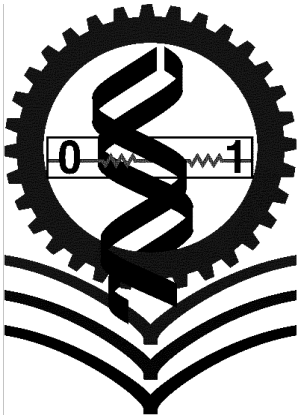
FACULTY OF FISHERIES

COURSE LAY OUT AND SYLLABUS

OF

B.SC.Fisheries (Hons.) DEGREE

Level-1



HAJEE MOHAMMAD DANESH SCIENCE AND TECHNOLOGY UNIVERSITY DINAJPUR.

Course Layout of B.Sc. Fisheries (Hons.) Degree

	Semesters					
Level /Year	Semester-I			Semester-II		
	Course Title	Course Code	Credit Hour (T+P)	Course Title	Course Code	Credit Hour (T+P)
1	**Compulsory**			**Compulsory**		
	Fisheries Zoology	FBG 101, 102	3+1.5	General Ichthyology	FBG 103, 104	3+1.5
	Aquatic Ecology	FMG 101, 102	3+1.5	Fresh Water Aquaculture	AQC 101, 102	3+1.5
	Chemistry	ACH 107, 108	3+1.5	Physico-Chemical Limnology	FMG 103, 104	3+1.5
	Rural Sociology	SSL 103	3+0	Biochemistry	ACH 109, 110	3+1.5
	Elective (any one)			**Elective (any one)**		
	English Language	SSL 105	2+0	Computer Science	CSE 109	2+0
	Introductory Aquaculture	AQC 103	2+0	Aquatic Soil Science	FMG 105	2+0
	Total Credit		**14+4.5=18.5**	**Total Credit**		**14+6=20**
	Semesters					
2	**Compulsory**			**Compulsory**		
	Biodiversity and Fishery Systematics	FBG 201, 202	3+1.5	Fish Parasitology	AQC 205, 206	3+1.5
	Coastal Aquaculture	AQC 201, 202	3+1.5	Fish Population Dynamics-I	FMG 203	3+0
	Fisheries Microbiology-I	FTL 201	3+0	Principles of Genetics	FBG 204, 205	3+1.5
	Statistics	STT 205, 206	3+1.5	Fisheries Microbiology-II	FTL 203	3+0
	Biological Limnology	FMG 201, 202	3+1.5	Fisheries Microbiology	FTL 204	0+1.5
	Elective (any one)			**Elective (any one)**		
	GIS in Fisheries	AQC 203	2+0	Live Food Culture	AQC 207	2+0
	Shell fish Biology	FBG 203	**2**	Semester-I	Semester-II	2+0
	Total Credit		**17+6=23**	**Total Credit**		**14+4.5=18.5**
	Semesters					
3	Semester-I			Semester-II		
	Compulsory			**Compulsory**		
	Fish Pathology	AQC 301, 302	3+1.5	Fish Nutrition	AQC 303, 304	3+1.5
	Fish Population Dynamics-II	FMG 301	3+0	Fish Farm Design and Construction	AQC 305, 306	3+1.5
	Fish Population Dynamics	FMG 302	0+1.5	Oceanography and Marine Biology	FMG 303, 304	3+1.5
	Fish Physiology	FBG 301, 302	3+1.5	Fish Processing	FTL 305, 306	3+1.5
	Fish Harvesting	FTL 301, 302	3+1.5			
	Elective (any one)			**Elective (any one)**		
	Fishery by-products	FTL 303	2+0	Marine Food Chemistry	FTL 307	2+0
	Biology of Farmed Fishes	FBG 303	2+0	Culture of Ornamental Fish	AQC 307	2+0
	Total Credit		**14+6=20**	**Total Credit**		**14+6=20**

COURSE LAYOUT

Level /Year	Course Title	Course Code	Credit Hour (T+P)	Course Title	Course Code	Credit Hour (T+P)
	Semesters					
4	Semester-I			Semester-II		
	Compulsory			**Compulsory**		
	Fish Genetics and Breeding	FBG 401, 402	3+1.5	Hatchery Management	FBG 403, 404	3+1.5
	Fish Feed Technology	AQC 401, 402	3+1.5	Fish Health Management	AQC 405, 406	3+1.5
	Inland Fisheries Management	FMG 401, 402	3+1.5	Fisheries Extension		3+1.5
	Quality Control of Fishery Products	FTL 401, 402	3+1.5	Marine Fisheries Management	FMG 405, 406	3+1.5
	Fisheries Economies	ECN 407	3+0	**Elective (any one)**		
	Elective (any one)			Principles of Molecular Biology & Biotechnology	FBG 405	2+0
	Integrated Aquaculture	AQC 403	2+0	Sustainable Livelihood Approach (SLA)	FMG 407	2+0
	Fisheries Resources	FMG 403	2+0			
	Total Credit		**17+6=23**	**Total Credit**		**14+6=20**

Credit required for Theoretical : 118
Credit required for Practical : 45
Total Credit required : 1

SEMESTER-I

Department of Fisheries Biology and Genetics

Course Code: FBG 101
Course Title: Fisheries Zoology
Theoretical: 3 Cr.

1. Introduction: Course goals, objectives and outcomes,
2. General survey and classification of animals up to sub-class level with special emphasis on groups having fisheries importance.
3. Adaptation of animals to aquatic life with special reference to temperature, salinity, current, depth, light etc.
4. Economic significance of the following groups of animals: Protozoans, Porifera, Coelenterates, Rotifers, Nematodes, Oligochaetes, Mollusks, Crustaceans, Aquatic insects, Echinoderms, Frogs, Aquatic reptiles, Fishing birds and Cetaceans.

