परियोजना का या परिप्रेक्ष्याचे सर्व संबंधित कल्पनिक प्रमाणे कि, दिनांक ०८ जून २०१९ ते रोजी संपन्न झालेल्या ४४व्या मा. विद्या परिषद बैठकीतील ऐपेलेटिव विषय क्र०१९/४४-२०१९ या उपाध्यक्षार्थ प्रस्तुत विद्यापीठाच्या संलग्न महाविद्यालयातील विज्ञान व तंत्रज्ञान विद्यार्थ्यांच्या पदश्री सर्वाधिक प्रमाण वर्षाचे खालील विषयांचे C.B.C.S. (Choice Based Credit System) Pattern नुसारचे अभ्यासक्रम शैक्षणिक वर्ष २०१९—२० पासून लागू करण्यात येत आहेत.

1. Agricultural Microbiology
2. Agrochemicals & Fertilizers
3. Analytical Chemistry
4. B.C.A.
5. B.Voc. (Food Processing, Preservation and Storage)
6. B.Voc. (Web Printing Technology)
7. Biochemistry
8. Bioinformatics
9. Biophysics
10. Biotechnology (Vocational)
11. Biotechnology
12. Botany
13. Chemistry
14. Computer Application (Optional)
15. Computer Science (Optional)
16. Computer Science
17. Dairy Science
18. Dyes and Drugs
19. Electronics
20. Environmental Science
21. Fishery Science
22. Food Science
23. Geology
24. Horticulture
25. Industrial Chemistry
26. Information Technology (Optional)
27. Mathematics
28. Microbiology
29. Network Technology
30. Physics
31. Software Engineering
32. Statistics
33. Zoology
SEMESTER PATTERN CURRICULUM UNDER
CHOICE BASED CREDIT SYSTEM(CBCS)
COURSE STRUCTURE (NEW SCHEME)
B. SC. FIRST YEAR (I - SEMESTER)

SUBJECT: FISHERY SCIENCE

FROM JUNE 2019
Class B.Sc. First Year

<table>
<thead>
<tr>
<th>Semester/ Annual</th>
<th>Course Name.</th>
<th>Paper No. &amp; Title Of paper</th>
<th>Total Periods/ Periods Perweek</th>
<th>Marks for Credits/ Marks</th>
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<tbody>
<tr>
<td>Semester I</td>
<td>CCFS-I</td>
<td>Icthyotaxonomy &amp; ecological adaptation I</td>
<td>45 (03/week)</td>
<td>10 40 Cre. 02 Mar.50</td>
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<td>Section A</td>
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<tr>
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<td>Section B</td>
<td>Type study - Wallago attu II</td>
<td>45 (03/week)</td>
<td>10 40 Cre. 02 Mar.50</td>
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<tr>
<td>Semester II</td>
<td>CCFS-II</td>
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<td>45 (03/week)</td>
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<td>Section B</td>
<td>Fish seed production &amp; hatcheries management IV</td>
<td>45 (03/week)</td>
<td>10 40 Cre. 02 Mar.50</td>
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<td>CCFSP I</td>
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<td>Section A + Section B</td>
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Total credits of semester I & II

60 240 12

CCFS: Core course fishery science, CCFSP Core course fishery science practical.
CA: Continuous assessment, ESE: End of semester examination.
Marks of CA10: 5 Marks for test/assignment & 5 marks for attendance.
Marks of CA20: 10 Marks for test & 10 marks for attendance.
## Class B.Sc. Second Year

