FACULTY OF FISHERIES

COURSE LAY OUT AND SYLLABUS

OF

B.SC.Fisheries (Hons.) DEGREE

Level- 4

HAJEE MOHAMMAD DANESH SCIENCE AND TECHNOLOGY UNIVERSITY
DINAJPUR

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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 103, 104	3+1.5
	Chemistry	ACH 107, 108	3+1.5	Physico-Chemical Limnology	FMG 103, 104	3+1.5
	Rural Sociology	SSL 119	3+0	Biochemistry	ACH 109, 110	3+1.5
	Elective (any one)			**Elective (any one)**		
	English Language	SSL 121	2+0	Computer Science	CSE 111	2+0
	Introductory Aquaculture	AQC 101	2+0	Aquatic Soil Science	FMG 105	2+0
	Total Credit		**14+4.5=18.5**	**Total Credit**		**14+6=20**
	Semesters					
2	Semester-I			Semester-II		
	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+0	Aquatic Environmental Science	FMG 205	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 : 163

Level - 4 Semester - I

Department of Fisheries Biology and Genetics
FBG 401 : Genetics and Fish Breeding
Theoretical : 3 Cr.

Introduction: Course goals, objectives and outcomes.

Breeding, the applied aspects of genetics: Prospects of genetics and breeding in aquaculture and fisheries.

Genetics of populations: Genetic variability in a population, gene pool and gene frequency, Hardy-Weinberg equilibrium, factors influencing allele frequency. Heterozygosity and genetic distance.

Genetics of quantitative phenotypes: Quantitative phenotypic variation and its components. Characteristics of quantitative inheritance. Calculating the number of multiple alleles. Significance of quantitative genetics.

Selection as a breeding program: Heritability and selection response, different types of selection programs, individual selection, family selection and mass selection.

Hybridization: Dominant genetic variance and hybridization, uses of hybridization, heterosis and hybrid vigor, recurrent selection and impact of hybridization. Outbreeding depression.

Inbreeding: Genetic effects of inbreeding, practical applications of inbreeding, inbreeding coefficient, calculation of inbreeding coefficient, inbreeding depression, approaches for reducing inbreeding accumulation; assortative mating and inbreeding genetic drift.

Gene-environment interaction variance: Environmental factors affecting productivity.

Genetics of brood stock management: Sources of brood fish. Genetic changes in hatchery populations. Unintentional selection and small population size. Seed storage and genetic conservation: Gene banking.

Sex and sexuality in fishes: sex determination mechanisms; genetic bases of sex determination.

Chromosome manipulation: polyploidy, gynogenesis, androgenesis, sex-reversal and production of monosex population.

Recent developments in genetics: Gene transfer: applications and biosafety of GMOs.

FBG 402: Genetics and Fish Breeding

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.

1. Study of quantitative phenotypes: Collection of fish from a natural population; Measurement of their length and weight. Creating frequency distribution to study the normality of the distribution.
2. Measurement of central tendency and distribution around the central tendency of the data. Comparison of difference in the distribution between a large and a small population. Calculation of heritability from a given data. Calculation of expected response from selection differential and heritability.
3. Population genetics: Familiarization with the techniques of starch gel electrophoresis. Calculation of gene and genotype frequencies from allozyme data / blood group data.
4. Study of sex-reversal and sex identification: Setting up experiment for hormonal sex-reversal using androgen and/or estrogen treated feed. Feeding the fry everyday and observation. Identifying the sexes of juvenile fish by acetocarmine squash method to evaluate the results of sex-reversal experiments.
5. Study of chromosome manipulation: Familiarization with the chromosome manipulation techniques to produce polyploid and gynogenetic fish.
6. Field visit: Visiting different government and privately-owned fish hatcheries to know the brood stock management practices by the hatchery operators and to learn the problems currently faced by the hatchery operators/fish farmers.

Text Books and references:

1. Tave, D., 1996. Genetics for Fish Hatchery Managers (3rd edition) Van Nostrand Reinhold, New York.
2. Ryman, N. and Utter, F. (eds.). 1987. Population Genetics and Fishery Management. University of Washington Press Seattle and London.
3. Falconer, D.S. 1996. Introduction to Quantitative Genetics (4th edition), Longman.
4. Tave, D., 1999. Inbreeding and Broodstock Management. FAO Technical Paper No. 392.
5. Reddy, P.V.G.K., 1999. Genetic Resources of the Indian Major Carps. FAO Fisheries Technical Paper No. 387.
6. Tave, D., 1995. Selective Breeding Programs for Medium-sized Fish Farms. FAO Fisheries Technical Paper No. 352.
7. Mostafa, S. (ed.), 1999. Genetics in Sustainable Fisheries Management. Fishing News Books.
8. Hillis, D.M., Moritz, C., and Mable, B.K., 1996. Molecular Sytematics. Sinauer Associates.
9. Kirpichnikov, V.S., 1981. Genetic Bases of Fish Selection. Springer-Verlag, Berlin, Heidelberg, New York.
10. Hussain, M.G. and Mazid, M.A., 2001. Genetic Improvement and Conservation of Carp Species in Bangladesh. Bangladesh Fisheries research Institute and International Centre for

Living Aquatic Resources Management.

11. Purdom, C.E., 1992. Genetics and Fish Breeding. Chapman and Hall.

Department of Aquaculture

AQC 401 : Fish Feed Technology
Theoretical : 3 Cr.

