I

GENERIC ELECTIVE PRACTICAL (GEP1)

CREDIT: 2; MARKS 25

Choose from the CBCS syllabus of Zoology/Chemistry/Botany

SEMESTER II

ABILITY ENHANCEMENT COMPULSORY COURSE II: ENVIRONMENTAL SCIENCE

SEMESTER II

CORE THEORY 3 (CT3)

FISH BIOLOGY

CREDITS 4; CLASS 50; MARKS 50

Unit 1: Fin fish and Shell fish anatomy:
   I. Morphology of skin, colouration, scales, mouth, jaws, teeth, fin and fin rays and their taxonomic importance.
   II. Internal anatomy of a typical elasmobranch and Teleost fish: Alimentary canal and associated structure, Respiratory and accessory respiratory organs, Heart and circulatory system, Reproductive system, sense organs, Lateral line system, outlines of skeletal system
   III. Structure of Digestive system, Respiratory system, Circulatory system, excretory system, Reproductive and Endocrine system of Prawns.
   IV. External Character of Prawn, Crab, Lobster, Bivalves, Gastropods and Cephalopod.

Unit 2: Fish Growth: Isometric and allometric growth, the cube law, analysis of growth check on hard parts (Scale, otolith, vertebrae), Marking and tagging of fish for growth
studies, length-weight relationship, poderal index, relative condition factor and gonadosomatic index.

**Unit 3: Fish Physiology:** Physiology and osmoregulation of fish. Endocrine organs in fishes and their roles in control of reproduction in fishes. Physiology of digestion, respiration (aerial and aquatic) and vision. Bioluminescence in fishes. Physiology of electric organs in fishes. Gametogenesis and fertilization of fishes.

**Unit 4: Fish Nutrition:** Food and feeding habit of fish, prawn, crab, bivalves and cephalopod.

**Unit 5: Fish behavior:** Parental care of fishes. Fish Migration.

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**Examination Pattern**

**Time:** 2 Hour \hspace{5cm} **Full Marks:** 50

(40 Theory + 10 Internal Assessment)

Question are to be set from entire syllabus; 4 question (out of six) of 2 marks each (2x4=8), four question (out of six) of 4 marks each (4x4=16), and two question (Out of two) of 8 marks each (8x2=16), are to be answered.

**Reference Books:**


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**CORE PRACTICAL 3 (CP3) \hspace{5cm} FISH BIOLOGY LAB \hspace{5cm} 2 CREDITS**

**LIST OF PRACTICAL**

1. **Major Dissection:**
   (i) Urinogenital system of Mrigal & Tilapia.
   (ii) Weberian ossicles of Catla.

2. **Minor Dissection:**
   (i) Digestive system of Mrigal & Tilapia.
   (ii) Mounting of appendages of Prawn/Shrimp.
   (iii) Study of the different types of scales of fishes.
   (iv) Gill rackers of fishes of different feeding habit.
   (v) Pharyngeal teeth in fishes.
   (vi) Otolith of Tilapia

3. Determination of RLG and Gut content analysis/Gonado Somatic index/ Condition factor/Fecundity of Rohu, Catla, Mrigal.

4. Laboratory Note Book.
6. Viva-Voce
7. Internal Assessment

Question Pattern

Time: 2½ Hour        Full Marks: 25

(20 Theory + 5 Internal Assessment)
One question from item no. 1 (10x1)=10
One question from item no.2 and 3 (5x1)=5
Laboratory Note Book: 3
Viva Voce: 2
Internal Assessment: 5

SEMESTER II

CORE THEORY 4 (CT4)          FRESHWATER AQUACULTURE

CREDITS 4; CLASS 50; MARKS 50

Unit 1: Scope and present status of aquaculture: Principles of site selection of various kinds of fish farms- quality and productivity of water, soil characteristics and other parameters.

Unit 2: Carp Culture: Pre stocking, Stocking and Post stocking management of Nursery, Rearing and Stocking pond.

Unit 3: Different systems of aquaculture: Monoculture, Polyculture, Integrated fish farming, cage culture, pen culture, raft culture, extensive, semi intensive and intensive fish culture, raceway culture, culture in re-circulatory systems-Criteria for selection of species for culture. Aquaculture diversification- Aquaponics system, Biofloc culture, IMTA and periphyton culture.

Unit 4: Sewage fed fish culture: Selection of species, methods of culture, advantage and disadvantage.

Unit 5: Culture of Catfishes and Murrels: Culturable species, Spawning and fry production and grow out.

Unit 6: Cold water aquaculture: Culture of Trout, Mahseer and Salmon- Culture systems, Development of brood stock, Techniques of propagation, Grow out in tanks, raceways, cages and ponds.

Unit 7: Culture of Tilapias: Cultivated species of tilapia, Culture systems, Spawning and production of seed stock, Growout and feeding.

