

CENTRAL INSTITUTE OF FISHERIES EDUCATION
(DEEMED UNIVERSITY, I.C.A.R.)
FISHERIES UNIVERSITY ROAD, SEVEN BUNGALOWS
ANDHERI(W), MUMBAI – 400 061.

INFORMATION BULLETIN FOR Ph.D. ENTRANCE TEST

1. AVAILABILITY OF SEATS

The candidates for the degree of Doctor of Philosophy (Ph.D.) in different disciplines of fisheries will be selected for the academic session 2008-2009 as per the marks secured in the All India Competitive Examination, candidate's academic performances and the interview. The advertisement for **Admission Notice 2008-2009** indicates the eligibility to appear for Entrance Test, the number of seats and the subject in which examination will be conducted for different disciplines of fisheries.

The number of seats available during the 2008-2009 Academic session are as follows :

Sl. No.	Name of the Discipline *	No. of seats	Reservations
1	Fisheries Resource Management	6	1(SC/ST)** & 1 (OBC)
2	Aquaculture	8	1(SC/ ST)** & 1(OBC)
3	Post Harvest Technology	3	1(SC/ST)**
4	Fish Genetics	3	1(SC/ST)**
5	Fish Biotechnology	2	1(SC/ST)**
6	Fish Pathology & Microbiology	3	1(ST/SC)**
7	Fish Nutrition & Biochemistry	4	1 (ST/SC) ** & 1 (OBC)
8	Fish Business Management	1	-
	Total	30	7(5SC,2 ST)** & 3 (OBC)

Numbers of seats are tentative and likely to be changed without prior notice.

* Separate entrance tests will be conducted for different disciplines.

** Seats are reserved for first category. In case suitable candidate is not found from that category then seat will be filled through the other reserved category and in case a candidate of reserved category is not found suitable, the seat will be treated as vacant. In addition one seat is reserved for Physically Handicapped and Kashmiri migrants. Reservation to the candidates belonging to OBC Category will be introduced as per the directive to be received from ICAR. There is a provision for admitting in-service candidates from ICAR Institutes/SAUs/CAUs/State Fisheries Department. In-service candidates will be required to qualify in the written entrance test. The CSIR/UGC/DBT/ICMR fellow and the candidates cleared through other national level fellowship will be admitted over and above to the allotted seats.

2. ELIGIBILITY

- 2.1 B.F.Sc. & M.F.Sc. (4 +2 yrs) or B.Sc & M.Sc. (3 yrs) from CIFE (till 1995) with M.F.Sc./M.Sc. OGPA 7.5 out of 10 and 3.75 out of 5 (OGPA for SC/ST candidates is 7.00 out of 10 and 3.50 out of 5).

(OR)

D.F.Sc. from CIFE, provided the candidate holds a Bachelor's degree in biological science and has two years of experience in fisheries development work after obtaining D.F.Sc.

In case of sponsored candidates, those holding M.Sc. in Fish and Fisheries and related disciplines with at least two years experience in fisheries development work are also eligible to apply.

AGE LIMIT

- 2.2 The minimum age for admission shall be 22 years as on 30th September 2008. No relaxation in age limit is permitted.

3. COURSE LOCATION

Candidates have to complete their course work at CIFE Hqrs, Mumbai. However, for research work they may be asked to work any where in India.

4. DURATION OF THE PROGRAMME

Duration of Ph.D. programme is 3 years and minimum residential requirement is 2 ½ years

5. ACADEMIC CALENDAR

An academic year will be of two semesters, roughly of 21 weeks duration.

I semester	-	October – March
II semester	-	April – September

6. PROCEDURE FOR APPLICATION

- 6.1 Prescribed Application Form and Information Bulletin / Prospectus for the Entrance Test and Admission of Ph.D. programmes can be obtained from the Registrar, Central Institute of Fisheries Education, (Deemed University, ICAR), Fisheries University Road, Seven Bungalows, Andheri (W), Mumbai – 400 061. Request for Information Bulletin and Application Form may be made at the CIFE office or through post well in advance.

Application Form and Information Bulletin will be issued at the CIFE Office, Mumbai in person up to 21st June 2008. However, postal requests will be entertained only up to 13th June 2008.