1. **Importance:** A brief review on nutritional requirements of cultivable fish and shellfishes.
2. **Feedstuffs:** Significance of animal versus plant foodstuffs. Conventional, unconventional and novel feedstuffs as applied in aquaculture (manufacture and processing, chemical and physiological properties, feeding value, recommended inclusion levels and legal aspects).
3. **Feedstuffs of Bangladesh origin:** Feedstuffs available with respect to cost and continuity of supply, variation to proximate composition, nutrient bioavailability and palatability.
4. **Antinutritonal / toxic factors:** Antinutrients in plant feedstuffs including the mode of action and processing methods to reduce their toxic effects. Adventitious toxic factors of plant and animal origin.
5. **Non-nutrient components of feeds:** Water, binders, fibre, antioxidants, feeding stimulants, pigments, antibiotics and growth promoters.
6. **Feed formulations:** Criteria for feedstuff selection, basic problems with plant feedstuff selection. Pearson's square hand formulation, spreadsheet formulation and. least-cost feed formulations for semi-intensive and intensive culture of fish and crustaceans.
7. **Commercial aquaculture feed types:** Starter, fry, fingerlings, grow-out, and product quality feed. Forms of feeds. Feed processing and manufacture - pre-processing of raw materials. Types of machinery and commercial feed manufacturing process.
8. **Farm-made aqua-feed:** Classification of on-farm feeds ingredients, processing equipment and options. Farm made aquafeed and feeding strategies in Bangladesh - importance, availability of ingredients, on-farm feed formulation and feed manufacturing. Feeding strategies - problems and constraints.
9. **Larval and broodstock feed:** First feed, weaning feed, starter feed, encapsulated diets. Special diets for broodstock prior to spawning.
10. **Feed storage and quality control:** Deteriorative changes in feedstuffs and feeds during storage. Quality control and preventive measures.
11. **Feeding regimes:** Relation between natural and supplementary and stocking density. Feeding levels and feeding frequency. Compensatory feeding. Different methods of feed presentation for fish and crustaceans aquaculture.

AQC 402: Fish Feed Technology
Practical: 1.5

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.

1. Quick test for feeds tuffs evaluation:
a) Bulk density measurement
b) Non-protein nitrogen in fish meal
c) Rancidity test for animal products and oilseed meals
d) Estimation of proportion of ingredients in feed mixture by floatation technique.
2. Formulation of a supplemental and balanced feed using square technique for semi-intensive and intensive aquaculture respectively.
3. Formulation of experimental diets replacing dietary fish meal using a potential plant protein source available in Bangladesh.
4. Formulation of a least cost diets using spreadsheet method or linear programming.
5. Analysis of prepared diets for their proximate composition.
6. Determination of water stability of polluted feeds.
7. Determination of nutrient digestibility of a diet through feeding trial using chromic oxide as an external marker in the diet.
8. Determination of fish growth parameters such as weight gain, specific growth rate, food conversion ratio, protein efficiency ratio, apparent net protein utilization and energy retention through laboratory trial using a prepared diet.

9. Survey of feeding practices and feed resources in a rural fish-farming village and cost benefit analysis of cost of production.
10. Visit to a commercial feed manufacturing plant.

Text and reference books:

1. Hertramptf, J.W. and F. Piedad-Pascual (2000). Hand book on ingredients for aquaculture feeds. Kluwer Academic Publishers, London, 573p.
2. Goddard, S. (1996). Feed management in intensive aquaculture. Chapman and Hall, New York, 194p.
3. DeSilva, S.S and T. A. Anderson, (1995). Fish Nutrition in Aquaculture. Chapman & Hall, London, 318pp.
4. AOAC (1990). Official Methods of Analysis. 15th ed. Association of official analytical chemists. Washington DC.
5. Guillaume, S. kaushik, P. Bergot and R. Metailler (2001). Nutrition and Feeding of Fish and Crustaceans. Springer-Praxis Publishing, UK.,408pp.
6. Tacon, A.G.J. (1990). Standard methods for the Nutrition and Feeding of Farmed Fish and Shrimp. Vol. I-II. Argent Laboratories Press, Redmond, Washington, USA. 454 pp.
7. New, M.B. (1987). Feeds and Feeding of fish and shrimp. ADCP/REP/87/26. UNDP/FAO, Rome, 275pp.
8. Steffens, W. (1989). Principles of Fish Nutrition. Ellis Horwood, 384pp.
9. Halver, J.E. (1989). Fish Nutrition (2nd Edition). Academic Press, 388 pp.
10. Tacon, A.G.J. (1993). Protein Sources for use in Warm Water Aquaculture Feeds. FAO Technical Paper.
11. Gohl, B. (1981). Tropical Feeds. FAO Animal Production and Health Series No. 12. 528pp.
12. Liener, I.E. (1980). Toxic Constituents of Plant Foodstuffs. Academic Press, 520pp.
13. ADCP (1980). Fish Feed Technology. ADCP/REP/80/11 UNDP/FAO. Rome, 395pp.
14. ADCP (1980). Fish Feeds and Feeding in Developing Countries. ADCP/REP/ 83/18, ADCP/FAO, 97pp.
15. Khajarern, J., D., Sinchermsiri and U. Kanto (1987). Manual of feed microscopy and quality control. 2nd Edition. Americam Soybean Association.

Department of Fisheries Management

FMG 401 : Inland Fisheries Management
Theoretical : 3 Cr.

1. **Introduction:** History of fisheries management. Importance of life history data in fisheries management.
2. **Protection against hazards:** Fishways, screens and racks. Operation and maintenance. Habitat improvement devices for lentic and lotic water environments.
3. **Management of natural population:** Control of undesirable species. Fishery regulations. Fish and wild life ordinance of Bangladesh.

4. **Management problem:** Problem and their mitigation measures. Co-management and community based management of waterbodies (rivers, haors, baors, beels, lakes, estuaries and bays).

5. **Fisheries management policy of Bangladesh:** History, principles and objectives of New Fisheries Management Policy (NFMP).

6. **Fisheries cooperative:** Role, general principles, objectives and activities. Problems and mitigation measures.

7. **Fish market and marketing system:** Types, marketing channels and transportation of fish and fishery products. Problems and mitigation measures.

8. **Recreational fisheries:** History and major recreational fishery resources. Management of recreational fisheries: Objectives, predation control, wetland protection and regulations. Future recreational fisheries development.

FMG 402 : Fisheries Management

Practical : 1.5

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. Field trips to observe different habitats in and around BAU campus and identify possible improvement measures.
2. Exercise on controlling undesirable species**.**
3. Visit to DFO office to know how fishery regulations are being implemented.
4. Visit to a fishermen cooperative to know their activities.
5. Visit to a fish market to observe various activities related to fish marketing.
6. Visit to a selected haor to study various aspects of fisheries management practices.
7. Visit to a selected beel/floodplain to observe different aspects of fishery management.
8. Seasonal observation of a representative river fishery of Bangladesh (Old Brahmaputra river near BAU campus) to observe the fishing activities and livelihood of the fishermen.