Examination Pattern

Time: 2 Hour        Full Marks: 50

(40 theory + 10 internal assessments)
Question are to be set from entire syllabus; 4 question (out of six) of 2 marks each(2x4=8), four question (out of six) of 4 marks each(4x4=16), and two question ( Out of two) of 8 marks each(8x2=16), are to be answered.

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**CORE PRACTICAL 4 (CP4) FRESH WATER AQUACULTURE LAB** 2 CREDITS

**List of practical**
1. Analysis of water parameters(Pond water, riverine water, lake water) by titration method: D.O, Free CO₂, Total alkalinity, Total Hardness, Salinity, Organic Carbon, Nitrogen, Phosphate, Sulphate, Chloride, BOD, COD.
2. Training on Fresh water aquaculture.
3. Submission of Laboratory Note Book.

**Question Pattern**

<table>
<thead>
<tr>
<th>Time: 2½ Hour</th>
<th>Full Marks: 25</th>
</tr>
</thead>
<tbody>
<tr>
<td>(20 Theory + 5 Internal Assessment)</td>
<td></td>
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<tr>
<td>1. One question from the item no. 1 (15x1) =10</td>
<td></td>
</tr>
<tr>
<td>2. Submission of training report (Compulsory) =08</td>
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<tr>
<td>3. Submission of Laboratory Notebook= 2</td>
<td></td>
</tr>
<tr>
<td>4. Internal Assessment=05</td>
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</tbody>
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**SEMESTER II**

**GENERIC ELECTIVE THEORY 2 (GET2)**

4 CREDITS; CLASS 50; MARKS 50

Choose from the CBCS syllabus of Zoology/ Chemistry/ Botany

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**SEMESTER II**

**GENERIC ELECTIVE PRACTICAL 2 (GEP2)**

**CREDIT: 2; MARKS 25**

Choose from the CBCS syllabus of Zoology/ Chemistry/ Botany
SEMESTER III

CORE THEORY 5 (CT5) FISH GENETIC ENGINEERING & MOLECULAR BIOLOGY

CREDITS 4; CLASS 50; MARKS 50

Unit 1: Nucleic acids: Salient features of DNA and RNA; Watson and Crick Model of DNA.

Unit 2: DNA Replication: Enzymes of DNA replication, Mechanism of DNA replication in Prokaryotes, prove that replication is semi-conservative, bidirectional and discontinuous Replication. Fidelity of DNA replication.

Unit 3: Transcription: Mechanism of Transcription in prokaryotes and eukaryotes, transcription factors, difference between prokaryotes and eukaryotic transcription.

Unit 4: Translation: Mechanism of translation in Prokaryotes and eukaryotes. Genetic code, Degeneracy of the genetic code, wobble hypothesis, inhibitors of protein synthesis, difference between prokaryotic and eukaryotic translation.

Unit 5: Post Transcriptional modifications and processing of eukaryotic RNA: Capping, splicing and polyadenylation.

Unit 6: DNA Repair mechanism: Types of DNA repair mechanisms, RecBCD model in prokaryotes, nucleotide and base excision repair, SOS repair.

Unit 7: Molecular techniques: PCR, Western, Southern and Northern Blot, Sanger DNA sequencing.

Unit 8: Gene structure and Function- Gene complementation, Cistron, muton, recon. molecular recombination, gene regulation.


Unit 10: Molecular hybridization- Labelling of Nucleic acid, molecular markers, amplification of DNA, Blotting techniques- Southern, Northern and Western blotting, DNA sequencing.

**Unit 12:** Transgenic fish production.

**Unit 13:** Cryopreservation of gametes.

**Unit 14:** Production of monosex and sterile fishes and their significance in aquaculture.

### Examination Pattern

<table>
<thead>
<tr>
<th>Time: 2 Hour</th>
<th>Full Marks: 50</th>
</tr>
</thead>
<tbody>
<tr>
<td>40 theory + 10 internal assessments</td>
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</table>

Question are to be set from entire syllabus; 4 question (out of six) of 2 marks each(2x4=8), four question (out of six) of 4 marks each(4x4=16), and two question (Out of two) of 8 marks each(8x2=16), are to be answered.

### Reference Books:


### CORE PRACTICAL 5 (CP5)  
FISH GENETIC ENGINEERING & MOLECULAR BIOLOGY

**CREDITS 2; MARKS 25**

### List of practical

1. Demonstration of polytene and lampbrush chromosome from photograph.
2. Isolation and quantification of genomic DNA using UV Spectrophotometer; Procedure/reference to be mentioned.
3. Agarose gel electrophoresis for DNA.
4. DNA isolation from fish liver.
5. Differential centrifugation of an artificially prepared mixture.
6. Histological staining of DNA & RNA in prepared slide.