When delivered **in person at the CIFE counter**, the charges for the same will be **Rs.300/-** in the form of a Crossed Demand Draft / Cash and if it is to be sent **by post a Crossed Demand Draft of Rs.350/-** will be required. The Demand Draft is to be drawn in favour of **ICAR Unit - CIFE Mumbai payable at State Bank of India, Versova Branch, Mumbai**. Payment for this material through Cheque / VPP / Postal Order will not be entertained. The application form may also be downloaded from the website www.cife.edu.in. However such application form shall be submitted along with the demand draft for Rs.300/-

The date of the Demand Draft should not be prior to the date of advertisement for admission in the newspapers. Application Form together with Information Bulletin will be sent to the candidates through Speed Post.

- 6.2 The Application form bears a serial number at the top right corner on page 1. This number, as well as the main discipline to which the admission is sought must be quoted in further correspondence.
- 6.3 Candidates must enclose attested copies of the following certificates and documents (originals should not be sent) in the order indicated below, failing which the application is liable to be rejected.
- (a) Proof of the Date of Birth.
 - (b) Certificate of Examinations passed starting from Matriculation / Higher Secondary / PUC / Pre degree to Master's Degree.
 - (c) Mark sheets in detail indicating percentage of marks, division / class obtained etc. for all the above examinations.
 - (d) Course completion certificate from the Registrar of the University / Controller of Examination / Dean / Principal in case of candidates from the University / College following the course-credit system. Candidates who have completed their degrees in Grade Point System should mention the OGPA / CGPA only.

- (e) Character Certificate either from the Principal / Dean / Registrar or Head of the Institute / University last attended.
- (f) A candidate who is appearing in the qualifying examination prior to the entrance test, or whose result is not declared can also apply and appear in the said test but he/she shall have to submit the mark sheet latest by 10th September 2008 otherwise his/her candidature for admission will be cancelled.
- (g) Scheduled Tribe / Scheduled Caste certificate in the proforma as at Annexure from District Magistrate of the authorities, empowered to issue such certificate of verification, issued not more than six months before the date of application. Applications without such certificate will be considered against unreserved seats only.
- (h) Certificate (in original) of physical fitness issued not more than six months before the date of application, by a Registered Medical Practitioner.
- (i) Two recent passport size photographs duly signed by the candidate should be affixed in the space provided, one on page 1 of Application Form and other on Admit Card.

- Note :**
- (a) The original certificates and mark sheets are to be produced at the time of admission. Candidates who does not possess the original certificates and mark sheets will not be admitted.
 - (b) Admitted students coming from other Universities / Institute will be required to submit the Migration Certificate in original within 2 months of joining the course.

6.4 For candidates coming from a University following the course credit system or otherwise, the application will be considered for undertaking the Entrance Examination even though the final viva-voce examination has not been completed, provided the full transcript is enclosed showing the overall grade point average / marks obtained along with a certificate from the Registrar of the University / Controller of Examinations/ Principal of the College / Dean of Faculty to the effect that the candidate has completed successfully all the prescribed course work. (Certificate from officials other than mentioned above will not be entertained). However, a Course Completion Certificate has to be produced at the time of the Entrance Test from the Competent Authority as mentioned above, failing which the candidate will not be allowed to appear in the Test.

6.5 Submit the Application Form for the Entrance Test filled legibly and correctly in the applicants own handwriting to the office of the Registrar, Central Institute of Fisheries Education, Fisheries University Road, Seven Bungalows, Andheri (W), Mumbai- 400 061 by 21st June 2008. Applications received after the due date will be rejected. Postal delay will not be accepted as a legitimate reason to entertain

applications received after the last date. Candidates are advised to send their applications by Registered Post with acknowledgement due.