Text books and references:

1. Ali, M.Y., 1997. Fish, water and people: Reflection on inland open water fisheries resources of Bangladesh. University Press Limited, Dhaka- 1000.
2. Anderson, L.G., 1977. The economics of fisheries management. The Johns Hopkins University Press, UK.
3. Aquero, A., Haque,M.S., Rahaman, A.K.A. and Ahmed, M. (eds.), 1997. Inland fisheries management. Department of Fisheries (DOF), Government of Bangladesh.
4. Baird, D.J.,Beveridge, M.C.M., Kelly, L.A. and Muir, J.F., 1996. Aquaculture and water resource management. Blackwell Science Ltd. UK.
5. Bennett, G.W., 1965. Management of artificial lakes and ponds. Reinhold publishing corporation, New York, Chapman and Hall Ltd. London.
6. Berkes, F., Mahon, R., McConney, P., Pollance, R. and R. Pomeroy, 2001. Managing small-scale fisheies: alternative directions and methods. International Development Research Centre, Canada.
7. Cowx, I.G. (ed.), 1995. Stock assessment in inland fisheries. Fishing News Books, Farnham, Surrey, UK.
8. Cowx, I.G., 2000. Management and ecology of river fisheries. Fishing News Books, UK.
9. Graaf, G.D., Born, B., Kamal, A.M. U. and Marttin, F., 2001. Floods fish and fishermen. The university Press Limited, Dhaka.
10. King, M., 1995. Fisheries biology, assessment and management. Fishing News Books, Farnham, Surrey, UK.
11. Rounsefell, G.A. and Everhart, W.H., 1953. Fishery science: its methods and application. John Wiley and Sons. Inc. New York.
12. Shaw, S.A., 1990. Marketing: a practical guide for fish farmers. Fishing News Books, UK.

13. Templeton, R.G. (ed.), 1992. Fisheries Management. Fishing News Books, Farnham, Surey, UK.

Department of Fisheries Technology

FTL 401 : Quality Control of Fishery Products

Theoretical: 3 Cr.

Introduction: Concept and purpose of quality assurance, importance of fish inspection and quality control programs, problems in quality assurance of fishery products.

Food laws and regulations: Food laws and competent authority, organization of quality control and official inspection system, regulatory standards for products and processing plants.

Quality assurance: Hygiene and safety aspects of quality control, standard sanitary operating system (SSOP) and standard operating system (SOP) in processing plant, inspection of fish and fishery products. Quality management information.

Process control: Hazard analysis critical control points (HACCP), inspection/test plans.

Methods of quality assessment: Organoleptic assessment of quality, biochemical and bacteriological methods of quality assessment

Raw material and finished products quality: Raw material collection system, maintenance of raw material quality and finished product quality.

Quality deterioration and defects in products: Chilled processed fish, frozen fish, smoked fish, dried and salted fish, canned fish, marinades and heat processed fish.

FTL 402: Quality Control of Fishery Products

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.

1. Study of sensory evaluation techniques: basic taste recognition test, basic colour recognition test, preference test and ratio profile.
2. Organoleptic, physical, biochemical and bacteriological evaluation of fresh, chilled and frozen fish and shellfish products.
3. Organoleptic, physical, biochemical and bacteriological evaluation of dried and salted dehydrated, salted and smoked products.
4. Determination of muscle proteins by biuret method and preparation of standard curve.
5. Studies on the stability of myofibrillar proteins by measuring ATPase activity, solubility and SDS-PAGE pattern of soluble protein fraction.
7. Samples collection of various products from processors, industries and market and assessment of their qualities by determining physical, organoleptic, bacteriological and microbial aspects.
8. Evaluation of gel-forming ability of the various fish paste (surimi) based products by determining rheological and biochemical parameters of fish products.
9. Group work and presentation about GMP, HACCP and ISO 9000.

Text books and reference:

Rudolf Kreuzer (edited) 1971. Fish Inspection and quality control. Fishing News (books), Limited. London, EC4, England.

Connell, J.J. 1985. Control of Fish Quality. Fishing News Book Ltd.

Bonnell, A.D. 1994. Quality assurance in seafood processing: A practical guide. Chapman & Hall, New York and London.

FAO 1994. Working Party on Fish Technology and Marketing. Proceeding of the workshop held at Cochin, India, 7-9 March. FAO Fisheries Report No. 514 Supplement. Indo Pacific Commission.

Huss, H,H, 1998. Fresh Fish-Quality and Quality Changes. FAO Fisheries Series No. 29, Rome

Pierson, M.D. and Donald, A. and Corlett, Jr. 1992. HACCP: Principles and Applications. An AVI Book, Published by Van Nostrand Reinhold, New York.

Kramer, A. and Twigg., B.A. 1966. Fundaments of Quality Control for the Food Industry. The Avi. Publishing Co. Inc., West port.

Michael T.M (Ed). 1988. Post-harvest Fishery Lossess. Proceeding of an International Workshop held April 12-16, 1997 at the University of Rhode Island, Kingston, RI. Published by ICMRD.

Reilly, P.I.J. and Parry, R.W.H. and Barile, L.E. (Ed) 1989. A proceeding of the international conference held at Bangkok, Thailand from November 13-17 on Post-harvest Technology, Preservation and Quality of Fish in South East Asia. International Foundation of Science.

Ross, M.H. 1993. Student Manual HACCP and Quality Control Programs. Kingsborough Community College, The City University of New York.

Wiryanti, J. and Madakia, H. (Ed). 1997. Improved Quality Control for Fresh and Frozen shrimp. ASEAN-CANADA Fisheries Post-harvest Technology Project-Phase II.

Wiryanti, J. and Madakia, H. (Ed). 1997. Improved Quality Control for the Handling and Processing of Fresh and Frozen Tuna at sea and on shore. ASEAN-CANADA Fisheries Post-harvest Technology Project-Phase II.

Watts, B.M. and Elias, L.G. 1989. Basic sensory methods for food evaluation. International Development Research Centre, Ottawa, Canada KIG 3H9

Botta, J. R. 1995. Evaluation of seafood freshness quality, VCH Publishers (UK) Ltd, United Kingdom.