### Question Pattern

<table>
<thead>
<tr>
<th>Time: 2½ Hour</th>
<th>Full Marks: 25</th>
</tr>
</thead>
<tbody>
<tr>
<td>1. One experiment from item no. 2=08</td>
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<tr>
<td>2. One experiment from item no. 6=04</td>
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<tr>
<td>3. One experiment from item no. 3,4,5=06</td>
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<tr>
<td>4. Laboratory note book=02</td>
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<tr>
<td>5. Internal assessment=05</td>
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</tbody>
</table>
CORE THEORY 6 (CT6)  
FISH SEED PRODUCTION TECHNOLOGY  

CREDITS 4; CLASS 50; MARKS 50


Unit 2: Induced Breeding of Fishes: Hypophysation of Indian major carps and exotic carps. History of hypophysation. Methods of pituitary extract preparation, dosage determination, injection to the brood fishes, spawning and hatching. Use of different synthetic hormones and analogues for induced spawning. Stripping and fertilization. Transport of fish seeds and brood fishes, use of anesthetics. Bundh breeding, types of bundh breeding techniques and problems of bundh breeding.

Unit 3: Hatchery Technology of For fishes: Indian Major Carps, Mahseer and Trout hatchery. Design and function of incubators, glass jar hatchery, Chinese hatchery and other hatchery systems.

Unit 4: Hatchery technology for different species: Indian major and minor carps, Exotic carps, Catfishes, Tilapia, Masheer and Trout.

Unit 5: Marine fish seed production: Seabass, milkfish, mullets, cobia and silver pompano.


Unit 7: Seed production in shell fishes: Seed production and nursery rearing of *Penaeus monodon* and *Macrobrachium rosenbergii*. Various components, equipments and infrastructures facilities required.

Unit 8: Riverine seed production techniques.

Unit 9: Different stages of seed: Spawn, Fry and Fingerlings.

Suggested Readings:
2. ICAR. 2006. Hand Book of Fisheries and Aquaculture. ICAR.

Examination Pattern

Time: 2 Hrs.         Full Marks: 50

(40 Theory + 10 Internal Assessment)

Question are to be set from entire syllabus; 4 question (out of six) of 2 marks each(2x4=8),
four question (out of six) of 4 marks each(4x4=16), and two question (Out of two) of 8
marks each(8x2=16), are to be answered.

CORE PRACTICAL 6 (CP6)          FISH SEED PRODUCTION TECHNOLOGY

CREDITS 2; MARKS 25

List of practical
1. Histological techniques: Preparation of Permanent Histological slide of different organs
   of fishes.

2. Dissection and collection of fish pituitary gland, preservation, extract preparation, doses
   determination and injection to the brood fishes.

3. Hatchery training(Fresh water fish/Brackish water fish/Aquarium fish/Prawns)

4. Laboratory Note Book.

5. Internal Assessment.

QUESTION PATTERN

Time: 2½ Hour         Full Marks: 25

1. Staining of one histological slide, identification, drawing and labeling. 5+2+1+1=09

2. Submission of two permanent histological slides: 02

3. Collection of Pituitary gland, extract preparation and dose determination. 06

4. Hatchery training report submission and Laboratory Note Book=03

5. Internal Assessment=05


UNIT 3: Crustacean Culture: Species of shrimps cultured in brackishwater – *Penaeus mondond*, *Penaeus indicus*, *Litopenaeus vannamei*. Extensive, semi-intensive and intensive shrimp farming practices. Species of crabs cultured and culture techniques, prospects in India. Species of lobsters, culture, problems and prospects in India; lobster fattening.


UNIT 6: Environmental Impacts: Environmental impact of brackish water and coastal aquaculture - Salinity intrusion, effluent discharge, eutrophication, chemical residues including antibiotics and hormones, destruction of natural habitat including paddy field and mangroves. Social issues and conflicts with other users on resources.
Examination Pattern

Time: 2 Hrs                                  Full Marks: 50

(40 Theory + 10 Internal Assessment)

Question are to be set from entire syllabus; 4 question (out of six) of 2 marks each(2x4=8), four question (out of six) of 4 marks each(4x4=16), and two question (Out of two) of 8 marks each(8x2=16), are to be answered.

CORE PRACTICAL 7 (CP7)              BRACKISH WATER AQUACULTURE & MARICULTURE

CREDITS 2; MARKS 25

List of practical:
1. Analysis of water parameters(Brackish water/marine water) by titration method: D.O, Free CO₂, Total alkalinity, Total Hardness, Salinity, Organic Carbon, Nitrogen, Phosphate, Sulphate, Chloride, BOD, COD.
3. Visit to any brackish water fish farm.
4. Laboratory Note Book.
5. Internal Assessment

Question Pattern

Time: 2½ Hour                                  Full Marks: 25

One question from item no. 1=10
One question from item no. 2=05
Field Note Book: 03
Laboratory Note Book: 02
Internal Assessment: 05

SEMESTER III

SKILL ENHANCEMENT COURSE (SEC - A) PEARL CULTURE 2 CREDITS; CLASS 25; MARKS 25

Unit 1: Biology of Pearl oyster: Pearl producing molluscs. Morphology and anatomy of Pearl oyster, Life cycle of pearl oyster.