- 6.6 Admit cards for the **Entrance Examination** to be held on the **24th August, 2008 (Sunday)** will be sent in advance to all the eligible candidates by the first week of August, 2008 indicating the Date, time and venue of the Entrance Test. **Viva-voce (interview)** for those candidates who qualify in the written test will be held on **Monday 25th August, 2008**. Candidates shall have to arrive at the place of Examination at their own expenses and make their own arrangement for stay. In case there is any change in the venue / date of Entrance Test due to some unforeseen reason, the changed venue / date will be intimated.
- 6.7 SC/ST candidates (except those employed) called for the Entrance Test will be paid TA as per rules for appearing at the Entrance Test, subject to production of Caste Certificate issued by the Competent Authority on the proper proforma, and also the evidence of having undertaken the journey.
- 6.8 Incomplete applications and those not supported by requisite certificates, mark sheets and other documents, or applications not in the prescribed printed form issued by Central Institute of Fisheries Education for admission to the particular academic session, or applications made on forms super scribed as “Complimentary Copy” or “Specimen Copy” or applications received after the last date of receipt notified will be rejected. No correspondence relating to such applications will be undertaken. The applications of the candidates who give vague or incomplete information or whose handwriting is illegible are liable to be rejected.
- 6.9 If a candidate is found to furnish wrong information or suppress any relevant information, the application is liable to be rejected and admission made to a course on the basis of such information will stand terminated without refund of fees etc., if already deposited.
- 6.10 All correspondence for admission should be addressed to :

THE REGISTRAR
CENTRAL INSTITUTE OF FISHERIES EDUCATION,
(DEEMED UNIVERSITY, ICAR),
FISHERIES UNIVERSITY ROAD, SEVEN BUNGALOWS
ANDHERI (W), MUMBAI – 400 061.

Tel. No. - 022-26361446/7/8
Fax No. - 022-26361573
E mail - sureshkumar@cife.edu.in

7. GENERAL INFORMATION FOR ENTRANCE TEST

An All India Competitive Written Examination for admission to Ph.D. in Fisheries shall be held on the Sunday 24th August, 2008 at Mumbai. The candidates who fulfill the minimum eligibility criteria will be permitted for the Entrance test. To test the knowledge of the candidate in the discipline to which admission is sought, a written test covering the subject matter shall be conducted before the interview. The details are as under :

	Academic Score	Written Test	Interview	Total
Contents	-	Subject matter	-	-
Duration	-	2 hrs.	-	-
Max. marks	-	200	-	-
Qualifying marks				
General	-	50%	-	-
SC/ST	-	45%	-	-
Weightage	20%	70%	10%	100%

It will be in the interest of the applicants that they should verify their eligibility as mentioned in the above sections before they submit their applications along with the application fee and appear in the Entrance Test. Applicants not satisfying the eligibility requirements shall not be permitted to appear in the Entrance Test.

The questions for Subject Matter will be from the syllabus as given in the Bulletin and will be only one paper of 2 hours duration.

Interview for the eligible candidates will be conducted after the Entrance Test on the next day i.e. 25th August 2008.

8. SELECTION OF CANDIDATES

Final selection of candidates for admission will take into account the marks obtained in the Entrance Test, Interview and the previous Academic performance. A careful scrutiny of the applicant's continuous academic records from Higher Secondary / PUC / Pre degree to Master's degree using a PG Ready Reckoner given in the bulletin will be done to calculate the academic score.

Permission to sit for the Entrance Test and to appear for the Interview is by itself no guarantee of admission to the Ph.D.

A minimum of 50% marks in written test as well as in interview should be obtained by the candidates to be considered for admission. Selected candidates will be intimated by post. No intimation will be sent to those who are not selected.

The selection procedure through Entrance Test is not applicable for holders of ICAR / CSIR / UGC and other national level Fellowships. Such fellowship holders will directly qualify for admission to the relevant discipline through interview.

Although the applicants are called for Entrance Test on the basis of the physical fitness certificate furnished by a Registered Medical Practitioner, the selected candidates are required to appear for medical checkup by the Institute Medical Officer, before they are enrolled / admitted to this Institute. They will be allowed to join the Institute for pursuing further studies only after they have been declared physically fit by the Institute Medical Officer. The fees for physical fitness certificate shall be paid by the candidates.

9. LAST DATE FOR ENROLMENT / ADMISSION

All selected candidates has to deposit Rs.50,000/- as Fixed Deposit in the name of the Institute at the time of admission. If the student submits his thesis / completed the course, the amount will be refunded to him / her failing which the same will be forfeited.