Department of Agricultural Economics & Rural Sociology

ECN 407: Fisheries Economics

Theoretical : 3 Cr.

Economic Concepts and principles Applicable to Fishery Economics: Definition and basic concepts of economics, Consumer behavior Law of demand and supply, factors of Production, function, Law of returns, Costs and revenue, Market mechanism Banking system and financing.

Economics of fish production: Fish Production and its economic importance: culture, capture and marine fisheries, Economic factors related to aquacultural production, Open water capture investment and economic returns. Population dynamics and sustainable yield. Present status and potentiality of island and marine fish production. Measures and steps for Improvement of fishery sector.

BOOKS RECOMMENDED:

1. Shang, Y.C (1981), Aquaculture Economics: Basic Concepts and Methods of Analysis, Westview Press, London.
2. Samuelson, P.A. and Nordhaus, W.D. (1989), Economics, 13th edn. Mcgraw-Hill, New York.

References:

1. Bell, F.W. (1978), Food from the Sea: The Economics and Policies of Ocean Fisheries Westview Press, Boulder.
2. Hill B. (1980), An Introduction to Economics for Students of Agriculture, Pergamon Press, London.
3. Lecomber, R. (1979), The Economics of Natural Resources, Mac- Millan, London.
4. Panayotou, T. (1987), Small- Scale Fisheries in Asia: Socio-economic Analysis and Policy, IDRC-229c, Canada.
5. Randal A. (1987), Resource Economics: An Economic Approach to Natural Resources and Environmental Policy, Wiley, New York.

Department of Aquaculture

AQC 403 : Integrated Aquaculture

Theoretical : 2 Cr.

1. **Introduction:** Concept of integrming,its importance,present status and prospects .
2. **Integrated systems:** Rationale of complex and multi-component integrated systems, categories of complex integrated systems-plant-fish;plant-animal-fish;animal-fish;waste –fish-plant and human waste-fish- plant .
3. **Integrated system environment:** Action of wastes on ponds,autotrophic and heterotrophic pathways, role of fish in integrated systems, waste loading and environmentil quality: Water Quality in integrated systems
4. **Waste management:** Management of wastes in waste fed ponds. Processing of additional wastes and utilization of processed wastes .
5. **Resource assessment in integration:** Effect of the value of resources on integration,ceonomice of using wastes in aquaculture, methodology for economic analysis of integrated farmi system, integrated use of land and water,energy budgeting and nutrient transter efficiency.
6. **Economic and social considerations:** Intgrated farming in economic development, insecurity of land tenure, users conflict and multiple ownership of land., price of credit, risks and marketing of integrated products .

Text and reference books:

1. Little,D. and J, Muir.1987.A Guide to Integrated Warm Water Aquaculture, University of Stirling Scotland,U.K.238 pp .

2. Edmods,P. K .E. MeCoy and C. Chantachaeng.1986.Pilot small-scale crop/livestock/Fish farm . AIT, Bangkok.Thailand. 131pp.

3. Ruddle,K. and G. Zhong.1988. Integrated Aquaculture in South China. Cambridge University Press, Cambridge,U. K.

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

5. Edwards, P., r. S. V. Pullin and J.A. Granter. 1988. Rsearch and education for development of integrated crop-livestock- fish farming in triopiccs. ICLARM Stud., Rev.Menilla,Philippines ICLARM, No. 16.53 pp

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

7. Islm, M.A. 1985. Nana Deshe Macher Chash. Bangla Academy, Dhaka. 352 pp.

8. Islam, M.A. 1988. Shomudra Upakule Macher Chash. Bangla Academy, Dhaka.

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

10. Muir, J. F. and R. J. Robert. 1982. Recent Advances in Aquaculture. Vol. 3 Beckenmen U.K. Croon Helm, London. 420 pp.

1. Pillay, T.V.R. 1992 Aquaculture Environment. Fishing News Books Ltd. Onsey Mead, Oxford OX2 OEL, England.

2. Pullin, R. S. V . and Z . H . Shehadeh (eds). 1980. Integrated agriculture aquaculture farming systems. ICLARM conf. Proc., 4. Manilla, Philippines.

3. Tetangco, M. h. (ed) 1980 Integrated crop- livestock-fish farming, scrics No. 16,Food and Fertilizer Technology Center, Taiwan, Republic of China.

Department of Fisheries Management

FMG 403 : Fisheries Research Methodology

Theoretical : 2 Cr.

Introduction: Fisheries research- Goals, objectives, rationale and outcomes. Types of research, steps in solving a problem. Planning- Definition, rational planning, outcome, theory and approach. Evaluation- Objectives and functions.

Research planning and management techniques: National fisheries policy, national environmental policy, national water policy, Govt.'s five-year plan, identification of research needs, human resources need for fisheries research. Administrative, legislation, guidelines, zoning, capacity building, collaboration and policy formulation.

Fisheries research activities in Bangladesh and global perspective: Universities, Fisheries research institutes (GOs and NGOs). Fisheries research on global basis.

Research issues, strategies and vision: Ponds, reservoirs and lakes, floodplains and rivers, coastal waters, coral reefs and soft bottom shelves.

SWOT (strength, weakness, opportunities and threats) analysis for fisheries research: Ponds, reservoirs and lakes, floodplains and rivers, coastal waters, coral reefs and soft bottom shelves.

Research priority setting: Potential benefits, ability to utilize benefits, scientific potential, research capacity, feasibility.

Environmental impact assessment (EIA): Need for an EIA, steps in the EIA process, operational EIA.

Research project monitoring and evaluation: Definition, steps and scoring.

Preparation of fisheries research projects and report writing: Justification, objectives, economics, outcomes, scientific report writing and technology packaging.

Case study on fisheries research in Bangladesh

Text books and references:

1. Berkes, F., Mahon, R., McConny, P., Pollnac, R. and Pomeroy, R., 2001. Managing small-scale fisheries: Alternative directions and methods. International Development Research Centre, Singapore, 310 pp.

2. Clark, J.R., 1996. Coastal zone management handbook. Lewis Publishers, 694 pp.

3. Hamlisch, R., 1989. Methodology and guidelines for fisheries development planning with special reference to developing countries in the African region. Food and Agriculture Organization, Rome, 61 pp.