5. Functional morphology and life history of the following aquatic animals: Paramecium, Aurelia, Pila, Lamellidens, Loligo, Macrobrachium, Scylla, Rana, Chitra, Crocodilus.

FBG 102 : Fisheries Zoology
Practical : 1.5 Cr.

Students shall maintain a record of everything done in the practical and field sessions in a Practical Note Book to be signed and checked by teacher(s) concerned.
Viva voce test will form an essential part of the Practical Examinations.
Collection and preservation of aquatic animals.
Characterization and identification of the collected specimens.
Study of external morphology of fresh and preserved specimens.
Study of anatomy of different organ systems of representative invertebrates and chordates.

Text Books and references:

Barnes, R.D., 1978. Invertebrate Zoology. W.B. Saunders Co., Philadelphia. London.
Parker, T.J. and Haswell, W.A., 1960. A Text Book of Zoology (7^{th} edition) Vol. I and II. Macmillan Co. Ltd. London.
Storer, T.I. and Usinger, R.L., 1965. General Zoology. McGraw Hill Book Co. New York.
Hyman, L.H., 1940. The Invertebrate, Vol. I-VI. McGraw Hill Publishing Co. New York.
Jordan, E.E. and Verma, P.S., 1985. Invertebrate Zoology. S.Chand and Company. Ramnagar, New Delhi.
Tonapi, G.T., 1980. Freshwater Animals of India. Oxford and IBH Publishing Co., New Delhi.
Walter, H.E. and Sayles, L.P., 1949. Biology of Vertebrates. The Macmillan Company, New York.
Young, J.S., 1962. The Life of Vertebrates (2^{nd} edition) Oxford University Press.
Weinchert, C.K. and Presch, W., 1975. Elements of Chordate Anatomy., McGraw Hill Book Company, New York.
Kurian, C.V. and Sebastin, V.O., 1976. Prawn and Prawn Fisheries of India. Hindustan Publ. Co. Delhi.
Cobb, J.S. and Bruce, F. (eds), 1980. The Biology and Management of Lobsters. Vol. I and II. Academic press, New York. London.
Cantley, P.T. and Hodgson, B.H., 1980. Reptiles and mammals of Indian subcontinent. Cosmo Publ. New Delhi.
Warner, G.F., 1972. The Biology of Crabs. Van Nostrand Reinhold, New York.
Spence, A., 1989. Crab and Lobster Fishing. Farnham Fishing News.
Bryden, M.M. (ed.), 1986. Research on Dolphins. Oxford University Press.

Department of Fisheries Management

Course Code : FMG 101
Course Title: Aquatic Ecology
Theoretical : 3 Cr.

1. **Introduction:** Definition of population, community and ecology, scope of ecology, subdivision of ecology.
2. **Ecosystem:** Concept of ecosystem, habitat, ecological niche, food chain, trophic structure and ecological pyramids, productivity of water, homeostasis and ecological balance.
3. **Limiting factors:** Liebig's law of minimum, She ford's Law of tolerance, combined concept of limiting factors, ecological indicators.
4. **Population ecology:** Concepts of population, population group properties, population density, rates, nasality, mortality, age distribution, biotic potential and environmental resistance, growth form and carrying capacity, population dispersal and structure.

5. **Concepts pertaining to organization at the interspecies population level:** Types of interaction between two species, competition, predation, parasitism, commensalisms, protocooperation and mutualism.
6. **Community ecology:** Community concept, community classification, composition, structure, stratification and periodicity, ecological succession and concept of the climax, ecotone and edge effect.
7. **Freshwater ecosystem:** Types and limiting factors, ecological classification of freshwater organisms, lakes, pools and other water-bodies, general models of production, running water communities, sources of food and energy flow in streams, floodplains, floodplain fisheries, modification of floodplain ecosystems.
8. **Estuarine ecosystem:** Definitions and types of biota, productivity, food production potential.
9. **Marine ecosystem:** The marine environment, communities of marine environment, function of marine ecosystem.

FMG –102 : Aquatic Ecology
Practical : 1.5 Cr.

Students shall be required to show a good knowledge of the topics included in the theoretical portion of the paper. They shall maintain a record of everything done in practical classes/ field trips in a practical note book to be signed and checked by the teacher (s) concerned. Viva-voce test will form an essential part of the practical examination.

1. Acquaintance with the equipment used in field study.
2. Study of pond as a lentic ecosystem.
3. Collection of freshwater fishes and their ecological classification.
4. Study of food web in a lentic habitat.
5. Study of stream as a lotic ecosystem.
6. Study of food web in a lotic habitat.
7. Study of species diversity indices in freshwater habitat.
8. Identification of aquatic weeds and their types.
9. Field visit to coastal mangrove and marine ecosystem and their community composition.

Text books and references:

1. Andrewartha, G.H., 1981. An introduction to animal populations.
2. Barnes, R.S.K. and Hughes, R.N., 1999. An introduction to marine ecology. 3rd Ed. Blackwell Science, 286 pp.
3. Cairns, Jr. J., 1995. Rehabilitating damaged ecosystems. 2nd Ed. Lewis Publishers, 424 pp.
4. Dudley, W.D., 1992. Aquatic insects. Wallingford: CAB International, 335 pp.
5. Elton, C. G., 1962. Animal ecology. Sidgwick & Jackson, London.
6. Gupta, O.P. 1992. Aquatic weeds. Today and Tomorrow's Printers and Pub., New Delhi, 272 pp.
7. Hynes, H.B., 1972. Ecology of running waters. Liverpool University Press, Liverpool.
8. Lincoln, R., Boxshall G. and Clark, P., 1998. A dictionary of ecology, evolution and systematics. Cambridge University Press, 361 pp.
9. Macan, T.T., 1974. Ecology of coastal waters. Blackwells, Oxford.