All selected candidates are required to enroll before 30th September 2008 by completing the formalities and paying the requisite fees. If the selected candidates do not report by then at the Institute, their selection will stand cancelled and seats will be offered to the candidates in the wait list. Wait listed candidates should secure admission positively before the date prescribed by the competent authority.

10. FEES STRUCTURE (subjected to change)

The following are the prescribed fees for Ph.D. programme of the Institute.

Sr.No.	Description of fee and other charges	Charges
1)	Caution money	Rs. 2,000.00 (Refundable)
2)	Registration fee	Rs. 100.00
3)	Tuition fee (Annual)	Rs. 10,000.00
4)	Hostel charges (Annual)	Rs. 2,000.00
5)	Students Union fee	Rs. 300.00
6)	Magazine	Rs. 100.00
7)	Welfare Fund	Rs. 200.00
8)	Sports Fund	Rs. 200.00
9)	Cultural and literary activities fee	Rs. 200.00
10)	Examination fee	
	(a) For Ph.D. students	Rs. 1,000.00
	(b) Thesis evaluation for Ph.D.	Rs. 1,000.00
11)	Identity card fee	Rs. 100.00
Other charges		
i)	Provisional Degree Certificate	Rs. 200.00
ii)	Transcript	Rs. 200.00
iii)	Duplicate Degree	Rs. 800.00
iv)	Award of Degree in absentia	Rs. 1,000.00
v)	Late registration	Rs. 500.00
vi)	Make-up examination	Rs. 800.00
vii)	Alumni Association	Rs. 500.00
viii)	Migration Certificate	Rs. 100.00

Students belonging to the SC/ST are exempted to pay the Tuition Fees under the Fees Structure. However, they are liable to pay the rest of the fees. Each student is required to register at the beginning of each semester on a notified date with a grace period as provided in the Academic Regulations till the completion of the degree requirements, failing which he/she will not be registered for the semester. Registration for newly admitted students is a part of the admission procedure and shall be governed by the admission rules.

11. ORIENTATION

In order to make all fresh students fully conversant with the requirements and working of the course-credit system of instruction followed at this Institute, an orientation programme will be arranged.

12. RESIDENCE

The Institute has separate hostels for men and women students at its head quarters in Mumbai. Students seeking admission to the hostel must apply separately at the beginning of each academic year in the prescribed form available at Warden's Office of the respective hostel.

Students admitted to the hostel shall abide by the decision of the Director / Warden with respect to the Hostel Rules. A copy of the hostel rules will be provided at the time of admission. Those violating the hostel rules will be liable for expulsion from the hostel.

13. GENERAL CONDITIONS

There is no provision for scrutiny or revaluation of answer books of the Entrance Examination and the result regarding admission as declared by the Institute shall be final.

The selected candidates should join the course by the date indicated in the admission letter. No interim enquiries will be entertained.

The right of admission or the right to cancel the admission of a candidate at any stage is vested with the Institute if it is found that the information furnished by the candidate is not true or is incomplete.

Admission to the Institute implies acceptance by the student and his/her parents/ guardians of all provisions given in the Bulletin or any change in the Institute Rules, Regulations, Fees etc. modified from time to time.

All requirements of Ph.D. degree must, however, be completed within 5 years of admission and 6 years for the Inservice candidates, failing which the name of the student will be removed from the rolls of the Institute.

The information given in the Bulletin is only for general guidance and could be modified/changed from time to time by the Institute. The Information Bulletin shall not be treated as a legal document.

14. FELLOWSHIP

There is provision for awarding Institutional fellowship to selected candidates @ Rs. 10,500/- p.m. for the period of 3 years and Rs.1000/- to the inservice candidates from ICAR Institutes/ SAUs/ CAUs but there is no provision for institutional fellowship for the selected candidates from State Fisheries Department. However, the candidates who passed the National Entrance Test /SRF conducted by ICAR/ASRB or CSIR/UGC/DBT/ICMR are eligible for the Fellowship of the above bodies as per rules.

15. REFUND OF CAUTION MONEY AND OTHER DEPOSITS

All refunds of money payable to students should be claimed by them within three years of their completion of the course. Claims there after will not be entertained. (Those desirous can relinquish the claim and give an application to be a life member of the Alumni Association of the Institute).

Fee (other than the refundable deposits) once paid will not be refunded under any circumstances.