4. ICLARM, 1999. Aquatic resources research in developing countries: Data and evaluation by region and research system. ICLARM, Manila, Philippines, 131 pp.

5. Kay, R. and Alder, J., 1999. Coastal planning and management. Spon Press, London, 375 pp.

6. Liao, D.S., 1995. International cooperation for fisheries and aquaculture development. Proceedings of the 7th Biennial Conference of the International Institute of Fisheries Economics and Trade, Organized by National Taiwan University, International Institute of Fisheries Economics and Trade, Taiwan, 405 pp.

Level-4, Semester- II

Department of Fisheries Biology and Genetics

FBG 403 : Hatchery Management

Theoretical : 3 Cr.

1. **Introduction:** Course goals, objectives and outcomes. Relevance of the course to other fishery courses. Importance of fish hatchery. Present status of hatchery in Bangladesh. Its role to meet the present fish seed requirement.

2. **Fish hatchery:** Site selection- soil and water quality, communication, market demand, transport and marketing facilities. Essential component: Hatchery proper (spawning and incubation facilities), brood rearing ponds, nursery ponds etc. Layout of a typical carp hatchery and a shrimp hatchery.

3. **Hatchery management (operational issues):** Technical considerations: Rotation, species and age Manpower:Technical, skilled and unskilled. Economic considerations: Budgeting, cost-benefit analysis and economic viability.

4. **Brood stock management:** Present brood management practices and impact of brood management on fish production. Brood rearing: Includes detailed brood rearing strategy Wild and hatchery reared brood management system. Selective breeding

5. **Hatchery operation:** Water quality monitoring, water supply and treatment, treatment of water for reuse and water pollutant.

6. **Spawning and egg handling:** Natural and artificial spawning methods, control of spawning and egg incubation.

7. **Types of Incubators:** Hatching trays, catfish troughs, hatching jars, circular incubator, bottle hatchery, hapa and vertical tray incubators. Advantages and disadvantages.

8. **Larvae and fry rearing:** Initial feeding, feeding frequency and feed particle size, larval feed. Pond preparation for fry nursing: One stage and two stage fry rearing.

9. **Transportation of live fishes:** Importance, conditioning, equipment for live fish transportation; traditional versus modern transportation systems.

FBG 404 : Hatchery Management
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.

1. Lay out of typical fish and shrimp hatchery.

2. Selection of breeders, handling and their management:
(a) Sex determination and selection of the ready-to-spawn breeders.
(b) Dose calculation of inducing agents, injection, stripping and fertilization.

3. Use of incubators for hatching of eggs:
Incubation of fertilized eggs in different types of incubators.
Study of fertilization, hatching and survival rates.

4. Field visit to commercial fish and shrimp hatcheries.

Text Books and references:

Wedemeyer,G.A., 2002. Fish Hatchery Management. American Fisheries Society Publication.

Jhingran, V. G. and Pullin, R.S.V., 1985. A Hatchery Manual for the Common, Chinese and Indian Major Carps. Asian Development Bank and International Centre for Living Aquatic Resources Management, Manila, Philippines.

Haylor G, 1998. A Fish Hatchery Manual for Africa. Pisces Press Ltd., Stirling, Scotland

Billard R., 1995. Carp: Biology and Culture. Praxis Publishing, Chichester, U.K.

Hickling, C. F., 1962. Fish Culture. Faber and Faber, London.

Huet, M., 1972. Text Book of Fish Culture: Breeding and Cultivation of Fish. Fishing News Books Ltd. Faroham, Surrey. England.

Black K.D. and Pickering, A.D., 1998. Biology of Famed Fish. Sheffield Academic Press Ltd. Sheffield, England.

Al- Hajj, A. B. and Farmer, A.S.D., 1984. Shrimp Hatchery Manual. Safut. Kuwait Institute for Institute for Scientific Research.

BAFRU (Bangladesh Agricultural and Fisheries Resources Unit), 1990. A Guide to Shrimp and Prawn Hatchery Techniques in Bangladesh. Stirling, Scotland, BAFRU/ Institute of Aquaculture.

Lee C.S.,M.S.Su and Liao, I.C., 1991. Finfish Hatchery in Asia (Proceedings of Finfish Hatchery in Asia'91.Tungakang Marine Laboratory, Taiwan.

Woynarovich E. and Horvath, L., 1984. The Artificial Propagation of Warm-water Finfishes, a manual for extension. FAO Fisheries Technical Paper 201.

4. Pullin, R. S. V . and Z . H . Shehadeh (eds). 1980. Integrated agriculture aquaculture farming systems. ICLARM conf. Proc., 4. Manilla, Philippines.

5. Tetangco, M. h. (ed) 1980 Integrated crop- livestock-fish farming, scrics No. 16,Food and Fertilizer Technology Center, Taiwan, Republic of China.

Department of Aquaculture

AQC 405 : Fish Health Management

Theoretical : 3 Cr.

1. Concept of Fish Health and disease. Causes of diseases outbreak in fish . General idea about prevevtion and control fo diseases in aquaculture organisms.
2. Introduction to fish immunology : Terminology , role immunity in preventing infectious diseases.
3. Sepcific and non-specific immunity in fish: Physicsl, humoral and cellular factor,effectors of immune response in fish .
4. Antibody probes: Polyclonal and monoclonal antibodies, preparation and application of antibody probes in diagnosis and control of fish diseases .Characteristics andimmune functions of fish blood .
5. Principles of immunodiagnostic techniques : Slide agglutination, agglutination, agglutination titration, ELISA, ELAT, IFAT, IHC and Weatern blot analysis
6. Immunization and vaccination : Principles immunization. Preparation, types and commercially available fish vaccines. Future prospects and use of immunostimulants.
7. Diseases diagnosis . Clinical and laboratory diagnosis. Health management and its significance .
8. Therany of the diseases in fish. Principles of chemotherapy. Types of therapeutic measures. Selection of drugs and mode of their actions on the fisheries organisms. Methods of application of drugs . Use of common drugs in aquaculture .
9. Prevention and control of viral, bacterial, fungal and parasitic diseases of fish .
10. Prevention and control of diseases in fish caused by environmental, dietarty and hereditary factors .