Unit 4: Pearl oyster culture: Techniques of pearl oyster culture (Fresh water and Marine water) for artificial production of pearls. Pearl culture techniques - Rafts, long lines, Pearls oyster baskets, underwater platforms, mother oyster culture/Collection of oysters, rearing of oysters, Environmental parameters. Pearl Oyster surgery (Selection of Oyster, Graft tissue preparation, Nucleus insertion, Conditioning for surgery), Post-operative culture, harvesting of pearl, clearing of pearl.

Unit 5: Diseases and Predators of Pearl oysters.

Unit 6: Present status, prospects and problems of pearl industry in India.

EXAMINATION PATTERN

Time: 1 Hrs.                  Full Marks: 25
20 Theory + 05 Internal Assessment

Question are to be set covering the entire syllabus; 2 questions; out to four of 2 marks each (2x2=4), 2 questions; out of four of 4 marks each (4x2=08) and one question; out of three of 8 marks (8x1=08), are to be answered.

SEMESTER III

GENERIC ELECTIVE THEORY 3 (GET3)        4 CREDITS; CLASS 50; MARKS 50
Choose from the CBCS syllabus of Zoology/ Chemistry/ Botany

SEMESTER III

GENERIC ELECTIVE PRACTICAL 3 (GEP3)        CREDIT: 2;   MARKS 25
Choose from the CBCS syllabus of Zoology/ Chemistry/ Botany
SEMESTER IV

CORE THEORY 8 (CT8) AQUARIUM FISHERIES

CREDITS 4; CLASS 50; MARKS 50

Unit 1: Aquarium design and Construction: Introduction to aquarium. World aquarium trade and present status. Design and construction of home and public aquaria (freshwater and marine), oceanarium. Aquarium accessories - Aerators, filters (different types) and lighting. Water quality requirements.

Unit 2: Aquarium Management: Setting up of aquarium – under gravel filter, pebbles, plants, drift wood, ornamental objects and selection of fishes, Quarantine measures. Aquarium maintenance and water quality management. Control of snail and algal growth. Handling, care, packing and transportation of fishes - Use of anesthetics. Temperature acclimation.


Examination Pattern

Time: 2 Hrs Full Marks: 50

(40 Theory + 10 Internal Assessment)

Question are to be set from entire syllabus; 4 question (out of six) of 2 marks each(2x4=8), four question (out of six) of 4 marks each(4x4=16), and two question ( Out of two) of 8 marks each(8x2=16), are to be answered.
CORE PRACTICAL 8 (CP8)  AQUARIUM FISHERIES

CREDITS 2; MARKS 25

LIST OF PRACTICAL

1. Construction of a glass aquarium.
2. Identification of aquarium fishes.
3. Identification of aquarium plants.
4. Laboratory Note Book.
5. Internal Assessment.

QUESTION PATTERN

Time: 2½ Hour Full Marks: 25

1. Construction of a model glass aquarium: 03
2. Identification of 4 aquarium fishes: 4x3=12
3. Identification of 2 aquarium plants: 2x2=04
4. Laboratory Note Book: 01
5. Internal Assessment: 05

CORE THEORY 9 (CT9)  FISH PATHOLOGY AND IMMUNOLOGY

CREDITS 4; CLASS 50; MARKS 50

Unit 1: Fin Fish Pathology: Causative agents, symptoms and control of some infectious diseases of fish- Fungal Diseases(Saprolegniasis, Branchiomycosis), Bacterial Diseases(Fin and Tail rot, Ulcer diseases, Dropsy, Eye diseases, Furunculosis, Bacterial Gill diseases, ERM, Edwardsielliosis, Vibriosis), Protozoan Diseases(White spot diseases, Costiasis, Trichodinosis, Whirling disease), Metazoans( Dactylogyrus, Gyrodactylus, Hirodinosis, Lernaea, Argulus)- Morphology, life cycle, symptom and control. Viral diseases(IPN, IHN, VHs, CCVD). EUS.

Unit 2: Shell Fish Pathology: Some common diseases of prawns – pathogens, symptoms and control- IHNV, Baculo virus, Black gill disease, brown spot disease.

Examination Pattern

Time: 2 Hrs         Full Marks: 50
(40 Theory + 10 Internal Assessment)
Question are to be set from entire syllabus; 4 question (out of six) of 2 marks each(2x4=8), four question (out of six) of 4 marks each(4x4=16), and two question (Out of two) of 8 marks each(8x2=16), are to be answered.

CORE PRACTICAL 9 (CP9)              FISH PATHOLOGY AND IMMUNOLOGY
CREDITS 2; MARKS 25

LIST OF PRACTICAL

1. Identification of fish diseases.
2. Identification of fish pathogen.
3. Preparation of stained blood film to study various types of blood cells.