10. Moss, B., 1988. Ecology of freshwaters. Blackwell Scientific Publications, Oxford.
11. Odum, E.P., 1971. Fundamentals of Ecology. W.B. Saunders Company, London, 574 pp.
12. Odum, E.P., 1993. Ecology and our endangered life-support systems. 2nd Ed. Sinauer Associates, Inc., Massachusetts, U.S.A., 301 pp.
13. Pitcher, T.J. and Hart, P., 1982. Fisheries Ecology. Croom Helm, London.
14. Rahman, A.K.A., 1989. Freshwater fishes of Bangladesh. Zoological Society of Bangladesh, 364pp.
15. Santhanam, Velayutham R. P. and Jagatheesan, G., 1989. A manual of freshwater ecology. Daya, New Delhi.
16. Seagrave, C., 1988. Aquatic weed control. Fishing News Books, 154 pp.

Department of Agricultural Chemistry & Biochemistry

Course Code: ACH 107
Course Tite: Chemistry
Theoretical : 3 Cr.

Solution: Colligative properties of dilute solutions.

Colloids & Surface chemistry : Definations, classification, preparation, purification and propertions Adsorption istherm .

Electrochemistry: Ionic equilibria, Ostwald's dilution law, common ion effect, electrolytic dissociation & conductance theories of strong electrolyties, p^H, buffer solution & its preparations, measurement of p^H by different method using different electrodes. Solubility & Solubility product, principle of precipitation.

Thermodynamics: First and second laws of thermodynamics with their applications.

Entopy & Free energy.

Chemical kinetics: Order of reaction, Order and Molccularity, Mathematical formulation of Kinetic expression.

Method of quantitative analysis: Principle of different types of volumctric analysis, Theory of acid-base indicator. Different redox reaction, Iodimetry & Iodimetric titration.

Colorimetric analysis: Theory spectrophotomety lambert's coloisnts, Beer's law and their application.

Formation & cleavage of covalent bond. Mechanism of addition, substitution & elimination reactions.

Name reactions: Aldol, Cannizzaro, Friedel Caraft perkins, Dicls-Alder reaction.

Aromatic & Hetreoyclic compounds: Specially pyrrole, Thiophene, Furan, pyridine etc. Carbonyl Compounds & Carboxylic acids:

Carbohyrates: Defination, Classification, Nomenclature, Ring structure & Reaction of glucose, Ruff's degradation, Killani Fischer synthesis, Amino & Deoxy suger etc.

Natural products: Chemistry of alkaloids, terpenoids & purincs.

Stereochemistry: Optical activity, Enantiomer, Meso compound, Racemic mixture, Diastero isomer, Stereochemistry of two or more simillar or dissmilar assymatric carbon, atom, Geometrical isomerism, Boat & chair conformation of glucose.

Nuclear Chemistry: Radioactivity, properties of a b & y raydiation, counters, application of radioisotopes.

Introduction of UU, IR, NMR and Mass spectrometry and chromatography.

BOOKS RECOMMENDED:

A text book of physical chemistry-Lewis & Glasstone.

Physical Chemistry Daniel & Alberty.

A text books of physical chemistry-Sharma & Sharma.

Principal of physical chemistry-Haque & Nawab.

Physical chemistry Shanti Ranjan palit.

Analytical chemistry Sirajul Karin.

Modern Inorganic Chemistry- S. Z. Haider

Analytical Chemistry Skoog, West & Holler

A text book of Organic Chemistry-Bahl & Bahl

Organic Chemistry- A Jabber & Mafizuddin Ahmed

Advanced Organic Chemistry (Reaction & Mechanism) – Jerry March

Organic Chemistry- Morrison & Boyd

Organic Chemistry (volume 1 & 11)-LL Finar

Text book of Qualitative & Quantitative analysis-Vogel

Carbohydrate chemistry- Davidson

Carbohydrate chemistry- Honeyman

Organic chemistry- Jiben Roy

Practical Analytical Chemistry-Hazari, Das & Dey.

Fundamental of Organic Chemistry by Graham Solomans.

Organic Chemistry A concise Approch by Menger, D Goldsmith and Mandif, W, A. Benjamin etc.

Chemistry of Organic Natural products by Agarwal, Guel publishing.

Natural products Chemistry by Nakanishi, Goto, Ito, Natori Nozoe Academic press Inc.

introduction to Alkaloids by Cordill.

Physical Chemistry by charg

Physical Chemistry by Atkins

Reaction Mechanism by Peter Sykes.

ACH 108: Chemistry
Practical : 1. 5 Cr.

Introduction of Quantitative & Quantitative. Preparation of primary and secondary standard solution analysis of the following compounds: $Na_2\ CO_3$, H_2SO_4, $H_2C_2O_4$, $KMnO_4$, $K_2Cr_2O_7$ etc.
Titration: Acids-Base titration, Red ox titration, potentimctric titration, Precipitation titration & complexometrics titration.
Identification of Organic compounds and their functional groups: Department on of melting & boiling points of compounds. Oxalic, Citric, Formic, Acetic & Malice acids, Urea, Aldehyde & Ketones etc. preparation of derivatives. Measurements of p^H and preparation of Buffer solution.
Separation Technique of organic and Bioorganic compounds by chromatography.

Department of Social Science and Language

Course Code: SSL 103
Course Title: Rural Sociology
Theoretical : 3 Cr.