Text Books:

1. Brown,L. 1994. Aquaculture for Vcterinarians: Fish Hushanddry and Meicine pwrgamon pressa Oxford .
2. Ellis,A.1988. Fish vaccination. Urgent publishers,USA.
3. Iwame, G. and T. Nakanishi (eds) . 1996. The Fish Immune System . Academic press.
4. Woo,P.T.K. and D.W.Bruno , 1999. Fish Diseases and Disorders Vo1. 3 CABI Publishing .

References:

1. Austin , B. and D.A. Austin . 1999. Bacterial Fish Pathogens: Diseases in Famed and Wild Fish .3rd. Ellis Horwood, England .
2. Broch,D. and M.T. Modigan. 1991. Biology of Microrsanisnas (6th Ed). Orentice-Hall International edtitions .
3. Brooks, G.J.S. Butel, and L.N. Ornston. 1991. Medical Microbiology (19th Ed). International edition . A large Mwdical book, Prentice Hall International Inc .
4. Charnatchkool. P. J. F. Turnbul and C. Limsuween 1996 . Health Management in Shrimp ponds AAHRI, Kasetsurt University Campus, Bangkok. 3nd ed .

5. Egusa, S. 1992. Infectious Diseases of fish . Oxonian press Ltd.. New Delth . Argent: BINFE- DF.
6. Fudeabers, H.H.D.P. Stites, J.L. Caldwell and J.V. Wells. 1980 . Basic and Clinical Immunology (3rd Ed). Maruzen Asian Edition .
7. Gudding , R.A. Lillenaug, P.J . midtlyng and F. Brown 1997. Fish Vaccinoology. Development of Biological Standardization, Karger.
8. Karunassagar, I and I.Karunasagar (eds) 1999. Aquaculrure and Biotechnology. Science publishers Inc,USA 186 pp
9. Mowat, N and M. Rweyemamu (eds). 1997. Vaccine Manual: The production and quality control of vaterinary vaccines for use in developing countries . FAQ Animal production and Health series No 35, Rome .
10. Plumb. J.A. 1994. Health Mianteance of Cultured Fishes : Principal Microbial Diseases. Argent:B-HEAL-MCF .
11. Roberts, R. J. 1989. Fish Pathology. Baillere Tindall, London, 2nd ed .
12. Robrts, R.J (ed). 1989. Fish Pathology (2nd Ed). Bailliere Tindall, London .
13. Roitt,I.M. 1983. Essential Immunology (4th ed reprinted). Blackwell Scientific Publication, Butler and Tannen Ltd. Frome,Great Britain .
14. Saunders W.B.1994. Dorland`s Illustrated Medical Dictionary, Philadelphia.
15. Stolen,J.S. T.C. Fletcher, D.P. Adrerson, B.S. Rohrson, W.B. Van Musiwinkel 1993. Techniques in Fish Immunology . Fish Immunology Techuical Communication 1 (FITC 1), 2nd Ed . SOS Publication, USA .
16. Thoesen. J.C (Editor). 1994. Bluebook: Suggested procedures for the Detection and Identification of Certain Finfish and Shellfish pathogens, AFS, Fish Health Section. 4th ed. Argent. B-BLUE-SPD .
17. Thrusfield, M. 1995. Veterinary Epidemiology. 2nd ed. The University press, Cambridge .
18. Tizard, I. 1987 . Veterinary immunology: An Introduction (3rd ed), W.B. Saunders Company, Philadelphia, USA.

Department of Aquaculture Extension

AQC 405 : Fisheries Extension
Theoretical : 3 Cr.

1. Introduction: Characteristics of rural society and fisheries situation in Bangladesh; meaning of agricultural extension and its philosophy, principles, phase, functions and objectives; need for extension work for fisheries development in Bangladesh; gradual growth of extension work in Bangladesh with special reference to fisheries development.

2. Organization for Extension Work: Main features of an extension organization; categories of personnel constituting an extension service; qualification and responsibilities of different categories of personnel in the extension services; principles of supervision and coordination in extension work.

3. Education, Motivation and leadership: Meaning, types and purposes of education, concept of need, motivation and learning; Maslow's need theory; laws of learning and their implications for extension work; criteria for effective learning.

4. Communication in Extension: Meaning and importance of communication in extension work for fisheries development; communication process and its elements; barriers to communication and possible solution.

5. Extension Teaching Methods: Steps in extension teaching; meaning, classification, procedures, advantages and limitations of different extension teaching methods; individual methods, group methods and mass methods; projected and non-projected visual and audio-visual aids-their classification, importance and use.

6. Innovation-Decision Process and Transfer of Technology: Meaning of diffusion, elements of the diffusion process, model of innovation-decision process; Innovativeness and adopter categories, rejection and discontinuance of innovations; factors affecting the transfer of technologies in fisheries development.

7. Leadership: Concept and types of group; importance of leadership in group work; kinds of leadership-authoritarian and democratic; role of professional and local leaders; selection and training of local leaders; recognition for good leadership.

8. Programme Planning and Evaluation in Extension: Concepts, importance, principles and procedures of programme planning for fisheries development; participation for programme planning; types and procedures for evaluation of programmes.

9. Extension Problems and programmes for Fisheries Development: Current extension programmes and approaches for fisheries development in Bangladesh; problems of extension work for fisheries development and their possible solution.

10. Rural Youth in Extension Work: Present condition of rural youth in Bangladesh; needs and interests of rural youths; past and present programmes for development of rural youth for development of fisheries and related agricultural development activities.

AQC 406 : Fisheries Extension
Practical : 1.5 Cr.

1. An orientation to different organizations related to agricultural and fisheries development.
2. Preparation of questionnaire for collection of data from the villages.
3. Survey of fisheries condition and preparation and presentation of survey report.
4. Preparation of extension programme for fisheries development in an area, preparation of annual plan calendar of work.
5. Preparation and use of extension communication materials and visual aids: leaflets, poster, flashcards, flip charts.
6. Practice of techniques facilitating participation of people in group: Lecture, small group discussion, Phillips-66 method, symposium, panel discussion, brain-storming, role playing, demonstration.
7. Preparation of training programme and practice training.
8. Extension Field trip to rural areas/Upazila Headquarters to observe rural development activities in the field situation with special emphasis on fisheries.
9. Use and handling of audio-visual aids.
10. Procedure and use of some participatory rural appraisal techniques: Social maps, transect walks and problem census.

