

INDUSTRIAL FISH AND FISHERIES (Pass)

4 Credits

Marks - 50

FISP – 101 (Theory)

Unit I Taxonomy

- i) Definition of taxonomy, taxonomic terms. Role of taxonomy.
- ii) Nomenclature and its importance. Binomial nomenclature.
- iii) Difference between systematics and taxonomy purpose of classification.
- iv) Hierarchy of categories in classification.
- v) General characters and outline classification of Pisces up to order with examples.
- vi) Biodiversity of ichthyofauna of N.E. India.
- vii) Morphological variation in body form, fins, body colouration scales, mouth, snouts, jaws, & teeth.

Unit II Physiology – I

- i) Food and feeding habits in fishes.
- ii) Digestive system of any Indian major carp and any cartilaginous fish. Mechanism of digestion. Role of digestive glands in digestion.
- iii) Respiration in fishes structure of gills, air bladder, accessory respiratory organs their functions, and mechanism of respiration.
- iv) Excretion and osmoregulation in fresh water and marine aquatic environment.
- v) Circulatory system of fish
- vi) Nervous system – structure of brain of any teleost fish, cranial nerves in teleost.

Unit III Physiology – II

- i) Different type of sense organs- lateral line system, olfactory, auditory and photoreceptor.
- ii) Electric organs – organ of sound production. Electric organs, structure, electric organs of torpedo, functions of electric organs ,sound producing organs - Air bladder as sound producing organ, significance of sound production.
- iii) Structure and function of endocrine glands in fishes- pituitary gland, thyroid, interrenal tissue. Chromaffin tissue, pancreatic islets, pheromones, urophysis
- iv) Growth of fish & methods of determining the growth of fish.
- v) Colouration – sources of colour, colour changes, control of colour changes, significance.

FISP- 102 (Pass)

3 credits

(Practical) Time- 5hrs.

Marks - 30

1. Visual aids/ display/ model of
 - i) Nervous system of Prawn
 - ii) Digestive and reproductive system of any Indian major carp.
 - iii) Afferent and efferent branchial vessels of any common teleost
 - iv) Digestive system of any air breathing fish.
 - v) Accessory respiratory organ of clariasbatrachus, Heteropneustesfossilis, Anabas sp., Channa sp.
 - vi) Brain of any common teleost.
2. Permanent slide preparation:-

Students are to familiar in to the basic principle of narcotisation, fixation, staining, dehydration and mounting of the following:-

Cycloid and ctenoid scale, daphnia, cyclops, mysis, spirogyra, volvox etc.
3. Study of prepared slides of the following:-

T.S. of stomach, intestine, gill, liver, kidney, and endocrine glands of fish.
4. Study of museum specimens:-

Prawn, crab, unio

Labeo rohita, Catla catla, Labeo calbasu, Labeo gonius, Cirrhinus mrigala, Ctenopharyngodon idella, Hypopthalmichthys molitrix, Notopterus notopterus, Notopterus chitala, Amblypharyngodon molar, Channa punctatus, Clarias batrachus, Anabas testudineus, Heterpneustes fossilis, Xenentodon cancila, Mastocembalus armatus, Amphipnous cuchia, Puntius sarana, P. ticto, P. sophore, Chanda sp, Nandus sp, Tilapia sp, Rita rita, Ailia coilia, Eutropichthys vacha, Gudusia chapra, Cyprinus carpio, Mystus vittatus, Aorichthys aor, Wallago altu, Colisa sp, Ompok bimaculatus, Botia dario, Hippocampus
5. Laboratory notebook
6. Viva voce.

Distribution of marks

i) Visual aids/display (Spottins & Comments)-	4
ii)Permanent slide preparation-	4
iii)Slide identifications-	4
iv)Museum specimens	8
v)Laboratory notebook-	5
vi)VivaVoce-	5

Internal assessment marks – 20

Total-30

FISP -201 (Pass) (Theory)

4Credits

Marks – 50

Unit I

Basic aquaculture and aquatic environment –I

- i) Aquaculture – Definition, History of aquaculture, purpose of aquaculture, importance of aquaculture status of aquaculture in different countries.
- ii) Categories of form type and fish farming system.
- iii) Basic considerations in the selection of species for culture.
- iv) Cultivable fresh water fin fishes. And non-fish organism. Advantage of fin fish culture.
- v) Breeding mechanism and techniquespecial reference to clarias.
- vi) Caudal fin –types, structure of finray,
- vii) Integument –structure and functions.
- viii) Scales – Types, use of scales in classification and life history