1. **Sociology ;** Importance of Rural Sociology ; Role of the Rural Sociologists in Agricultural Development.
2. **Introduction :** Definition of Sociology and Rural Sociology , Origin and Development of Rural Sociology ; Scope of Rural Methods and Techniques of Social Research : Scientific research methods , importance value judgments and ethical issues , types , research process , sampling , mode of data collection, and analysis of social data.
3. **Culture :** Meaning , Importance of functions , elements , Cultural universals and variability ethnocentrism and relativism.
4. **Social Differentiation , Stratification and Rural Power Structure:** Nature and sources of social differentiation , importance and consequences, form of Stratification , class and caste , class system of rural Bangladesh , Nature of Rural Power Structure, kinship and rural elite power structure and development activities.

5. **Society, Technology and Rural Social Change:** Technology and change in human society , Changes in traditional technologies , Green revolution , industrialization , urbanization, modernization, unemployment.
6. **Rural Livelihood and Sustainability:** Definition of Livelihood and Changing Socio Economic activities , Institutional Arrangements , Integrated Framing System ; Agriculture Rice Fish Culture, Poultry and Livestock.
7. **Rural Poverty, Rural Development and GO and NGO Activities :** Meaning and nature of Rural Poverty , Rural Development models , GO and NGO activities.
8. **Fisheries and Environmental Quality:** History of environmental movement, impact of culture on environment, consequences for human communities, social impact assessment .
9. **Rural women and gender issues:** Women and development , gender discrimination, aspects of gender inequality, important issues and techniques of development of women in Bangladesh.
10. **Rural social Policy and planning :** Meaning and contribution of Rural Sociology in so policy , objectives of rural social planning pre- requisite , limitations and obstacles of effective social planning ,application of social planning.

Text Books:

1. Browne, Ken. 1998. An Introduction to Sociology. Polity Press , London
2. Rogers , E.M. et al. 1998. Social Change in Rural Societies: An Introduction to Rural Sociology, Prentice Hall , London .
3. Giddens , Anthony . 1998 . Sociology, 3rd edition , Polity Press , London
4. Devi , Laxmi. 1998 . Rural Sociology . Anmol , India.
5. Chitambar, J.B. 1993. Introductory Rural Sociology.Wily Eastern Ltd , India.

Department of Social Science and Language

Course Code: SSL 105 (Elective)
Course Title: English Language
Theoretical : 2 Cr.

English Grammar: Types of sentences and their constructions, grammatical problems and common errors ; Vocabulary; English Phonetics ; Spoken English ; Developing fluency.
Reading comprehension : Reading strategies for different purposes.
Paragraph writing : Paragraph development techniques, choice of words, mechanics of paragraph writing, Précis writing , Amplification.

Report writing : Formal, Mechanics of language ; Business correspondence and tenders ; Short stories

Department of Aquaculture

Course Code: AQC 101
Course Title: Introductory Aquaculture
Theoretical : 2 Cr.

1. **Introduction:** Definition and aim of aquaculture, history of aquaculture, present ststus and scope of aquaculture in Bangladesh.

2. **Aquaculture resources:** Inland, brackish and marine water bodies. Culturable indigenous and exotic fishes. Problems and prospects of fish culture in Bangladesh. Problems and prospects of aquaculture in Bangladesh.

3. **Fish ponds:** Classification and characteristics of an ideal fishpond. Pond construction-area, shape, pond dike, bottom, contour etc.

4. **Water quality in aquaculture:** Physical and chemical properties of water, primary productivity, phytoplankton, zooplankton and benthos.

5. **Selection of species for stocking:** Biological characteristics of aquacultural species. Economic and market considerations. Sources of fry, fingerlings, primary nursing and stocking. Stocking ratio for mono-culture and polyculture.

6. **Nutrition and feeding:** Major nutrients in fish feed. Natural and artificial feed. Supplemental and balanced diets. Feeding habits and food utilization. Different types of live foods used in aquaculture.

7. **Controls of weeds, pests and predators:** Different types of aquatic weed. Weed problem in aquaculture. Methods of controlling of weeds and pests in aquaculture.

8. **Aquaculture extension:** Government and non-government organizations involved in aquaculture extension. Constraints to aquaculture extension.

Text and reference books:

1. Huet, M. (1979). Textbook of fish culture Fishing News Books Ltd. U.K.

2. Pillay, T. V. R. (1990). Aquaculture. Principles and practices. Fishing News. Books Ltd. U. K.

3. Stickney, R. R. (1994). Principles of Aquaculture. John Wiley & Sons, INC. New York.

4. Bardach, J. E., J. H. Ryther and W. O. McLarney. (1972). Aquaculture. Wiley-Interscience, New York..

Islam, M. A. (2001). Aquaculture. Bangla Academy. Dhaka.

Karim, M. A. 1975. An introduction to fish culture in Bangladesh. Ruby Press, Mymensingh, Bangladesh.

Landau, M. (1992). Introduction to aquaculture. John Wiley & Sons, New York.

Shang, Y. C. 1981. Aquaculture Economics: Basic Concepts and Methods Analysis. Westview Press, Croom Helmm, England.

Wheaton, F. W. (1977). Aquaculture engineering. Wiley- Interscience, New York.

LEVEL-1, SEMESTER - II

Department of Fisheries Biology and Genetics

Course Code: FBG 103

Course Title: **General Ichthyology**

Theoretical : 3 Cr.