<table>
<thead>
<tr>
<th>Semester/Annual</th>
<th>Course Name.</th>
<th>Paper No.&amp; Title Of paper</th>
<th>Total Periods/Periods Per week</th>
<th>Marks for</th>
<th>Credits/Marks</th>
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<tbody>
<tr>
<td><strong>Semester III</strong></td>
<td>CCFS-III</td>
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<tr>
<td></td>
<td>Section A</td>
<td>Fish diseases management VI</td>
<td>45 03/week</td>
<td>10</td>
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<td></td>
<td>Section B</td>
<td>Fish developmental Biology VII</td>
<td>45 03/week</td>
<td>10</td>
<td>40</td>
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<td></td>
<td>Annual pattern</td>
<td>SECFS I</td>
<td>Manufacturing of fish byproduct(A) Or Soil &amp; water analysis techniques(B)</td>
<td>25 2+1</td>
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<tr>
<td><strong>Semester IV</strong></td>
<td>CCFS-IV</td>
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<tr>
<td></td>
<td>Section A</td>
<td>Fish preservation &amp;fish by production technology VIII</td>
<td>45 03/week</td>
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<td>Section B</td>
<td>Fishing craft &amp;gear technology IX</td>
<td>45 03/week</td>
<td>10</td>
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<tr>
<td></td>
<td>Annual pattern</td>
<td>SECFS II</td>
<td>Preservation and Processing Technology(A) OR Manufacturing of fishing nets</td>
<td>25 2+1</td>
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<tr>
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<td>Annual pattern</td>
<td>CCFSP II</td>
<td>Practical Paper X Based on CCFS VI&amp;VIII</td>
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<td>Annual pattern</td>
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<td>Practical Paper XI Based on CCFS VII&amp;IX</td>
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**Total credits of semester III&IV:** 290

**Credits:** 16
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<tr>
<th>Semester/Annual</th>
<th>Course Name.</th>
<th>Paper No.&amp; Title Of paper</th>
<th>Total Periods/Periods Perweek</th>
<th>Marks for Credits / Marks</th>
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<tbody>
<tr>
<td>Semester V</td>
<td>CCFS-V</td>
<td>Section A</td>
<td>Indian Marine Fisheries (A) XII</td>
<td>45 03/week</td>
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<td>Section B</td>
<td>Aquaculture Techniques and fish Nutrition(B I) XIII OR Soil &amp; water management in aquaculture(B II) XIII</td>
<td>45 03/week</td>
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<tr>
<td>Annual pattern</td>
<td>SECFS III</td>
<td>Fabrication of aquarium (A) (Theory + pract.) OR Breeding technique of ornamental fishes(B)</td>
<td>25 2+1</td>
<td>25 25 Cre. 02 Mar.50</td>
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<td>Semester VI</td>
<td>CCFS-VI</td>
<td>Section A</td>
<td>Ornamental fish production and Management(A)XIV</td>
<td>45 03/week</td>
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<td>Section B</td>
<td>Fisheries Economics co-operative &amp; marketing management (B I) XV OR Nutrition and feed technology(B II) XV</td>
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<td>Annual pattern</td>
<td>SECFS IV</td>
<td>Fabrication of aquarium (A) (Theory + pract.) OR Breeding technique of ornamental fishes(B)</td>
<td>25 2+1</td>
<td>25 25 Cre. 02 Mar.50</td>
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<tr>
<td>Annual pattern</td>
<td>CCFSP IV</td>
<td>Practical XVI A based on theory papers XII+XIV</td>
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<td>Annual pattern</td>
<td>CCFSP V</td>
<td>Practical XVII based on theory papers(B I) OR Practical XVII based on theory papers(B II)</td>
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<tr>
<td>Semester</td>
<td>Paper No.</td>
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<tr>
<td>I</td>
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<td>Icthyotaxonomy &amp; ecological adaptation</td>
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<td>II</td>
<td>Type study of Wallago attu</td>
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<td>II</td>
<td>III</td>
<td>Fresh water fish culture technology</td>
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<td></td>
<td>IV</td>
<td>Fish seed production &amp; hatcheries management</td>
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<td>V</td>
<td>Practical Based on paper I &amp; II</td>
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<tr>
<td>III</td>
<td>VI</td>
<td>Fish diseases management</td>
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<td></td>
<td>VII</td>
<td>Fish developmental Biology</td>
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</tbody>
</table>
| SEC I    |           | Manufacturing of fish byproduct (A)  
|          |           | Or  
|          |           | Soil & water analysis techniques |
| IV       | VIII      | Fish preservation & fish by production technology |
| IX       |           | Fishing craft & gear technology |
| SEC II   |           | Preservation and Processing Technology (A)  
|          |           | OR  
|          |           | Manufacturing of fishing nets |
| X        |           | Practical based on VI & VIII |
| XI       |           | Practical based on Paper VII & IX |
| V        | XII       | Indian Marine Fisheries (A) |
|          | XIII      | Aquaculture Techniques and fish Nutrition (B I)  
|          |           | OR  
|          |           | Soil & water management in aquaculture (B II) |
| SEC III  |           | Fish feed production technology (A) (Theory + pract)  
|          |           | OR  
|          |           | Culture of fish food organisms (B) (Theory + pract) |
| VI       | XIV       | Ornamental fish production and Management (A) |
|          | XV        | Fisheries Economics, co-operative and marketing management (B I)  
|          |           | OR  
<p>|          |           | Nutrition and feed technology (B II) |</p>
<table>
<thead>
<tr>
<th>SEC IV A OR B</th>
<th>Fabrication of aquarium (A) (Theory+pract) OR Breeding technique of ornamental fishes(B)</th>
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<tbody>
<tr>
<td>XVI(A)</td>
<td>Practical based on theory papers XII+XIV</td>
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<tr>
<td>XVII (B I &amp; II)</td>
<td>Practical based on theory papers XIII+XV (B I) OR Practical based on theory papers XIII+XV (B II)</td>
</tr>
</tbody>
</table>
UNIT I (11 Period)