Unit II

Fish genetics and biotechnology

- i) Principles of genetics.
- ii) Sex Chromosomes and sex determination polyploidy
- iii) Chromosomes- Morphology, chemical structure & kinds of chromosomal
- iv) Mutation- Gene and chromosomal
- v) Interaction of gene- complementary, supplementary, inhibitory (epistatis) and duplicate type.
- vi) Different methods of breeding- inbreeding, crossbreeding& selective breeding.
- vii) Hybridization- Process, Advantages & disadvantages
- viii) Transgenic fishes- concept & its applications
- ix) Cryopreservation of gametes (gene banking) Cryopreservation technique.
- x) Selection- Aim, basis & methods of selection.

Unit III

System of aquaculture

- i) Extensive, intensive, semi-intensive culture.
- ii) Mono culture and mono sex culture, recovery culture, sex reversal, and sterile fish.
- iii) Integrated fish farming- definition paddy cum fish culture, poultry cum fish culture, duckery cum fish culture, piggery cum fish culture.
- iv) Construction and maintenance of fish farm.
- v) General organization and affinities of dipnoi
- vi) Aquatic& their control & importance
- vii) Algal bloom – types, bloom formation effects of algal bloom on fish.

- viii) Nutritional requirements and formulation of artificial diet, storage of food.
- ix) Feeding techniques to fishes
- x) Biology of exotic fishes.

Unit IV

INLAND CAPTURE FISHERIES - I

- i) Inland capture fishery resources of india.
- ii) Riverine fisheries of India- Brahmaputra Bank, Ganga, Indus, East coast and west coast river system
- iii) Reservoir fishery management- reservoir (lacustrine), Distribution of reservoirs, Merits & demerits of reservoirs.
- iv) Lacustrine fisheries – lake –definition, classification of lakes on the basis of circulation of another, principal lakes of India, fisheries of lakes.
- v) Beel fisheries of Assam.
Fisheries of the cold water- Indigenous cold water fishes, Exotic cold water fishes.

Unit V

INLAND CAPTURE FISHERIES - II

- I) Concept of Inland capture fisheries of the world- principal non fish cultivated organisms of the world used in aquaculture. Present status global decline in fishing catches.
- II) Brackish water fisheries – Types of estuary, ecological characteristics of brackish water, principal estuaries. Principal fisheries – clupeids, mullets, catfishes, perches, threadfins, milkfish Chilka lake –its fisheries.
- III) Bheries- definition, fish species cultured in bheries.
- IV) Conservation of fish genetic resources.
- V) Major Pelagic and demersal fin fishes
- VI) Fishing Craft and fishing gear. Use of Acoustic equipments

Distribution of Marks

Unit I	-	10
Unit II	-	10
Unit III	-	10
Unit IV	-	10
Unit V	-	10
<hr/>		
Marks	-	50

FISP- 202 (Practical) 3 Credits

Time – 5 hrs.

Marks - 30

1. Visual aid/ display/ model
Aquaculture of different types:-
Fresh water, brackish water and marine water. Induced breeding of carps.
2. Integrated fish farming (visual aid/ model/ display)
Paddy cum fish culture
Poultry cum fish culture
Duckery cum fish culture
Piggery cum fish culture
3. Preparation of pituitary extract from any Indian major carp.
4. Qualitative and quantitative estimation of stomach content of clarias/ any Indian major carp
5. Laboratory notebook
6. Via Voce

Distribution of Marks

i)	Aquaculture- Visual time- (Identification of aquaculture & related comments specifying different types of fish SP. Cultured) (Different types of fish be displayed as visual aid in different aquaculture)	3
ii)	Different types of integrated- Fish farming be shows as model or visual aid specifying related comments	3
iii)	Pituitary extract preparation-	7
iv)	Estimation of stomach content -	7
v)	Laboratory note book-	5
vi)	Viva Voce-	5

Total- 30

Internal Assessment Marks - 20

FISP- 301 (Pass) (Theory)

4 Credits

Marks - 50

Unit I

Coastal aquaculture

- i) Culture of brackish water prawn- production of seed, factors influencing the development of larval, Methods of prawn culture, eye stalk ablation. Culture of Prawn for commercial purposes.
- ii) Natural feed for brackish water Prawn
- iii) Sea weed culture- Definition, important species of seaweeds, Benefits of seaweeds culture.
- iv) Mariculture with reference to crustacean and molluscan fishery.
- v) Culture of marine edible oyster and pearl oyster in India. Importance of pearls. composition of pearls.
- vi) Adaptations in the deep sea fishes.