1. **Introduction:** Course goals, objectives and outcomes. History of Ichthyology
2. **Definition of fish. Important facts and figures about fishes:** Classification of major groups of freshwater and marine fishes
3. **External morphology:** Body forms, shapes and sizes. Body coverings. Appendages and openings. Skin, scales, skeleton, and fins. Derivatives of skin. Coloration in fishes and its significance
4. **Muscles and locomotion:** Types, and their roles in locomotion and movements of different body parts

5. **Anatomy of different internal organs:** Respiratory system: Structure of gills, accessory air-breathing organs. Digestive system: Food, feeding habits and feeding adaptations; comparative study of the alimentary canal in different groups of fishes. Circulatory system: Components of circulatory systems. Excretory system: Excretory organs, types of kidneys. Reproductive system: Types of reproduction, primary and secondary sexual characters.
6. **Swim bladder:** Origin and role in buoyancy
7. **Integration systems in fishes:** Nervous systems- brain and cranial nerves; spinal cord and nerves. Receptors- types and functions .Endocrine system- types of endocrine glands, their location and function.
8. Adaptive radiation in fish.

Text Books and references:

Lagler, K. F., Bardach, J. E., Miller, R. R. and Passino D. R. M., 1977. Ichthyology. John Wiley & Sons, Inc., New York.

Love, M. S. and Cailliet. G. M. (eds.), 1979. Readings in Ichthyology, Prentice-Hall of IndiaLtd. New Delhi.

Bond, C. F., 1979. Biology of Fishes. Sunders College Publishing, Philadelphia.

Aleev, Y. G. (ed.). 1969. Function and Gross Morphology of Fish. Keter Press, Jerusalem.

Brown, M. E. (Ed.) 1957. The Physiology of Fishes. Vols. I and II. Academic Press, New York and London.

Day, F., 1971. The Fishes of India, Today and Tomorrows Book Agency, New Delhi.

Goodrich, E. S., 1958. Studies on the Structures and Development of Vertebrates (Reprintedition)Vols. I an II. Dover Publications. New York.

Gunther, A. C. L. G., 1963. An Introduction to the Studies of Fishes (Reprintedition). Today and Tomorrows Book Agency. New Delhi.

Hyman, L. H., 1961. Comparative Vertebrate Anatomy. (2nd edition, 18th impression).The University of Chicago Press. U.S. A.

Jhingran, V. G. 1988. Fish and Fisheries of India, Hindustan Publishing Corporation (India), Delhi.

Lagler, K. F., 1950. Studies in Freshwater Fishery Biology. (3rd rev. ed.), Michigan, USA.

Lagler, K. F., 1952. Freshwater Fishery Biology. IOWA Press Inc., U.S.A.

Marshall, N.B., 1965. The Life of Fishes. Weidenfeld and Nicolson. London.

Rahman, A. K. A., 1989. Freshwater Fishes of Bangladesh., The Zoological Society of Bangladesh, Dhaka 1000.

Romer, A. S.,1949. The vertebrate body. W. B. Saunders Company. Philadelphia.

Schultz, L. P., and Stern, E. M., 1949. The Ways of Fishes. Van Nostrand Reinhold Company Inc., New York.

Shafi, M. and Kuddus, M. M. A., 1982: Bangladesher Matsya Sammpad (Bangla). Bangla Academy, Dhaka.

Stockard, A. H. 1949: A Laboratory Manual of Comparative Anatomy of the Chordates. Edward Brothers, Michigan.

FBG 104 : General Ichthyology
Practical :1.5 Cr.

Students shall maintain a record of everything done in the practical and field sessions in a Practical Note Book to be signed and checked by teacher(s) concerned.

Viva voce test will form an essential part of the Practical Examinations.
Identification of important marine and freshwater fishes.
Study of different types of scales.
Study of external morphology and internal anatomy of fishes.
Comparative study of digestive systems of fishes with different food and feeding habits.
Major circulatory blood vessels.
Identification of important bones and preparation of bone album.
Study of brain and pituitary gland.

Text Books and references:

Lagler, K. F., Bardach, J. E., Miller, R. R. and Passino D. R. M., 1977. Ichthyology. John Wiley & Sons, Inc., New York.

Love, M. S. and Cailliet. G. M. (eds.), 1979. Readings in Ichthyology, Prentice-Hall of IndiaLtd. New Delhi.

Bond, C. F., 1979. Biology of Fishes. Sunders College Publishing, Philadelphia.

Aleev, Y. G. (ed.). 1969. Function and Gross Morphology of Fish. Keter Press, Jerusalem.

Brown, M. E. (Ed.) 1957. The Physiology of Fishes. Vols. I and II. Academic Press, New York and London.

Day, F., 1971. The Fishes of India, Today and Tomorrows Book Agency, New Delhi.

Goodrich, E. S., 1958. Studies on the Structures and Development of Vertebrates (Reprintedition)Vols. I an II. Dover Publications. New York.

Gunther, A. C. L. G., 1963. An Introduction to the Studies of Fishes (Reprintedition). Today and Tomorrows Book Agency. New Delhi.

Hyman, L. H., 1961. Comparative Vertebrate Anatomy. (2nd edition, 18th impression).The University of Chicago Press. U.S. A.

Jhingran, V. G. 1988. Fish and Fisheries of India, Hindustan Publishing Corporation (India), Delhi.

Lagler, K. F., 1950. Studies in Freshwater Fishery Biology. (3rd rev. ed.), Michigan, USA.

Lagler, K. F., 1952. Freshwater Fishery Biology. IOWA Press Inc., U.S.A.

Marshall, N.B., 1965. The Life of Fishes. Weidenfeld and Nicolson. London.

Rahman, A. K. A., 1989. Freshwater Fishes of Bangladesh., The Zoological Society of Bangladesh, Dhaka 1000.

Romer, A. S.,1949. The vertebrate body. W. B. Saunders Company. Philadelphia.