16. FOREIGN STUDENTS

The application of foreign students for admission shall have to be forwarded through their respective Embassies at New Delhi or through the respective Indian Missions abroad to the Secretary, DARE, Govt. of India, ICAR, Krishi Bhavan, New Delhi – 110 001 and their candidature shall be considered only if they are sponsored by their Government or Government of India.

The eligibility for admission of sponsored foreign students will be decided by the Equivalence Committee of CIFE. They should possess the requisite Master's degree in the concerned discipline or its cognate branches. A good knowledge of English is essential. A certificate of the candidate's proficiency in English, issued by the respective Indian Mission abroad, should accompany their application for admission. Further the foreign students are required to be in possession of student's visa.

The Institutional economic fee of US \$ 4000 per annum is to be paid besides other fees as per the requirements of CIFE.

The last date for receipt of applications, results and mark sheets from the applicants who are foreign nationals but are resident in India will be the same as prescribed for the Indian applicants for admission through open competition.

The admission of foreign students shall be finalized without any interview. Foreign students who are already residents in India, will, however, have to appear for Entrance Examination and Interview. Candidates sponsored by International organization like the Agricultural Development Council, the Food and Agricultural Organization (FAO) of the United Nations, United Nations Educational Scientific and Cultural Organization (UNESCO) etc. shall be considered for admission at the Central Institute of Fisheries Education provided such a request is received through the ICAR / DARE and fulfilling the conditions as prescribed from time to time by the Competent Authority. Their cases shall be considered along with the other candidates without giving them any concession in minimum marks but they shall be exempted from appearing in the Entrance Examination and Interview.

As per the directive from the Govt. of India, Ministry of Family Welfare, New Delhi, health check-up for foreign students including that for AIDS, has been introduced. It has been laid down that foreign students will be provisionally admitted. Their admission will be confirmed on production of fitness certificate from the competent authority.

17. FINAL DECISION OF ADMISSION

The decision of the Director, Central Institute of Fisheries Education, Mumbai shall be final regarding admissions and other matters. Copy of Academic regulations will be provided to the admitted students.

The director may summarily cancel the registration of any student or group / batch / class of students who violate(s) the rules and regulations of the Institute or whose continuance in the Institute would not be in the best interest of the Institute.

18. SYLLABUS FOR ENTRANCE EXAMINATION

For admission to Ph.D. Programme in Fisheries Resources Management / Aquaculture / Post-Harvest Technology / Fish Genetics / Fish Biotechnology / Fish Pathology & Microbiology / Fish Nutrition & Biochemistry / Fish Business Management, written examination will be of objective type only.

Syllabus - Fisheries Resource Management

- World Fisheries : Present status of world fisheries utilization and demand.
- Fishery Hydrography : Hydrology of the continental shelf around India, Fisheries oceanography, physico-chemical and biological parameters related to fisheries, primary production, thermocline, carbon cycle, nitrogen cycle, phosphorus cycle, food chain and web, micronutrients in the water and soil. Pollution aspects.
- Marine Fisheries of India : Pelagic demersal fishery resources, their exploitation area, season, important species, production, potential resources, efforts, determination of age, mortality, yield per recruit, maximum sustainable yield and stock-recruitment relationship.
- Inland Fisheries of India : Inland fisheries resources of India, riverine fisheries of India, Management and development of reservoir and lakes fisheries resource of India. Their conservation and management.
- Fishing Craft & Gear : Mechanized and country craft, efficiency and mode of operation.
- Fish Processing & Marketing : Chemical composition of fish, causes of fish spoilage, evaluation of fish freshness, preservation, processing and marketing.
- Extension, Economics Statistics : Extension techniques for marine fisheries, and economics of capture fisheries and statistical method in management of capture fisheries.