QUESTION PATTERN

Time: 2½ Hour         Full Marks: 25
1. Identification of two fish diseases (2x2)=04
2. Identification with reasons of one fish pathogen(4x1)=04
3. Preparation of blood film of fishes, Differential count of WBC, drawing and labeling= 10
4. Laboratory note book=02
5. Internal Assessment=05
CORE THEORY 10 (CT10)                                      FISHING CRAFT AND GEAR TECHNOLOGY

CREDITS 4; CLASS 50; MARKS 50

Unit 1: Fishing crafts: Fishing craft materials-introduction to fishing craft technology- Boat building material- wood, steel, aluminum, Ferro-cement, FRP (GRP)-advantages and disadvantages. Classification and description of different type of fishing crafts in India (inland and marine) traditional, motorized and mechanized. General arrangements of different type of fishing boats, trawl, gill netters, purse seiners, long liners, trollers, deep sea vessels. Classification of Marine corrosion.


Unit 3: FAD’s, Fish finding devices and conservation: Fish aggregating devices and artificial reefs; Impact of artificial reefs on fish stock improvement; Turtle Exclusion Devices (TED) - By-catch Reduction Devices (BRD). Fish finder, GPS navigator, sonar, net sonde, gear monitoring equipment; remote sensing.


Examination Pattern

Time: 2 Hrs         Full Marks: 50

(40 Theory + 10 Internal Assessment)

Question are to be set from entire syllabus; 4 question (out of six) of 2 marks each(2x4=8), four question (out of six) of 4 marks each(4x4=16), and two question (Out of two) of 8 marks each(8x2=16), are to be answered.
CORE PRACTICAL 10 (CP10)                                    FISHING CRAFT AND GEAR TECHNOLOGY

CREDITS 2; MARKS 25

LIST OF PRACTICAL

1. Identification of fishing crafts, gears, fishing accessories, (floats/sinkers/hook/synthetic and natural fibres, twines, ropes, iron wares).
2. Preparation of fishing nets.
4. Laboratory Note Book.
5. Internal Assessment.

QUESTION PATTERN

Time: 2½ Hour                                                   Full Marks: 25

1. Two Identification from the item no. 1(2x4)=08
3. Preparation of one fishing net / a part/knot)=06
4. Laboratory Note Book=02
5. Submission of a model fishing craft/gear=04
6. Internal Assessment=05

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SEMESTER IV

SKILL ENHANCEMENT COURSE (SEC - B) CRABS CULTURE     2 CREDITS; CLASS 25; MARKS 25

Unit 1: Introduction: History and Present status of crab culture.

Unit 2: Biology of Crabs: Economically important species of crabs. Morphology and anatomy of crabs. Life cycle of crabs.

Unit 3: Crabs culture: Cultivable species of crabs in India. Techniques of Crabs culture. Crabs fattening

Unit 4: Prospect, problems and development of crab culture in India.
EXAMINATION PATTERN

Time: 1 Hrs.                    Full Marks: 25
        20 Theory + 05 Internal Assessment

Question are to be set covering the entire syllabus; 2 questions; out to four of 2 marks each (2x2=4), 2 questions; out of four of 4 marks each (4x2=08) and one question; out of three of 8 marks (8x1=08), are to be answered.

SEMESTER IV

GENERIC ELECTIVE THEORY 4 (GET-4)

CHOOSE FROM THE CBCS SYLLABUS OF ZOOLOGY / CHEMISTRY /BOTANY

CREDIT: 4; CLASS 50; MARKS 50

SEMESTER IV

GENERIC ELECTIVE PRACTICAL 4 (GEP-4)

FOLLOW THE RESPECTIVE CBCS SYLLABUS OF ZOOLOGY / CHEMISTRY /BOTANY

CREDIT: 2; MARKS 25

SEMESTER V

CORE THEORY 11 (CT11)                  FISHERIES POST HARVEST TECHNOLOGY

CREDITS 4; CLASS 50; MARKS 50

Unit 1: Post Harvest Technology: Principles and importance of fish preservation. Fish spoilage- post mortem changes and rigor mortis, post rigor spoilage. Methods of fish preservation- Icing, Freezing, Cold storage, Drying, Salting, Smoking, Canning and Fish Pickling.
Unit 2: Fish product and Byproduct: Fish Oil, Fish liver oil, Fish meal, Fish manure, Fish flour, fish glue, isinglass.


Examination Pattern

**Time:** 2 Hrs  
**Full Marks:** 50

(40 Theory + 10 Internal Assessment)

Question are to be set from entire syllabus; 4 question (out of six) of 2 marks each(2x4=8), four question (out of six) of 4 marks each(4x4=16), and two question (Out of two) of 8 marks each(8x2=16), are to be answered.