Unit II

Fish Pathology

- i) Significance of fish disease in relation to aquaculture practices and fish farm management.
- ii) Pathological changes in organs and tissues of fishes and diagnosis of fish disease.
- iii) Principles of fish health management. Fish immunization and vaccine.
- iv) Disease types- infections and Non infections
- v) Non infections disease- Environmental, Nutritional.
- vi) Infection fish disease with their remedial measure- Bacterial, Viral, Fungal, EUS, protozoon, Metazoan (Helminth Annelid and Crustacean)

Unit III

Basic aquaculture and aquatic environment

- i) Productivity of aquatic ecosystem, food chain
- ii) Water quality and soil condition of fish
- iii) Management of soil and water for aquaculture
- iv) Limiting factors- definition & principles
- v) Aquatic insects & their control
- vi) Microorganisms and nutrient cycles
- vii) Aquatic pollution – definition, water pollutants sources causes & types of water pollution effects of pollution on fish & control of water pollution.

Unit IV

System Of Aquaculture

- i) Composite fish culture
- ii) Cage culture of fishes and its importance
- iii) Pen culture of fishes and its importance
- iv) Air breathing and carnivorous fish culture
- v) Sewage fed fisheries- definition, quality, advantage, sewage, treatment techniques and its use in fish ponds.
- vi) Pond fertilization – significance, organic manure- advantage, varieties of inorganic fertilizers- advantage.
- vii) Organic aquaculture – elementary knowledge & its significance.
- viii) Management of feeding – probiotics, prebiotics, immunostimulators

Unit V

Fish reproduction and development

- i) Male reproductive organs – histology of testis
- ii) Seasonal morpho – histological changes intestes of a teleost and GSI (Gonado somatic index)
- iii) Female reproductive organs- different stages in the maturation of anoocyte
- iv) Maturation and spawning. Factors affecting spawn ring in fishes.
- v) Types of Eggs, ovulation & fertilization
- vi) Sexual dimorphism & courtship
- vii) Parental care in fishes.
- viii) Gastrulation in fishes- early development
- ix) Fecundity – definition, types, Methods of estimation of fecundity,
- x) Fish migration – definition, types, migratory species, Patterns of Migration. Migration for spawning.

Distribution of Marks

Unit I - 10

Unit II - 10

Unit III - 10

Unit IV - 10

Unit V - 10

Marks - 50

Fisp- 302 (Pass) (Practical)**3 Credits****Time – 5 hrs.****Marks - 30**

1. Identification of the following :
Paeneus monodon, sting ray, Torpedo, Bombay duck, Latescalcariffer, pomfret, scoliodon, chanos SP. Hilasa, Stegostoma, sardinella, pristis, sphyrna, Fish diseases- Dropsy, furunculosis, gillrot, tailrot, argulus, lernaea, caligus.
2. Identification of predatory insets:- Dragon fly nymph, Ranatra, Corixa, Cybister, Notonecta, lithocerus, Hydaticus, Anisops, Belostoma.
3. Physico-chemical analysis of soil and water:-
 - a) Temperature, moisture, texture, of soil
 - b) Temperature, turbidity, PH, dissolved oxygen (DO) of water
4. Model/ Display/ Visual presentation of composite fish culture, case culture, air breathing fish culture. Parental care in fish.
5. Laboratory Note book
6. Viva Voce

Distribution of Marks:

i)	Identification (Specimens) -	10
ii)	Experiment-	6
iii)	Visual aid-	4
iv)	Laboratory note book -	5
v)	Viva Voce-	5
Total		30

Internal Assessment Marks – 20

FISP- 401 (Pass) (Theory)

4 Credits

Marks - 50

Unit I

Fresh Water aquaculture

- i) Pond management prestocking management of ponds, types of ponds for fish culture.
- ii) Breed of cultivable fish species.
- iii) Preparation & management of nursery, rearing & stocking ponds.
- iv) Post stacking management of ponds- feeding, thinning and harvesting.
- v) Larvivorous fishes- exotic species- indigenous species. Relative utility of exotic & indigenous larvivorous fishes.
- vi) Hill stream fishes- their modifications and adaptations.
- vii) Elementary idea of predatory and weed fishes
- viii) Culture of fresh water prawn and pearl.