Syllabus –Aquaculture

World Fisheries	:	Present status of world fisheries, utilization and demand of fish and fish products.
World Aquaculture	:	Status of world aquaculture, production trend, important Cultivable species of finfish and shellfish, aquatic plants and their culture practices.
Fish/Shellfish Aquaculture	:	Selection of species, biology of commercially important species, culture of finfishes, crustaceans, mollusks, sea weeds, availability of seed, hatchery practices and management, monoculture, polyculture, Integrated farming system and economics of aquaculture.
Aquatic Environment:		Physico-chemical parameters of water, soil and their interaction in aquaculture ecosystems, management of water and soil qualities for sustainable aquaculture production, nutrient cycles, principles of aeration, Chlorination, Ozonation and U.V. radiation. Aquatic pollution, types of pollution, pollution indicators, mitigation measures and environment impact assessment study.
Nursery and Grow out :		Farm construction, pond preparations, fertilization, feeding, soil-water management, stocking and management, culture in ponds, pens and cages, sea ranching and production economics.
Seed Production and Hatchery Technology	:	Natural seed resources and its management, collection techniques, hatchery seed production and management, hypothesis of spawning and induced breeding, larval rearing, seed transportation and economics.
Fish Nutrition	:	Feed composition, feed formulation, supplementary feeds and feeding methods for finfish and shellfish, feed dispenser, protein, fat, amino acid and micro-nutrients requirement of culturable finfish and shellfish, methods of feeding. Anti-nutritional factor in aquatic feeds. Live feeds and artificial feeds for larviculture.

- Fish Pathology : Common fish diseases and their control, bacteria, virus, protozoan and metazoan-parasites, symptoms of diseases and prophylactics.
- Genetics and Biotechnology : Biochemical genetics; polymorphisms, gene action and allele expression, manipulations of chromosome sets; gynogenesis/ androgenesis, polyploidy. Control of sexuality, gametic manipulations and cryopreservation. Gene cloning technology and its applications in mariculture. Genetic improvement of aquaculture candidates through selective breeding / hybridization / transgenesis.
- Aquaculture Economics : Extension techniques for aquaculture, economics of Extension and Statistics : aquaculture. Projects feasibility analysis, marketing aspects of aquaculture, products and transfer of technology programs in fisheries and statistical techniques in aquaculture

Syllabus - Post-Harvest Technology

Amino acids – structure and quality of protein, digestibility, primary, secondary, tertiary, quaternary structure of protein and denaturation of protein.

Fish oil, body oil, liver oil, fatty acid composition of fish oils, PUFA and HUFA in fish oil, rancidity, antioxidants and vitamins.

Staining of bacteria, nutrition of bacteria, effect of environment on bacteria, growth phase of bacteria and microbial changes during icing, freezing and curing.

Factors affecting quality of fresh fish, handling of fish and board fishing vessels, chill storage of fish, shelf life, storage method, insulated boxes, heat load calculation and ice as a cooling medium.

Freezing – freezing curve for fish, different types of freezers, quality changes during frozen storage and unit steps in freezing.

Rate of drying, unit steps in drying of fish, defects in dried products, mechanical driers and solar driers.

Canning preservation of fish, sterilization and commercial sterilization, defects in canned products and unit steps in canning.

Quality assurance in fishery products, HACCP – principles of HACCP and its implementation.

Fishmeal and different fisheries products, chitin, chitosan, fish sauce, fish silage and fish hydrolyzate.

Hurdle technology, modified atmosphere packaging, transportation of fish and value added products.

Syllabus - Fish Genetics

Principal of Genetics and Breeding

Historical development of genetics, Physical basis of heredity. Significance of mitosis and meiosis; Mendelian principles-importance, interpretation, scope and limitation. Modification of Mendelian ratio. Sex determination and development; Modification of inheritance, Multiple alleles. Linkage and crossing over, recombination, interference. Modern concept of gene. DNA as genetics material - structure, chemistry of nucleic acids. Genetic code and protein synthesis. Transfer and regulation of genetic information. Pleiotropy, modification, penetrance. Mutation-natural and induced, mutagenic agents and fate of mutant allele in the population.