Schultz, L. P., and Stern, E. M., 1949. The Ways of Fishes. Van Nostrand Reinhold Company Inc., New York.

Shafi, M. and Kuddus, M. M. A., 1982: Bangladesher Matsya Sammpad (Bangla). Bangla Academy, Dhaka.

Stockard, A. H. 1949: A Laboratory Manual of Comparative Anatomy of the Chordates. Edward Brothers, Michigan.

Department of Aquaculture

Course Code: AQC 103

Course Title: Fresh Water Aquaculture

Theoretical : 3 Cr.

Introduction: Definition and aim of aquaculture history of aquaculture importance of aquaculture problems and prospects of aquaculture.

Aquaculture system: Management approach, extensive (traditional), improved traditional, semi-intensive and intensive culture. Monoculture, polyculture, composite fish culture and integrated aquaculture.

Pond aquaculture: Site selection, pond construction, classification of ponds, and ideal fish pond, drying, liming, fertilization, productivity, species selection stocking and post stocking management.

Nursery management: Pond preparation, fertilization, post and predator control, stocking and post stocking management.

Natural fish seed collection, seed production and transportation: Natural fish seed collection, bundh spawning, induced spawning, methods of packing and transport of fry and live fish, causes of mortality

of fry and brood fish during transportation, use of anaesthetics, antiseptics and antibiotics in live fish transport.

Aquatic weeds post and predators: Common aquatic weeds and methods of their control. Preparation of compost with aquatic weeds, algal bloom and its control, methods of controlling post and predator.

Culture of important freshwater species: Carp, prawn, pangus and other catfishs, tilapia, eel, snake and small indigenous species (SIS).

Cage and pen culture: Site selection, design and construction of cages and pens, species selection, stocking, feeding and harvesting.

Commercial aquaculture farm operation.

AQC: 104 Freshwater Aquaculture
Practical : 1.5 Cr.

Students shall maintain a record of everything done in the practical and field sessions in a practical notebook to be signed and checked by teacher (s) concerned. Viva voce test will form an essential part of the practical examination.

Identification of common aquatic weeds and algae.

Identification of seeds of important aquacultural fish and shrimp species.

Preparation, fertilization and management of a nursery pond.

Preparation, liming, fertilization and management of a stocking pond.

Use of anaesthetics in handling of fish.

Transportation of fry, fingerlings and live fish.

Case study: Visit to hatcheries and fish farms and preparation of cage study report.

Text and reference books:

1. Huet, M. 1979. Textbook of Fish Culture: Breeding and Cultivation of Fish. Fishing News Books Ltd. Farnham, Surrey, England.

Islam, M. A. 2001. Aquaculture. Bangla Academy, Dhaka. 352 pp.

Pillay, T. V. R. 1993. Aquaculture: Principles and practices, Fishing News Books Black well Scientific Publications Ltd. Osney Weed Oxford OX2 OEL, U.K. 592 pp.

Anonymous, 1997. Training on Integrated Fish Farming to the Thana Fisheries Officer, Fisheries Research Institute, Mymensingh.

Axelord, H. R. 1980. Schultz, L. P. 1983. Hand book of Tropical Aquarium Fishes, Neptune, New Jersey, T. F. H. Publications Inc. Ltd. 718 p 3rd rev. ed.

Chondar, S. L. 1980. Hypophysation of Indian Major Carps. Shatish Book Enterprise Motikatra, Agra-3, India, 146pp.

Edwards, P., D. C. Little and H. Demaine (eds.). 2002. Rural Aquaculture, CABI Publishing, CAB international, Wallingford, Oxon OX10 8DE, U. K.358 pp.

FAO (Food and Agricultural Organization) 1990. Farming Systems. Developments, Guidelines for the conduct of training course in farming systems development. FAO- United Nations.

Jhingran, V. G. 1977. Fish and Fisheries in India. Hindustan Publishing Delhi.

Jhingran, V. G. and R. S. V. Pullin 1985. A Hatchery Manual for Common, Chinese and Indian Major carps. Asian Development Bank, ICLARM, Manila, Philippines

Karim, M. A. 1975. An Introduction of Fish Culture in Bangladesh, Ruby Press, Mymensingh, Bangladesh.

Kurian, C. V. and Sebastian, V. O. 1982. Prawns and Prawn Fisheries of India. Delhi, Hindustan Publishing Corporation (India) 186p. 2nd rev. ed.

Muir, J. F. and Roberts, R. J. (Eds.) , Recent Advances in Aquaculture, Vol. I, II, III and IV, Croom Helm, London.

Pillay, T. V. R. 1994. Aquaculture Development: Progress and Prospect. Fishing News Books Black well Scientific Publications Ltd. Oxford.

Pullin, R. S. V. and Lowe-McConnel, R. H. 1982. The Biology and Culture of Tilapias, ICLARM Conference Proceedings 7. 432 p. International Center for Living Aquatic Resource Management, Manila, Philippines.

Islam, M. A. 1985. Macher Chash Babosthapana. Bangla Academy, Dhaka. 277 pp.

Islam, M. A. 1989. Macher Chash Babosthapana. Bangla Academy, Dhaka. 174 pp.

Islam, M. A. 1992. Macher Pukurer Pani. Bangla Academy, Dhaka. 229 pp.

Department of Fisheries Management

Course Code : FMG 103
Course Title: Physico-Chemical Limnology
Theoretical : 3 Cr.

1. **Definition of limnology. Scope of limnology:** Introduction to the study of inland waters. Historical development in Limnology. Origin and morphology of ponds, lakes, and reservoirs. Lakes of the world and Bangladesh.
2. **Rivers:** Definition, types, origin, sources of water, rivers of Bangladesh, and rivers of the world.
3. **The nature of water:** The water molecule, physical and chemical characteristics of pure water.
4. **The physical characteristics of inland water environments:** Light, colour, turbidity, heat and temperature, thermal classification of lakes. Heat budget and lake stability. Holomixis and meromixis.