CORE PRACTICAL 11 (CP11)  
FISHERIES POST HARVEST TECHNOLOGY

CREDITS 2; MARKS 25

LIST OF PRACTICAL


2. Detection of organoleptic changes in fish.

5. Laboratory Note Book.

6. Internal Assessment.
QUESTION PATTERN

Time: 2½ Hour  
Full Marks: 25

1. One question from item no.1=10
2. One question from item no.2=05
3. Laboratory Note Book=05
4. Internal Assessment=05

SEMESTER V

CORE THEORY 12 (CT12)  
FUNDAMENTAL OF BIOCHEMISTRY

CREDITS 4; CLASS 50; MARKS 50


Unit 3: Elementary idea of biological oxidation, oxidative phosphorylation and electron transport chain.

Unit 4: Lipid metabolism: synthesis and oxidation of fatty acid.

Unit 5: Protein Metabolism: Transamination, Deamination and urea cycle.

Unit 6: Enzymes: Classification, Kinetics (Michelis-Menten Concept), Factors affecting enzymatic action.

Examination Pattern

Time: 2 Hrs  
Full Marks: 50

(40 Theory + 10 Internal Assessment)

Question are to be set from entire syllabus; 4 question (out of six) of 2 marks each(2x4=8), four question (out of six) of 4 marks each(4x4=16), and two question (Out of two) of 8 marks each(8x2=16), are to be answered.
CORE PRACTICAL 12 (CP12)                                            FUNDAMENTAL OF BIOCHEMISTRY

CREDITS 2; MARKS 25

LIST OF PRACTICAL

1. Qualitative tests of functional groups in carbohydrates, proteins and lipids. Qualitative tests for carbohydrate; starch, sucrose, Maltose, fructose, glucose, protein; albumin, gelatin, peptone, fat; Test to be performed- Biuret test, Millon’s test, Iodine test, Benedict’s test, Barfoed test, Seliwantoff’s test.


4. Laboratory Note Book.

5. Internal Assessment.

QUESTION PATTERN

Time: 2½ Hour         Full Marks: 25

1. Identification of one unknown sample; Qualitative test; Item No. 1=08

2. Identification of one amino acid; From Item 2=04

3. Quantitative estimation of concentration of unknown protein sample=06

4. Laboratory Note Book=02

5. Internal Assessment=05

SEMESTER V

DISCIPLINE SPECIFIC ELECTIVE; DSE A:A1 THEORY (T1)            FISHERY MICROBIOLOGY

CREDITS 4; CLASS 50; MARKS 50


Unit 2: Structure of microbes: Structure of prokaryotic cell, Structure and function of bacterial cell wall, plasma membrane, capsule, flagella and endospore. Structure of fungi


**Unit 4**: Aquatic Microbiology: Microflora of aquatic environment. Autotrophic and heterotrophic microorganisms in aquatic environment. Nutrient regeneration, role of microbes in biogeochemical cycles – Carbon, Nitrogen, Phosphorus and Sulphur cycles. Autochthonous and allochthonous microorganisms in aquatic environment.

**Unit 5**: Bacteria in culture pond: Health significant bacteria in culture ponds. Culture characteristics and epidemiology of *E. coli*, pathogenic *Vibrio*, *Salmonella*, *Aeromonas hydrophila*, and *Pseudomonas*.

**Unit 6**: Fish Microbiology: Perishability of seafood – Microbial spoilage of fish and shell fish. Spoilage microflora. Intrinsic and extrinsic factors affecting spoilage. Microflora associated with body parts. Food borne pathogens. Sources of contamination.

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**Examination Pattern**

Time: 2 Hrs

(40 Theory + 10 Internal Assessment)

Full Marks: 50

Question are to be set from entire syllabus; 4 question (out of six) of 2 marks each(2x4=8), four question (out of six) of 4 marks each(4x4=16), and two question ( Out of two) of 8 marks each(8x2=16), are to be answered.

**DISCIPLINE SPECIFIC ELECTIVE; DSE A:A1 PRACTICAL (P1) FISHERY MICROBIOLOGY**

**CREDITS 2; MARKS 25**

**LIST OF PRACTICAL**

1. Sterilization technique- dry heating, autoclaving


3. Isolation and maintenance of bacteria from fishes and water.


5. Laboratory Note Book.
6. Internal Assessment.

**QUESTION PATTERN**

Time: 2½ Hour       Full Marks: 25

1. One question from item1=05
2. One question from item2 and 3=05
3. One question from item4=08
4. Laboratory Note Book=02
5. Internal Assessment=05

**SEMESTER V**

**DISCIPLINE SPECIFIC ELECTIVE; DSE B:B1**  
**ON THE JOB TRAINING**

**CREDITS 6; CLASS 75; MARKS 75**

(CREDIT2: CONTINUOUS EVALUATION+CREDIT4: MERIT OF THE TRANING PROGRAMME UNDERTAKEN)

The students of semester V will have to undergo On the Job training for one month in any central or state government or recognized private institute concerning fisheries post harvest technology/ fresh water fish farm/ prawn or shrimp farm or any other fisheries institute.