Icthyotaxonomy
1) Scope and importance of fishery science.
2) Classification of fishes (Berg, 1940) up to class level
3) General characters of class Elasmobranchii
4) General characters of class Holocephali
5) General characters of class Dipnoi
6) General characters of class Teleostomi
7) Difference between Elasmobranch and Teleost fishes

UNIT II (12 Period)
1) Body forms in fishes.
2) Different types of fins and their functions.
3) Fish identification techniques.
   i. Study of morphometric characters in fishes.
   ii. Study of meristic characters in fishes
   iii. Study of descriptive characters in fishes
4) Locomotion in fishes: Types of locomotion, special mode of locomotion, locomotion due to the movement of appendages.
5) Structure and functions of skin in fishes.
6) Study of different types of scales.

UNIT III (11 Period)

Ecological adaptation in fishes
1) Migration in fishes – general account of migration, types of migration, advantages of migration, factors influencing migration.
2) Colouration in fishes – Source of colour, colour changes in fishes, regulation of colour changes, significance of colour changes.
3) Light producing organs in fishes – occurrence, nature of light producing, location, structure of light producing organs, significance of luminescence in fishes.
4) Electric organs in fishes – Occurrence, location of electric organs, general structure of electric organ, electric organ in torpedo, *Electrophorus electricus*, functions of electric organ.
5) Sound producing organs in fishes
6) Poison glands in fishes – Introduction, difference between poisonous and venomous fishes, division of poisonous fishes

UNIT IV (11 Period)
1) Air bladder, location of air bladder, different types of air bladder, their structure and functions.
2) Weberian ossicle in fishes – structure and functions.
3) Lateral line canal – Structure of lateral line canal
4) Structure and functions of neuromast organs.
UNIT I
1) Introduction and classification
2) External characters
3) Skin – structure and functions.
4) Endoskeleton
   i. Axial skeleton – typical trunk vertebra, caudal vertebra, ribs
   ii. Appendicular skeleton – pectoral girdle and fin, pelvic girdle and fin.
5) Air bladder – structure and functions.
6) Weberian ossicles – structure and functions.

UNIT II
1) Coelom and alimentary canal.
2) Associated glands of digestive system.
   i. Liver
   ii. Pancreas
   iii. Gall bladder
3) Physiology of digestion
4) Respiratory system
   i. Structure of gills
   ii. Physiology of respiration

UNIT III
1) Blood circulatory system
   i. Structure & working of heart
   ii. Arterial system
   iii. Venous system
   iv. Composition of blood
2) Nervous system
   i. Structure of brain
   ii. Cranial nerves
   iii. Spinal nerves

UNIT IV
1) Excretory system
2) Male reproductive system
3) Female reproductive system
4) Spawning habits and structure of eggs.
5) Photoreceptor organs (eye)
6) Internal ear (membranos labyrinth) – Structure and functions.
7) Olfactory organs – Structure and functions.