Quantitative Genetics

Hardy Weinberg principles-deduction and test of equilibrium, application of the equilibrium law. Equilibrium populations-properties. Equilibrium points in case of multiple alleles more than one loci and linked loci. Attainment of equilibrium by non equilibrium population; when gene frequencies are different in two sexes for autosomal and sex linked genes. Change in gene frequency and forces affecting equilibrium points under migration, mutation and selection. Effect of small population on gene frequency on populations in approximate equilibrium. Theory of path coefficients and analysis. Basis of relationships-independent and correlated causes; path relation between parent and offspring, collateral relatives, etc. Inbreeding - increase of homozygosity, random fluctuation of gene frequency, genetic drift, effective population size. Pedigreed populations and close inbreeding. Quantitative and qualitative traits-mode of inheritance and continuous variation. Components of phenotypic value-population mean, genotypic value, average effect of gene and gene substitution. Breeding value, dominance deviations interaction deviations. Components of variation-additive non additive environment genotype and environmental interaction. Biometrical relationship among relatives-genetic, environment and phenotypic covariances. Genetic parameters and their usage in fish breeding. Selection and its effect on population structure Intensity of selection, measurement of response to selection,

methods of selection and their relative efficiencies, genetic gain, correlated response. Utilisation of non-additive genetic variance; specification of heterosis-theories, estimation of heterosis under additive dominance model and usage in fish production. Maternal effect Diallel mating: scale effects and their estimation; interpretation of genetic components. Bidirectional selection and its implications in performance improvement. Aids to selection; methods of selection. QTL and MAS (Quantitative Trait loci and Marker Assisted Selection). Construction of selection indices; sire and dam evaluation. Selection experiments and genetic advance in various fish species. Development of new strains/ synthetic population. National breeding plans. Trends in fish breeding research. Threshold characters and their importance. Selection procedure for threshold characters.

Cytogenetics and molecular Genetics

Range of chromosomes in finfish and shell fish. Chromosomal aberrations-inherited and induced, structural and numerical, karyotyping of chromosomes. Chromosome banding G- C-, NORs Restriction Enzyme banding; Fluorescent In Situ Hybridization. Sister chromatid exchanges. Cytogenetics and evolution, genetic and evolutionary implication of chromosomal aberrations and their implications on economic traits. Cytogenetic Engineering Triploidy and tetraploidy Induction, androgenesis, gynogenesis, their importance in fish breeding and aquaculture production. Role of molecular genetic tools (Allozyme and DNA markers) in stock structure analysis and aquaculture.

Fish and Shell Fish Breeding

Population and production statistics of cultivable finfish, shellfish and ornamental fish breeding. Current status of aquaculture in world and India. Quarantine procedures, Tagging and maintaining breeding records. Performance; Growth, productive and reproductive traits and their inheritance. Study of growth curves and their components. Influence of non genetic factors on growth. Endocrine control of reproduction; Synchronisation of spawning. Estimation of heritability and repeatability. Phenotypic, genetic and environmental correlations among various economic characters and their role in formulation of breeding strategies. Brood stock management. Inbreeding depression and heterosis in various economic characters. Ornamental fishes as models in genetic research. Introduction to bioinformatics and various software packages. Data base relevant to fish genetics and breeding. Packages for genetic data analysis.

Fish Genetic Resources Conservation

Survey and geographic distribution of Marine, Brackish-water Freshwater and Cold water fish genetic resources. Threatened aquatic species of India and world and their status. Technical problems associated with conservation and

preservation of aquatic species. Breeding strategies for threatened species. National and international programs and strategies for conservation of fish genetic resources. Cryopreservation of sperms, eggs and embryos. Factors threatening indigenous species. IPR issues and patenting of genetic resources. Regulation regarding introduction of exotic germplasm.

Syllabus - Fish Biotechnology

Genome organization in prokaryotes and eukaryotes, structure and replication of DNA, proteins and enzymes in DNA replication, telomerase and chromosome replication, recombination, mutation, DNA repair, gene and operon models, promoters and regulatory elements, transfer of genetic material, transformation, conjugation and transduction, transcription in prokaryotes and eukaryotes; translation in eukaryotes and prokaryotes, genetic code, wobble hypothesis, genetic code in mitochondria, codon bias, post translational modifications. Restriction and DNA/RNA modifying enzymes and their application; Vectors - plasmids; cosmids; Yeast artificial chromosomes; Adapters and linkers; Molecular cloning; strategies to construction genomic and cDNA libraries; Screening of libraries. Nucleic acid and protein sequencing; Nucleic acid probes and their application; Recombinant expression systems and application. Genome analysis and manipulations in fish and shell fish. Chromosomal and gene manipulations transgenic fish. Recombinant biologicals and their importance in fisheries.