References:

Bhuiya,M.H. 1988. Krishi Samprasaran Parichiti. Dhaka: Jamuna Printers.

Bhuiya, M.H. and M.A.M. Miah. 1998. Extension Psychology. Dhaka: Krishi Lekhak Forum.

Dahama, O.P. and O.P. Bhatnagar 1980. Education and Communication fir Development. 2nd edn. New Delhi: Oxford and IBH Publishing Co. Pvt. Ltd.

Kamath, M.C. (ed) 1961. Extension Education in Community for Development. Directorate of Extension. New Delhi: Ministry of Food and Agriculture, Govt. of India.

Kashem, M.A. 1992. Samprasaran Bijnan (Extension Science). Dhaka: The Bangladesh Packing Press.

Kelsey, L.D and C.C. Herne. 1963. Cooperative Extension Work. 3rd edition. New York: Comstock Publishing Associates.

Ray, G.L. 1996. Extension Communication and Management. 3rd edn. Kolkata: Naya Prokash.

Samanta, R.K. (ed). 1990. Development Communication for Agriculture. New Delhi: B.R. Publishing Corporation

Van den Ban, A.W. and H.S. Hawkins. 1996. Agricultural Extension. 2nd ed. London: Blackwell Science Ltd.

Department of Fisheries Management

FMG 405: Marine Fisheries Management

Theoretical : 3Cr.

1. Introduction: Scope and importance of marine fisheries management. Managemant objectives and strategies.
2. Key goals in marine fisheries management: Maximizing sustainable catches; Maximizing economic yield; Fishing to biological reference points; Maintaining minimum stock sizes; Maintaining spawning stocks; Ecologically Sustainable Development (ESD); Adaptive management strategies; Risk assessment; Technology creep.
3. Regulations in Marine fisheries: Input controls (Limiting the number of fishing units; Limiting the efficiency and types of fishing gear; Closures; Minimum mesh sizes and escape gaps; output controls (Size limits; Rejection of females or spawning females; Catch quotas; Enforcement of regulations)
4. Marine fishing gears and their impacts on fisheries resources. The complexity of multigear and multispecies fisheries management. Reduction of fishing effort in the estuarine set bag-net fishery, banning of particular fishing gear, Management of the industrial trawl fishery.
5.Conservations rules and regulations of marine fisheries. Review of the rules of marine fisheries, ordinance and related issues, need for institutional strengthening and infrastructure development for proper management.
6. Existing problems in marine fisheries and their solutions. Fishing rights and conflicts, socioeconomic conditions of estuarine set bag-net fisher folk and artisanal fisher folk in Bangladesh and their impact on marine fisheries management.
7. National and international policy for marine fisheries management Role of government and non-government organizations in coastal fisheries management. Property rights and coastal fisheries, role of fishers community, Bay of Bengal programme's (BOBP's) experiences in applying stakeholder approach to fisheries management.

FMG 405 : Marine Fisheries Management

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) concearned. Viva-voce test will form an essential part of the practical examination.

1. Preliminary survey of commercially important fisheries resources (natural fish stocks) of the Bay of Bengal:

1. Assessment of the current status of a commercially important resource (fish stock) of the Bay of Bengal: Collection of data on species composition, distribution and abundance data, biological data, environmental data, and financial information to suggest management strategies for the fishery.
2. Visit to any fish landing center of the Bay of Bengal and to get familiar with the markrting channel of the yield with related commercial activities.
3. Visit to a coastal fishermen community that subsists on marine fishery to know their livelihoods.
4. Visit to any coastal district fisheries office to know how marine fisheries regulations are being applied.

Text Books:

1. Bennett, G.W. 1965. Management of artificial lakes and ponds. Reinhold publishing corporation, New York, Chapman and Hall Ltd. London.

Cowx, I,G. (ed.) 1995. Stock assessment in inland fisheries. Fishing News Books, Farnham, Surrey, UK.

King, M. 1995. Fisheries biology, assessment and management. Fishing News Books, Farnham, Surrey,Uk.

Rounsefell, G.A. and W.H. Everhart. 1953. Fishery science: its methods and application. John Wiley and Sons. Inc. New York.

Templeton, R.G.(ed.). 1992. Fisheries Management. Fishing News Books, Farnham, Surrey, UK.

References:

1. Anderson, L.G. 1977. The economics of fisheries management. The johns Hopkins University Press, UK.
2. Aquero, A., M.S. Haque, A.k.A. Rahman and M. Ahmed (eds.). 1997. Inland fisheries management. Department of Fisheries (DOF), Government of Bangladesh.
3. Baird, D.J., M.C.M. Beveridge, L. A. Kelly and J.F. Muir. 1996. Aquaculture and water resource management. Blackwell Science Ltd. UK.
4. Berkes, F., R. Mahon, P. McConney, R. Pollance and R. Pomeroy. 2001. Managing small-scale fisheries: alternative directions and methods. International Development Research Centre, Canada.

Department of Fisheries Biology and Genetics

FBG 405 : Principles of Molecular Biology & Biotechnology

Theoretical: 2 Cr.

Introduction: Course goals, objectives and outcomes.

Overview of molecular biology and biotechnology: Scope of molecular biology and biotechnology. Application of biotechnology. Scope of biotechnology for stock improvement.

Macromolecules: Chemical structure of the major classes of macromolecules- Proteins, and Nucleic acids, DNA replication.

Gene expression: Protein synthesis, transcription, the genetic code and translation.

DNA Technology: Restriction endonucleases; properties of restriction endonucleases, restriction mapping, general plan of protein coding genes, creation of recombinant DNA molecules.

Gene cloning: Cloning vectors, plasmid and cosmid vectors; reverse transcription and creation of cDNA library, creation of genomic DNA library, cloning restriction fragments in plasmids.

Molecular techniques: Electrophoresis; Southern blotting; Northern blotting; Polymerase Chain Reaction (PCR).