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UNIT I  (11 Period)

1) Importance, objective and scope of aquaculture.
2) Introduction to types of aquaculture.
   i. Culture based on economic or commercial consideration: Extensive culture, intensive culture & semi-intensive culture
   ii. Culture based on the types of designs of culture: Pond culture, culture in manmade reservoirs, fish culture in paddy fields, culture in bheries, culture in tanks, raceway culture, cage culture and pen culture.
   iii. Culture based on number of species: Monoculture and poly culture
   iv. Culture based on climatic condition: Cold water fish culture, warm water fish culture

UNIT II  (12 Period)

Intensive fish farming
1) Selection of site -
   i. Topography ii. Soil type iii. Water supply
2) Construction of fish farm
   a) Layout, design and construction of different types of pond
      i. Hatching pits
      ii. Nursery pond
      iii. Rearing pond
      iv. Stocking pond
   b) Physical chemical and biological factors affecting fish culture.
3) Objectives of fish culture
4) Qualities of culturable species of fishes
5) Types of cultivable fishes
6) Culture qualities & breeding habits of Indian major carps

UNIT III  (11 Period)

Fish Pond Management
1. Pre-stocking Management: Drying, ploughing, liming, mannuring, watering, Eradication of aquatic weeds; Eradication of predatory fishes, weed fishes, aquatic insects, predatory animals
2. Stocking Management: Seed selection, acclimatization, stocking
3. Post-stocking Management: Feeding and Feed management, Water quality management, disease management, harvesting

UNIT IV  (11 Period)

1) Composite fish farming
   i. Principle of composite fish farming
   ii. Objectives of composite fish culture
   iii. Composite fish culture in India
   iv. Stocking density
2) Integrated fish farming
   i. Principle of Integrated fish farming
   ii. Paddy cum fish farming
iii. Poultry cum fish farming
iv. Cattle cum fish farming

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY NANDED
Choice Based Credit System (CBCS) Course Structure (New Scheme)
B. Sc. First year (II - SEMESTER)
Semester Pattern effective from June 2019
FISHERY SCIENCE
CCFS II (Section-B) (P-IV)

Paper- IV: Fish Seed Production & Hatcherries Management
Credit 02 Marks 50 period 45

UNIT I (11 Period)
1) Natural Seed collection
   i. Spawn resources investigation technique
   ii. Selection of spawn collection site
   iii. Gears used for collection of spawn
   iv. Methods of collection of spawn
2) Bundh breeding
   Types of bundhs –
   i) Wet bundhs ii) Dry bundhs iii) Modern bundhs

UNIT II (11 Period)
1) Artificial fertilization by stripping
   i) Dry Method ii) Wet Method
2) Induced breeding by hypophysation
   i. Introduction
   ii. Identification & selection of brooders
   iii. Dissection and removal of pituitary gland
   iv. Preservation and storage of pituitary gland
   v. Preparation of gland suspension for injection and dosage
3) Hormones responsible for induced breeding
4) Synthetic hormones used in induced breeding

UNIT III (12 Period)
Hatcherries and management (Principle, structure and management)
1) Hatching happa
2) Glass jar hatchery
3) Bin hatchery
4) CIFE D 80 model (Dwivedi – 80)
5) Chinese circular hatchery

