

CENTRAL INSTITUTE OF FRESHWATER AQUACULTURE
(*Indian Council of Agricultural Research*)
P.O. Kausalyaganga, Bhubaneswar- 751002, Odisha, India

SYLLABUS FOR PH.D. IN FISHERIES SCIENCE
(UTKAL UNIVERSITY)

FS-1. Finfish Breeding and Culture (FBC)

(8+3)

Present status and future perspectives of fisheries and aquaculture in India and world; Important cultivable species of finfishes and ornamental fishes, their biology and culture practices; Advances in different farming systems, such as semi-intensive and intensive systems; recirculatory system; flow-through system; integrated farming system; etc. Advances in design and construction of ponds and tanks; pens and cages; Farm mechanization; Economics of culture practices; Code of conduct for responsible and sustainable aquaculture.

Current status and future perspectives of carp/cultivable fish seed production in India and world; Natural seed resources and their management; Collection techniques and transportation of seed; Induced breeding techniques; Different types of hatcheries in operation in India and their management; Economics of hatchery operation; Larval rearing.

FS-2: Shellfish Breeding and Culture (SBC)

(8+3)

Present status and future perspectives of shellfish fisheries and culture in India and world; Important cultivable species of shellfishes, their biology and culture practices; Advances in farming systems and culture practices; Semi-intensive and intensive culture systems; Polyculture; Pearl culture techniques; Advances in design and construction of hatcheries, ponds and tanks.

Current status of shellfish seed production, problems and prospects; Natural seed resources and their management, availability of seed, collection techniques and transportation; Induced breeding and hatchery management techniques; Larval rearing; Economics of seed production; Culture and use of different live feed in shellfish hatcheries; Hatchery standards and biosecurity; Better management practices (BMPs).

FS-3: Aquatic Environment Management (AEM)

(3+1)

Physico-chemical parameters of water, soil and their interactions in aquaculture ecosystems; Management of water and soil qualities for sustainable aquaculture production; Climatic elements of concern in aquaculture; Aquatic pollution and its management; Impact of aquaculture on environment. Eutrophication; Bioremediation in

aquatic environment; Toxicity assessment, ecolabelling and traceability; Role of microbes in aquatic environment; Assessment of probiotic impact in aquaculture.

FS-4: Fish Health Management (FHM)

(5+2)

Common fish diseases caused by bacteria, virus, fungus and parasites, symptoms of diseases, pathology and prophylactics; Defence mechanism in fish and shellfish: Specific and non-specific defence mechanisms, immune cells, ontogeny of immune system; Disease diagnostic tools; Histopathological methods, diagnostic PCR, immunoassays, biochemical assays, monoclonal and polyclonal antibody based assays; Disease prevention and therapeutics: vaccines and immunostimulants, antibiotics and chemotherapeutics; Quarantine: Biosecurity principles, SPF and SPR, quarantine protocols, and facilities, brood stock and seed certification measures; Transboundary diseases; Preventive health management principles.

FS-5: Fish Nutrition and Physiology (FNP)

(5+2)

Nutritional requirements of finfish and shellfish, feed evaluations systems, feeding standards; Feed ingredients, anti-nutritional factors and ameliorations; Natural foods; Feed formulations; Feed processing and feed technology; Quality control of aquafeed; Feeding of carps, catfishes and prawns.

Physiology of digestion: Digestion of carbohydrates, lipid and proteins; Digestive enzymes and regulation of their secretions, absorption and assimilation of nutrients, factors affecting nutrient digestibility.

Endocrinology and reproductive physiology: Overview of important endocrine glands and their secretions, storage and secretion of hormones, mechanism of hormonal actions; development of gonads in fish, oogenesis; spermatogenesis, vitellogenesis and gonadal steroidogenesis; Mechanism of oocyte maturation and ovulation; Factors affecting gonadal development in fish; Stress physiology: physiological stress response, cellular stress response, stress hormones and their actions, factors affecting stress response.

FS-6: Application of Genetics in Fisheries (AGF)

(4+2)

Scope of applied fish genetics; Inheritance of qualitative and quantitative traits in fish; Chromosomal polymorphism; Non-chromosomal inheritance - mitochondrial inheritance; Gynogenesis and androgenesis; Production of yy males; Use of biochemical and molecular genetic markers in hybridization; Inbreeding and genetic drift - estimation of genetic parameters; Selective breeding and chromosomal manipulation; Selective breeding - qualitative and quantitative traits for selection, methods of selection- individual selection, mass selection, family selection and combined selection; Diallele crossing; genetic improvement of particular trait in fish; Banding techniques: c-banding,

G-banding, NOR-banding, FISH. Genotoxicity assay: comet assay, sister chromatid exchange, MNT, etc.