Molecular markers in fisheries and aquaculture: DNA fingerprinting (RFLP analysis), mtDNA RFLP analysis; AFLP; RAPD and microsatellite markers.

Production of transgenic fish: Creation of a gene construct, methods of gene transfer. Application of genetic engineering technique to produce fish with enhanced growth, disease resistance and cold tolerance.

Chromosome manipulation: production of polyploid, gynogenetic and androgenetic fish; production of monosex population.

Text Books and references:

Freifelder, D., 1987. Molecular Biology (2nd Edition). Jones and Bartlett Publishers, Inc.

Gupta, P.K., 2000. Genetics (3rd edition). Rastogi Publications.

Ranga, M.M., 2000. Animal Biotechnology. Agrobios (India).

Balasubramanian, D., Bryce, C.F.A., Dharmalingam, K., Green, J., and Jayaraman, K., 1996. Concept in Biotechnology. University Press (India) Ltd.

Turner, P.C., McLennan, A.G., Bates, A.D., and White, M.R.H., 1998. Instant Notes in Molecular Biology. Viva Books Pvt. Ltd. New Delhi. Mumbai. Chennai.

Twyman, R.M. and Wisden, W. (Consultant Editor), 1998. Advanced Molecular Biology. Viva Books Pvt. Ltd. New Delhi. Mumbai. Chennai.

Alberts, B., Bray, D., Lewis, J., Raff, M., Roberts, K., and Watson J.D., 1994. Molecular Biology of the Cell. Garland Publishing Inc.

Tave, D., 1996. Genetics for Fish Hatchery Managers (3rd edition); Van Nostrand Reinhold, New York

Mostafa, S. (ed.), 1999. Genetics in Sustainable Fisheries Management. Fishing News Books.

Hoelzel, A.R., 1998. Molecular Genetics Analysis of Populations: A Practical Approach. Oxford University Press.

Hew, C.L. and Flecther, G.L., 1992. Transgenic Fish. World Scientific. Singapore. New Jersey. London. Hong Kong.

Hochachka, P.W. and Mommsen, T.P., 1993. Biochemistry and Molecular Biology of Fishes. Elsevier Science Publishers, Amsterdam.

Bolsover, S.R., Hyams, J.S., Jones, S., Shephard, E.A. and White, H.A., 1997. From Genes to Cells. USA Publishers.

Meyers, R.A., 1995. Molecular Biology and Biotechnology. VCH Publishers, New York.

Glick, B.R. and Pasternak, J.J., 1994. Molecular Biotechnology. ASM Press, Washington DC.

Department of Fisheries Management

FMG 407 : Sustainable Livelihood Approach (SLA)
Theoretical : 2 Cr.

1. **Introduction:** Concept of Sustainable Livelihood Approach (SLA); importance of SLA in fisheries sector; overview of SLA framework; basic needs for fishermen households.
2. **Historical Context:** Historical contest (according to Amartya Sen): entitlement, household level, famines, poverty; levels of food security (availability, access, utilization) for fishermen households.
3. **Livelihood Systems:** Livelihood assets in fishermen households: relation among – basic needs, means, context, stakeholders; livelihold outcome: food/nutrition, health, economic, education, housing, environment etc; how different factors/ components are affecting or improving livelihoods: policies, laws, process, cultur etc.
4. **Livelihood Security:** Factors influence livelihood security of fishermen; risk factors: drought and flood, conflict, disease outbreak and illness, population growth, economic adjustment policies, natural resources degradation, others related to fishing community, etc.
5. **Vulnerability Context in Fisheries:** Concepts; characteristics; time dimension: shocks, trends, seasonality, multiple-dimension: social, political, economic etc.
6. **Coping Strategies:** Diet changes of fishermen's households, other income generating activities (IGA), sell labor, credit/ loans, selling assets, migarations etc.
7. **Institutions and Types of Interventions in Fisheries Sector:** Government agencies; NGOs; Community-Based Organigations (CBOs); universities and research institutions; international agencies; role of institutions for fishermen's livelihoods security: relief, rehabilitation, mitigation, development (i.e, micro- credit, extension) etc.
8. **Gender:** Women and develoment in fisheries sector; gender dimension; gender role in incoming generating activities; constraints for their participaton; empowerment, develoment and equity.
9. **Ethnicity, Class, and Power Relations of Foshermen Society:** Beliefs and rituals; ethnic composition; existing social class and power structure; conflicts; mitigation strategies.
10. **Participatory Research and Participatory Rural Appraisal (PRA):** Concept; importance of participatory research; overview of participatory research; concept of PRA and use in sustainable fisheries development; PRA tools and techniques.

Textbooks:

1. DFID. 2000. Sustainable Livelihoods Guidance Sheets. Department for International Development (DFID), I Place Street, London SWIE 5 HE, UK.

2. Ellis, F. 2000. Rural Livelihood and Diversity in Developing Country. Oxford University Press, Oxford, UK.
3. Phillip, T. 1996. Rapid Rural Appraisal and Participatory Rural Appraisal in Aquaculture. FAO Technical Paper 358, Food and Agriculture Organization (FAO), Rome.

References:

1. Chambers, R. and G. Conway. 1998. Sustainable Rural Livelihood: Practical Concepts for the 21st Centure. IDS Discussion Paper 296, Institute of Development Studies (IDS), Sussex University, UK.
2. Frankenberger, T. 1996. Measuring Household Security: an Approach for Reducing Poverty. TANGO, USA.
3. Frankenberger, T. and J. Garret. 1998. Getting Connection: Reducing Livelihood in Security by Investing in Social Capital. TANGO, USA.
4. Frankenberger, T. and K. McCaston. 1999. Interrelated Factors that Infulance Household Livelihood Security. TANGO,USA.
5. Hamid, S. 1997. Why Women count: Essays in Development on Bangladesh. University Press Limited, Dhaka, Bangladesh.
6. Jansen, E. 1996. Rural Bangladesh: Competition for Scarce Resources. University Press Limited, Dhaka, Bangladesh.
7. Sen, A. 1981. Poverty and Famines: an Assay on Entitlement and Deprivation. Cambridge University Press, UK.
8. TANGO-CARE. 2002. Household Livelihood Security Assessment: A Toolkit for Assessment. TANGO, USA.