UNIT IV (11 Period)
1) Fish seed transportation
   i. Open transportation system
   ii. Close transportation system
   iii. Causes of mortality in transportation
   iv. Use of chemicals in live-fish transportation
   v. Anesthetic drugs use in transport
   vi. Antiseptic and antibiotics used in transportation
   vii. Technique of fish seed release.
2) Fish seed trade
   i. Classification of fish seed
   ii. Identification techniques
iii. Different units of fish seed counting
iv. Fish seed trade in India
1) Fish identification techniques (any locally available fish)
   i. Study of any five morphometric characters
   ii. Study of any five meristic characters
2) Identify, classify and describe following fishes:
   a) Indian major carps
      i) *Catla catla* ii) *Labeo rohita* iii) *Cirhinus mrigala*
   b) Exotic carps
      i) *Hypothalmymyes molitrix* ii) *Ctinopharyngodon idella* iii) *Cyprinus carpio*
   c) Adaptation in fishes
      i) *Tropedo* ii) *Trygon* iii) *Tilapia* iv) *Pterois* v) *Exocoetus*
3) Identify and describe predatory fishes (any three).
4) Identify and describe predatory insects (any three).
5) Identification of aquatic weeds (any three)
6) Identification of fish feed (any three)
7) Permanent mounting of fish scales (Submission)
   i) Placoid ii) Cycloid iii) Ctenoid
8) Identification of spawn, fry and fingerlings of Indian major carps.
9) Preparation of pituitary gland extract, injection techniques & dosage.
10) Skeleton study
    i) Trunk vertebra ii) Caudal vertebra iii) Pectoral girdle iv) Pelvic girdle
11) Dissection of *wallago attu* / any locally available teleost.
    i. Digestive system,
    ii. Urinogenital system
    iii. Heart and Ventral aorta, afferent branchial vessels,
    iv. Brain,
    v. Air bladder
    vi. Weberian ossicle
12) Preparation of layout plan of fish farm and their submission.
13) Visit to fish farm/ hatchery / fish market and submission of report.
Q. 1) Dissect fish so as to expose --------------- system of local available fish
(Wallago/ local available any fish, major dissection)  

Q. 2) Dissect fish so as to expose/ dissect out its brain/ air bladder/ weberian ossicle
(Local available any fish minor dissection)  

OR

Preparation of pituitary gland extract

Q. 3) Identify, classify and describe the following one specimen from each

a) Major carp

b) Exotic carp

c) Modification in fish

Q. 4) Identify, classify and describe the following one specimen from each

a) Predatory fish

b) Predatory insect

c) Fish scale

Q. 5. a) Define and measure any five morphometric characters from the given fish

b) Define and count any five meristic characters from the given fish
Board of Studies in Fishery Science

01 Dr. Gaikwad Jayprakash Manikrao  
Associate Professor & Head, Department of Fishery Science  
Shri. Shivaji College, Parbhani, Dist. Parbhani.  
Chairman

02 Dr. Ahirrao Sunil Deoram  
Associate Professor, Department of Fishery Science  
Shri Shivaji College, Parbhani, Dist. Parbhani.  
Member

03 Dr. Papatwar N.G  
Associate Professor & Head, Department of Fishery Science  
DSM Arts, Commerce & Science College, Jintur Dist. Parbhani.  
Member

04 Dr. Kadam Sunil Uttamrao  
Associate Professor & Head, Department of Fishery Science  
DSM College, Parbhani, Dist. Parbhani  
Member

05 Mrs. Ratna Vyankat Kirtane  
Assistant Professor, Department of Fishery Science  
Dayanand Science College, Latur  
Member

06 Dr. Hiwre Chandrashekar J.  
Professor & Head, Department of Zoology  
Dr. Babasaheb Ambedkar Marathwada University, Aurangabad  
Member

07 Dr. Ingole Baban  
Professor of CSIR & Chief Scientist  
National Institute of Oceanography (NIO), GOA  
Member

08 Dr. Sarwade Jeevan Pandurang  
Associate Professor & Head, Department of Zoology, Art, Science & Commerce College, Indapur, Dist. Pune  
Member

09 Dr. Sawate Sopan Sambhaji  
Assistant Manager, Growel Feeds Pvt. Ltd. Syno 57, Chevuru Village, Mudinepalli Mandal, Dist. Krishna, AP  
Member

10 Shri Patil Dhananjay Wamanrao  
Assistant professor & Head, Department of Fishery Science  
Toshniwal Arts Commerce & Science College, Sengaon Dist: Hingoli  
Invited Member

11 Shri Markad Sandip Surendra  
Assistant professor, Department of Fishery Science  
Toshniwal Arts Commerce & Science College, Sengaon Dist: Hingoli  
Invited Member