FS-7: Application of Biotechnology in Fisheries (ABF)

(6+3)

Scope of biotechnology in fisheries and aquaculture research; Genetic material, structures of DNA and RNA; Stereochemistry of bases and secondary structures; Organization of the nucleic acids - chromatin structure; Models of DNA replication in prokaryotes and eukaryotes; Mechanics of DNA replication; Enzymes: structure and function of DNA polymerases; Types of priming; Transcription; Translation; Mutations; Recombinant DNA and its applications in aquaculture; Monoclonal antibodies and their applications; Cell lines and stem cell culture; DNA markers and MAS; Resource conservation: genetic diversity analysis of fish resources and conservation; Fish genomics, proteomics and comparative genomics. Genetic engineering; Biotechnology in health management.

FS-8: Instrumentation (INS)

(6+3)

General instrumentation; Spectroscopy: Principles and applications of UV, Visible, fluorescence etc.; Chromatographic techniques: Principles and applications of chromatographic techniques, viz., HPLC, GLC, ion-exchange, affinity chromatography; Electrophoretic techniques: Concepts in electrophoresis, PAGE, SDS-PAGE, molecular weight determination; PCR: Principles and applications; Principles and applications of Northern blot, Western Blot and Southern Blot; Enzyme-linked immunosorbent assay (ELISA): basic principle and methodology; Classification and types of ELISA; Application of ELISA.

FS-9: Research Methodology and Computer Application in Fisheries (RMCAF)
(7+3)

Concept of information; Communication technology and its role in fisheries development; Recent advances in information and communication technologies in India and world - virtual learning, print and electronic media, e-mail, Internet, use of multimedia, video and teleconferencing, computer-assisted instructions, touch screens, micro-computers and web technologies; Curriculum design and development of e-learning courses and modules; Networking system of information; Agricultural Technology Information Centers (ATIC); Technology parks; Use of expert system/MIS in fisheries extension; Cyber / e-extension in India and world, its challenges and limitations in fisheries development; Definition and characteristics of research, types of research, language of research, research paradigms, research ethics; Research process: steps in planning and conducting a research study; Formulating a research problem; Conceptualizing a research design; Writing a research proposal; Writing a research report.

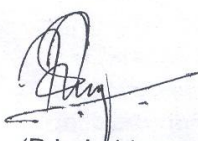
Test of significance; Probability distribution; Analysis of Variance (ANOVA), Analysis of Covariance; Non parametric test: Wilcoxon test, Mann-Whitney U-test, Kruskal and

Wallis test and Friedman's test; Use of computer software for data analysis; Survival analysis. Linear programming.

FS-10: Fisheries Extension and Social Science (FESS)

(6+0)

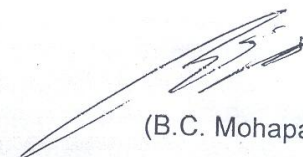
Extension techniques for aquaculture; Economic analysis in aquaculture; Projects feasibility analysis; Marketing aspects of aquaculture; Products and transfer of technology programs in fisheries and aquaculture; Critical analysis of different approaches in fisheries and aquaculture extension under public and private sector; Production oriented vs. livelihood oriented extension approach; Agricultural knowledge and information system (AKIS); Significance of theories of social learning for extension practice; New approaches in extension; Financial institutions; Implications of globalization and WTO agreements for extension services; Monitoring, evaluation and impact assessment - importance and scope in fisheries programs, conceptual frameworks, results frameworks and logic models, quantitative and qualitative indicators; Information systems for sustainable fisheries development; Difference between outcome and impact; Types of impact assessment; Impact assessment methods; Fisheries and aquaculture extension and development systems in South Asian countries and South East Asian countries; Approaches and achievements of fisheries development organizations; Indigenous knowledge - historical perspective, terminologies, concepts, systems, importance, relevance and roles in fisheries sector; Types of indigenous knowledge: information, practices and technologies; Accessing the indigenous knowledge; Constraints of indigenous knowledge, Conserving ITK. Issues in protection of traditional knowledge / ITK; Integration of indigenous knowledge and modern technologies.



(P.L. Lalrinsanga)

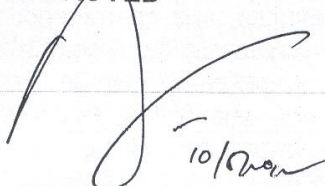


(Ashis Saha)



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APPROVED



10/02/20

DIRECTOR