**QUESTION PATTERN**

Time: 3 Hours       Marks: 75

1. Submission of the training report= 20
2. Power Point Presentation=10
3. Grand Viva= 30
5. Continuous Evaluation (Internal Assessment) by the Training Institute: 15
SEMESTER VI

CORE THEORY 13 (CT13)  AQUATIC ECOLOGY

CREDITS 4; CLASS 50; MARKS 50

Unit 1: Introduction: Definition of Ecology and Ecosystem, Subdivision of ecology- autecology and synecology.

Unit 2: Species and the individual in the ecosystem: Concept of habitat and ecological niche, ecological equivalents, character displacements- sympatry and allopatry, Biological clocks.

Unit 3: Population(Structure and dynamics): Population characteristics, theories of population growth, population interactions.

Unit 4: Community(Structure, classification and dynamics): Characteristics of community- species diversity, growth forms and structure, dominance, composition, structure. Ecological succession- definition, types of succession, general process of succession, hydrocere.

Unit 5: Ecosystem(Structure and function): Definition, kinds of ecosystem, structure of ecosystem, ecological pyramids, productivity, food chains, food webs, energy flow in ecosystem, pond ecosystem, ocean(marine) ecosystem.

Unit 6: Fresh water ecology: The freshwater environment, types and limiting factor, ecological classification of freshwater organism, the freshwater biota, lentic communities, lakes, ponds, lotic communities, longitudinal Zonation in streams, springs.

Unit 7: Marine ecology: The marine environment, the marine biota, Zonation in the sea, communities of the marine environment.

Unit 8: Estuarine ecology: Definition and types, biota and productivity.

Unit 9: Water pollution: Sources of water pollution, Ground water pollution, marine pollution, mercury pollution, fluoride pollution, Ganga action plan(GAP), Yamuna action plan(YAP), Prevention and control of water pollution, wetland conservation.
Examination Pattern

**Time:** 2 Hrs

**(40 Theory + 10 Internal Assessment)**

Question are to be set from entire syllabus; 4 question (out of six) of 2 marks each(2x4=8), four question (out of six) of 4 marks each(4x4=16), and two question (Out of two) of 8 marks each(8x2=16), are to be answered.

**CORE PRACTICAL 13 (CP13)  AQUATIC ECOLOGY**

**CREDITS 2; MARKS 25**

**LIST OF PRACTICAL**

1. Estimation of productivity in water bodies.
2. Collection, fixation and Identification of living phytoplankton and zooplankton from the water bodies (not by permanent slide).
3. Laboratory Note Book.
4. Internal Assessment.

**QUESTION PATTERN**

**Time: 2½ Hour  Full Marks: 25**

1. One question from the item no1=10
2. One question from the item no2=08
3. Laboratory Note Book=02
4. Internal Assessment=05
SEMESTER VI

CORE THEORY 14 (CT14) FISHERIES ECONOMICS, FISHERIES EXTENSION, MARKETING & ENTREPRENEURSHIP DEVELOPMENT

CREDITS 4; CLASS 50; MARKS 50

Unit 1: Principles of economics: Definition, subject matter and scope of economics. Law of diminishing returns, laws of increasing, constant and decreasing utility and returns. Importance of economics in aquaculture development.

Unit 2: Economy of fishermen: Fishermen populations, GDP from fisheries sector, foreign exchange earnings and employment potential of fishing industry.

Unit 3: Prospective of Aquaculture in Socio-Economic impact & Rural Development: Resource use and development, Socio-economic analysis, Socio-demographic profile, work contribution, household expenditure, income contribution, decision making, female headed household, impact of different age groups, socio-economic condition of fisherman.


Unit 5: Fishery co-operatives: Functions, financial assistance, input supplies, marketing of fish. Socio-economic development. Role of fisheries corporations and Missionary Organizations in fisheries development.

Unit 6: Fishery extension: Extension education- objective and principles. Role of extension in community development. Integrated rural development strategies. Programmes for weaker section of the community. Fishery development plans and various schemes

Unit 8: Entrepreneurship Development:

(A) Entrepreneurship Building:
2. Need, scope, characteristics and types of Entrepreneurship. STED.
4. Human resource management, Leadership, Motivation attitude, communication, Group dynamics, Delegation, Setting of goals, Transactional analysis, Creativity, Problem solving, Strength weakness opportunity and threat (SWOT) Techniques, Decision making, Stress management.