Unit II

Aquarium management

- i) Aquarium- Definition, History and types.
- ii) Setting of Aquarium- gravels, plants, ornamental objects and selection of fishes.
- iii) Aquarium fishes – live bearers and egg layers.
- iv) Maintenance of aquarium, food for aquarium fishes
- v) Breeding of ornamental fishes. Selection and conditioning of fishes for breeding
- vi) Common diseases of aquarium fishes and treatment.
- vii) Culture of fish food organism with reference to Diatoms and rotifers and copepods.

Unit III

Past harvest Technology

- i) Presentation- Definition, principles, merits and demerits of preservation
- ii) Causes of spoilage of fish- use of fish preservations special problems in fish preservation
- iii) Methods of preservation chilling, freezing, canning semidrying, salting, smoking, brining and preservation with chemicals.
- iv) Processing and preservation of fish by product – fish liver and body oil, fish meal, fish silage, fish manure and guano, fish guano and isinglass and fish leather.
- v) Economic value of fishes.

- vi) Estimation of population- direct or actual count method, indirect methods of estimation mark and recapture methods.

Unit IV

Fish Economics and fisheries extension

- i) Economics- Definition, application of Economics principle in fishery- free goods and economic goods.
- ii) Demand and law of demand of fish, properties and features. Production and factors of production. Laws of production economic value.
- iii) Fishery resources and property resources concept of maximum sustainable yield (MSY) Maximum Economic yield (MEY) optimum sustainable yield (OSY)
- iv) Overfishing- growth over fishing and recruitment overfishing. Ranching (Culture based capture method)
- v) Acoustic assessment and satellite/ aircraft remote sensing of fish stock.
- vi) Fish farmers development Agencies and other agencies (FFDA)
- vii) Rational fishery- introduction, organization- fishery survey, fishes statistics & fishery management.

Unit V

Fish Economics And Fisheries Extension II

- i) Fish marketing- definition, Aim, Characteristic, Types and Stages of fish marketing.
- ii) Methods of selling fish marketing organization and improvement
- iii) Problems of fish marketing.
- iv) Fishery co-operative- Aim and role of co-operative in fishery economy. Organization of fishermen co-operatives.
- v) Fisheries extension- Definition, extension philosophy and Methodology
- vi) Fishing community and their socio- economic problems.
- vii) Co-operative movements.

Distribution of Marks

Unit I - 10

Unit II - 10

Unit III - 10

Unit IV - 10

Unit V - 10

Marks - 50

FISP- 402 (Pass) (Practical)**3 Credits****Time – 5 hrs.****Marks - 30**

1. Collection and identification of planktons.
2. Identification of six ornamental fishes. Fish predator- Reptilia, Aves and Mammalia (At least two predators from each clan)
3. Submission – students are to submit at least four wet preserved specimens mentioning name, classification etc. during practical examination
4. Histological slide preparation through microtomy techniques in fishes.
(Students are to submit two slides prepared in the laboratory during practical examination.)
5. Field study:- Students are to visit any wet land or fish farm. They are to observe fishing and collecting field data regarding species composition, crafts and gears and field problems. Submission of field report giving analysis of data drawing of graph, Photograph etc. indicating their distribution, abundance concerned teacher.
6. Job Training Report (JTR):- Students are to participate in any training programme conducted by various fishing or aquaculture related institute or any organization fish farm within or outside the state. They have to submit a detailed report of their training programme, along with photograph data, certificate etc & duly signed by teacher- incharge.
7. Laboratory note book
8. Viva voce

Distribution of Marks:

1.	Identification (Planktons)-(2x2)	4
2.	Identification-(Specimens)-(3x2)	6
3.	Submission of histological slides-	3
4.	Job Training Report-	7
5.	Laboratory notebook-	5
6.	Viva Voce-	5

Total – 30**Internal Assessment marks - 20**