5. **Chemical characteristics of inland waters:** Dissolved gases (oxygen, carbon dioxide and other gases). Dissolved solids (nitrogenous compounds, phosphorus, calcium and magnesium, sodium and potassium, iron, silicon, trace elements). Role of nutrients in primary production.

6. **pH:** definition, description, and effects on fishes and aquatic environment.

7. **Biogeochemical cycles:** definitions, biogeochemical cycles of nitrogen, phosphorus, calcium, carbon, silicon, sulfur, iron etc.

8. Estuaries: definition, types and description. Estuaries of Bangladesh

FMG 104 : Physico-Chemical Limnology
Practical : 1.5Cr.

Students shall be required to show a good knowledge of the topics included in the theoretical portion of the paper. They shall maintain a record of everything done in practical classes/ field trips in a practical note book to be signed and checked by the teacher (s) concerned. Viva-voce test will form an essential part of the practical examination.

Studies of water-body morphometry. Shoreline surveys of ponds and lakes. Water level recording procedures. Method for determining area and volume of ponds, lakes and reservoirs.

Recording of temperature, turbidity, colour, light penetration and water flow of water-bodies.

Chemical analysis of water: Water sampling methods. Determination of dissolved oxygen, free carbondioxide, pH, total alkalinity, total hardness, phosphate, nitrate, nitrite, ammonia, calcium, iron, silicon and salinity.

Procedures of removing turbidity by different methods.

Lime application: Determination of dose and application procedures.

Field visit to study water quality parameters of fish farm.

Text books and references:

American Pablic Health Association, 1987. Standard Methods for the Examination of Water and Wastewater. 11th Edition. American Public Health Association. New York.

Boyd, C.E. 1979. Water Quality in Warmwater Fish Ponds Aubum Univeristy, Alabama.

Goldman, C.R. & A.J. Horne. 1983. Limnology. McGraw-Hill Book Company, New York.

Golterman, H.L. 1969. Methods for chemical Analysis of Fresh Waters. ISH 8. Blackwell Scientific Publications. Oxford.

Jorgensen, S.E. 1980. Lake Management. Pergamon Press Ltd. Oxford.

Lecren, E.D. & R.H. Low-McConnell. 1980. The Functioning of Freshwater Ecosystems. IBP 22. Cambridge University Press. Cambridge, London.

Lind. O.T. 1985. Handbook of common methods in Limnology. Kendall/Hunt, Iowa.

Rahman, M.S. 1992: Water quality management in aquaculture. BRAC Prokashana, Dhaka-1212.

Reid G.K. & R.B. Wood. 1976: Ecology of Inland waters and Estuaries, Reinhold Publishing Co., New York.

Schwoerbel, J. 1987. Handbook of Limnology. Ellis Horwood Limited, New York.

Serruya, C. & U. Pollinger. 1983. Lakes of Warm Belt. Cambridge University Press, Cambridge, London.

Stirling, H.P. 1985. Chemical and Biological Methods of Water Analysis for Aquaculturists. Institute of Aquaculture, Stirling.

Welch, P.S. 1952: Limnology. McGraw-Hill Book Co. New York.

Wetzel, R.G. 1983. Limnology, CBS College Publishing, The Dryden Press.

Wetzel, R.G. & G.E. Likens. 1991. Limnological Analysis. Springer – Verlag, New York, London, Tokyo, Baracelona.

Department of Agricultural Chemistry & Biochemistry

Course Code : ACH 109

Course Title: Biochemistry

Theoretical : 3 Cr.

CARBOHYDRATE: Chemistry of monosaccharide and disaccharide, composition & chemical linkage of polysaccharides specially starch, glycogen, cellulose, chitin, pectin etc.

PROTEIN: Definition and classifition of amino acid, physical & chemical properties amino acid, peptide, important reactions of amino acid. Amphoteric characters of amino acid, isoelectric point, colour reactions of protein/amino acid. Different bonds involved in amino acid/protein. Biological value of amino acid.

LIPID: Definition, classifition, chemical and physical properties of fatty acid. Characterisation of fat, oil and wax. Phospholipid with special reference to lecithin and cephalin.

NUCLEIC ACID: Occurence and composition classification. Physical and chemical prperties, important functions of nucleic acid.

ENZYME: Definition, classification & chemical nature of enzyme. Concept of enzyme and prosthetic groups. Mode of action of enzyme. Factors affecting enzymetic reactions. Enzyme specificity and inhabitation with special reference to proteolytic enzymes.

VITAMIN: Definition, occurence and classification, physical & chemical properties of vitamins, physiological funetions of vitamins.

HORMONE: Definetion, caassification, function & physiological role of Hormones. Biological tundtions of pitutary, hypthalamus, adrenal contexxd sex hormones.

METABOLISM: Anabolism of catabolism, TCA cycle, central pathway and metabolism anaplerotic parhway, carbohydrate, fat, proticin, of lipid metabolism their relationship.