(B) Financial Management:
1. Institutions, Financing procedure and Financial incentives, Banking norms as in vogue.
3. Fund flow and Cash flow concept.
4. Break even analysis
(C) Technology Management:

1. Criteria for principles of product, selection and development.
2. Choice of technology, plant and equipment.
3. Critical Path Method (CPM) & Project Evaluation Review Techniques (PERT) as planning tools for establishing SSI.
4. Quality control / quality assurance and testing of product.
5. Production Management: Elements of production process, Production Planning and control, Product development, Testing facilities, Patents, Quality Assurance, Time control and Cost control, Total Quality Management.

8. Materials Purchasing Management: Material Planning and Budgeting, Value engineering, Value analysis, Economic ordering quantity, Inventory control.

(D) Marketing Management:
1. Elements of marketing & sales management.
2. Nature of product and market strategy – Packing & advertising – After sales service.
3. Touch on Import – Export procedure and methods.
4. Analyzing marketing opportunities, Planning marketing strategy, Forecasting, Marketing mix, Advertising the marketing programme & sales management, market survey techniques.

(E) Project Formulation:
1. Stages and methodology in Project identification, Selection of a project format, Project report writing.

(F) Statutory provisions:
1. Licensing, Registration – Municipal bye laws and Insurance coverage.
5. Business & Industrial laws, labour relations.

(G) Knowledge input:
1. Industrial and Economic policy declared by Government from time to time.
2. Sickness in small scale industries and their remedial measures.
3. Management Information System (MIS)

(H) Data Base management:
1. Books of accounts, financial statements.
Examination Pattern

Time: 2 Hrs

(40 Theory + 10 Internal Assessment)

Full Marks: 50

Question are to be set from entire syllabus; 4 question (out of six) of 2 marks each (2x4 = 8), four question (out of six) of 4 marks each (4x4 = 16), and two question (Out of two) of 8 marks each (8x2 = 16), are to be answered.

CORE PRACTICAL 14 (CP14) FISHERIES ECONOMICS, FISHERIES EXTENSION, MARKETING & ENTREPRENEURSHIP DEVELOPMENT

CREDITS 2; MARKS 25

LIST OF PRACTICAL

1. Fish market survey.


4. Seminar on Fisheries extension/rural economics.

5. Internal Assessment.

EXAMINATION PATTERN

1. Submission of a fish market survey report or the report of socio-economic status of fishermen of any fishing villages of West Bengal =08

2. Seminar on Fisheries extension/rural economics.(Hard copy 6+ Presentation 6)=12

3. Internal Assessment=05
SEMESTER VI

DISCIPLINE SPECIFIC ELECTIVE; DSE A:A2 THEORY (T2) BIOSTATISTICS, COMPUTER APPLICATION, REMOTE SENSING & GIS.

CREDITS 4; CLASS 50; MARKS 50


Unit 2: Computer Application: Introduction to computer, advantages, limitations, classification of computer, elementary idea of desktop, input-output devices-CPU, Key Board, Mouse, FD drive, CD-DVD Rom drive, RAM, Hardware and software. Office application- software: Introduction to windows, MS Word, MS-Excel and Powerpoint Presentation. Concept of Internet and its application in information collection. Basic ideas of www.

Unit 3: Remote sensing and GIS: Definition and principle of remote sensing and GIS. Sensing mechanism. Analysis of images and data. Fisheries forecasting system in India and other countries. GPS. Application of remote sensing and GIS in fisheries conservation and management of fish faunal diversity and exploitation of capture fisheries.

Examination Pattern

Time: 2 Hrs

(40 Theory + 10 Internal Assessment) 

Full Marks: 50

Question are to be set from entire syllabus; 4 question (out of six) of 2 marks each(2x4=8), four question (out of six) of 4 marks each(4x4=16), and two question ( Out of two) of 8 marks each(8x2=16), are to be answered.

DISCIPLINE SPECIFIC ELECTIVE; DSE A:A2 PRACTICAL (P2) BIOSTATISTICS, COMPUTER APPLICATION, REMOTE SENSING & GIS.

CREDITS 2; MARKS 25

LIST OF PRACTICAL

1. Identification of computer accessories.

2. Preparation of chart, graphs and power point presentation in computer.

3. Seminar on remote sensing (Hardcopy-6, presentation-6).
4. Internal Assessment.

**QUESTION PATTERN**

1. One question from item no.1 and 2 =08
2. One question from item no.3=12
3. Internal Assessment=05

**SEMESTER VI**

**DISCIPLINE SPECIFIC ELECTIVE; DSE B:B2**

**PROJECT WORK**

**CREDITS 6; CLASS 75; MARKS 75**

**2 CREDITS FOR CONTINUOUS EVALUATION + 4 CREDITS FOR MERIT OF THE PROJECT**

Project work to be done under a faculty member of the department. Project supervisors may be allocated during the end of second semester. Completed project report may be submitted at the end of Semester VI.

**Examination Pattern**

**Time: 3Hrs**

1. Submission of Project Report=30
2. Power Point Presentation=10
3. Grand Viva=20
4. Internal Assessment=15

**END OF SYLLABUS**