BOOKS RECOMMENDED:

1. Principle of Biochemistry by Wet and Tood. 4th Edition. The Macmillan Book company, New York.
2. Plant Biochemistry by Bonner and Venner. Academic Press, New York.
3. Fundamentals of Biochemistry by J/L/ Jain, Ram, New Delhi.
4. Principals of Biochemistry by Albert L. Lehninger, Shahdra, New Delhi.
5. Principles of pant Biochemistry by Kbretovich. Pergramon press, New York.
6. Enzymes by Doxon Webb. Academic Press, London.
7. Plant metabolism by sreet. per non Press, London.
8. Principals of Biochemistry by writ, Handler and Smith MCG raw Hill Book Company, New York.
9. A reference book of Organic Chemistry, Morrison & Boyd.
10. Outlines of Biochemistry by CONN & STUMPF, John Wiley & Sons.
11. Principles of Biochemistry by Zubay & person Win. C. Brown.
12. Text book of Biochemistry by West, Todd, Manson & Bruggen, Mcmillan Company.
13. Plant Biochemistry and Moleular Biology by Hons-Water Heldt, Oxford University Press.
14. Biochemistry & Molecular Biology of plants by Buchanath, Gruinees, Gruissccm & Jone, Amsoc. Plant phusiologists
15. Plants Hormones and their Role in plant Grougth & Development by Davies, kluwen. Academic Publishers.

ACH 110 : Biochemistry
Practical: 3 Cr.

Colour test for Carbohydrate and protein.
Estimation of vitamin "C" by oxidation-reduction method.
Estimation of glucose.
Isolation of potato starch.
Preparation of buffer solution and determination of P^H.
Separation of sugars and amino acids by TLC.
Isolectric P^H determination of proteins.
Extraction of starch and glycogen.
Estimation of fish protcin By Kjelahl method.
Estimation of casein by Biuret method.
Estimation of reducting sugars.
Determination of saponification value, acid value and peroxide value of fish oils.
Estimation of alpha-amylase.
Protein fractionation by electrophoresis.
Estimation of Glucose by Fehling solution method.

BOOKS RECOMMENDED:

Biochemistry Laboratory Manual by strong, C. Brown Co. publishers, India.
Laboratory Experiments in Biochemistry Merts and parter. Burgess publishing Company, Minneapolis.

Experimental Biochemistry by Clarks. W. H. Freeman and Company.
Practical Manual of Biochemistry by S. P. Singh. 3rd Edition, CBS publishers & Distributors.
Text Book of Practical Organic Chemistry & Inorganic Chemistry by Vogel's.
Experimental Biochemistry by Switzer & Garrity, Freeman & Company.
An Introduction to Practical Biochemistry by Plummer, McGraw Hill.
Modern Experimental Biochemistry by Boyer, Banjamin Cummings.
David Glick, 1995. Methods of Biochemistry Analysis. Interscience publishers, Inc. N. Y.
Litwack, G. 1960. Experimental Biochemistry. John Wiley and sons. Inc. N. York.
Malhotra, V. K. 1968. Practical Biochemistry for students. Lypec brothers, N. Y.
Plummer.D. T. 1995. And Introduction to practical Biochemistry. Tata Megraw-Hill. Delhi.
Segel, I. H. 1968. Biochemistry Calculations. John Wiley and sons. New York.

Department of Fisheries Management

Course Code: CIT 111

Course Title: Computer Science

Theoretical : 2 Cr.

Computer basics: History and development, Computer types on size and use, impact of Computer on technology, Computer systems, hardware and software, Computer peripherals, i/ o devices, and storage media, system sofware, language software and application ssoftware program and algorithm, information coding, number system and their internal representation, simple application and applet development using java, introduction to HTML and java script in in applet development, familiarity with word processing, database, spread sheet and statistical packages, development of presentation materials using Microsoft power point. Course.

Department of Fisheries Management

Course Code : FMG 105
Course Title: Aquatic Soil Science
Theoretical : 2 Cr.

1. Definition, physical properties of soil- texture, colour, consistency and temperature. Suitability of soil for pond construction and fish culture.
2. Chemical properties: pH, cation-anion exchange and adsorption. Soil fertility and productivity.
3. Soil-water interactions and their effects on productivity of waterbodies.
4. Bioturbation: Benthic organisms responsible for bioturbation, effects of bioturbation on physico-chemical properties of overlying water.
5. Bottom-mud: Bottom-mud as a store-house of nutrients for aquatic productivity. Physico-chemical factors affecting release and retention of nutrients from/to mud. Management of bottom mud.
6. Saline soils and acid sulphate soils: Characteristics, reclamation and impacts in coastal aquaculture and mangrove fisheries.
7. Sandy soils: Problems of very sandy soils in pond construction and fish culture and their solutions.
8. Red soil: Characteristics, problems to fish culture and mitigation measures.
9. Soil microorganism: Role in nutrient cycling.

Text books and references:

1. Boyd, C.E., 1988: Water quality management for pond fish culture. Elsevier Science Publishers B.V., Amsterdam. 318pp.
2. Buckman, H.O. and Brady, N.C., 1988. The Nature and Properties of Soils. Ninth edition. S. Chand & Company (Pvt.) Ltd. co. Inc. 750pp.
3. Donahue, R.L., Miller, R.W. and Shickluna, F.C., 1990. Soils-an Introduction to Soils and Plants Growth. Fifth edition. Prentice-Hall of India private Ltd. New Delhi. 667pp.
4. Fitzpatrick, E.A., 1986. Soils-their formation, classification and distribution. English language Book Society. Longman, England. 353pp.
5. Golterman, H.L. (ed.), Interactions between sediments and freshwater: Proceedings of an international symposium held at Amsterdam. The Netherlands, September 6-10, 1976.

6. Tamhane, R.V., Motiramoni, D.P. and Bali, Y.P., 1970. Soils: Their Chemistry and Fertility in Tropical Asia. Third edition. Prentice-Hall Int. Inc. 475pp.

7. Thompson, L.M. and Troeh, F.R., 1978. Soils and soil fertility. Fourth edition. McGraw Hill Book Co., New York. 516 pp.