Immune system of shell fish and finfish, characterization of antigen, production and purification of antibodies (polyclonal & monoclonal), complement system, Immunodiagnosics, Immunoglobulins and their functions, CMI & Humoral Immunity, Vaccine and Immunization in fish, Electrophoresis and Western blotting, Cell and tissue culture techniques, PCR.

Production of single cell protein as feed for Fish/Prawn, Nutrition and gene interaction, Bio-conversion of agriculture and animal wastes into fish feed, sex reversal of larvae by dietary manipulation, Enhancement of quality of meat by dietary manipulation. Use of digestive enzymes for enhancing digestibility of feed and probiotics in feed.

Syllabus - Fish Pathology and Microbiology

Inflammation and cellular components participating in the inflammatory process, types of inflammation and sequelae, reparative process, Oedema, Necrosis, Degenerative process, Disturbances in growth of tissue and cellular components.

Neoplasm, the etiology and classification, gross and histological features.

Immune system in fishes and their function, Antigen and antigenicity, phagocytic system and lymphoid system, Histocompatibility, Hypersensitivity reactions, Antigen processing, Antigen - antibody reactions.

Vaccines and methods of vaccination in fish, immunostimulants and probiotics, Immuno diagnostics.

Bacterial and viral diseases of fish and shellfish, the clinical, gross and microscopic changes in various organ tissues. Diagnosis of specific diseases and differential diagnosis, treatment methods for bacterial diseases.

Drugs, chemicals and antibiotics used in aquaculture and their modes of action and application.

Pathogenesis, pathology, treatment and control of common bacterial, parasitic, protozoan and fungal diseases of fish and shellfish.

Common parasites of freshwater and marine fishes, their morphology, life cycle, diseases they produce and their treatment and control.

Microorganisms associated with aquatic environment, pollution and its effect on aquatic organisms, fish production and public health. Role of microorganisms in degradation of pollutants and bioremediation.

Pathogenesis, pathology and diagnosis of heavy metal toxicity in fish.

Syllabus - Fish Nutrition and Biochemistry

Structure and biological functions/ properties of biomolecules and nutraceuticals. Carbohydrates (Mono, Di, Poly and mucopolysaccharides, starch, glycogen, cellulose, chitin). Lipids (essential w-3 and w-6 fatty acids, phospholipids, prostaglandins and steroids). Proteins (Essential and non essential amino acids, glycoproteins, and lipoproteins), Nucleic acids(Purines, pyrimidines, nucleosides and nucleotides, RNAs, DNAs, Watson crick model of DNA), Enzymes, hormones(Steroidal, peptides and biogenic amines, T3, T4) and Vitamins (water and fat soluble).

Transcription, translation, promoters and growth enhancers, nutrient gene interactions.

Enzyme classification and catalysis: general acid – base, covalent, electrostatic and metal ion catalysis, principles of enzyme kinetics, transition state theory – application and significance of enzyme catalysis. Enzyme inhibition: factors influencing enzyme reaction velocity, significance of inhibition of enzyme activity. Competitive, non competitive and feed back inhibition. covalent modification. Allosteric enzyme. Mechanism of action of enzymes and hormones. Isolation, purification and characterization of biomolecules including enzymes, vitamins and hormones.

Principles, procedures and applications of analytical techniques in biochemical and nutritional research, colorimetry, spectrophotometry, chromatography (TLC, GC, HPLC, Affinity, column, paper), gel filtration, electrophoresis(PAGE, AGE, PFGE), ultracentrifugation, radioactivity, protein estimation by micro kjeldahl, , and bomb calorimetry.

Metabolism of lipids, proteins, carbohydrates, and nucleic acids. Oxidative phosphorylation and electron transport chain, integration and homeostasis of intermediary metabolism.

Food and feeding habits, and nutrient requirement of finfish and shellfish, factors affecting nutrient requirements, digestion, absorption and metabolism of nutrients, Energy requirements of fish and shellfish: Principles of energy requirements, Factors affecting energy requirement. Energy budgeting.

Feed formulation, Proximate composition, digestibility of feed ingredients, antinutritional, antimetabolic factors and toxins in feed ingredients, hydrostability of feed and their storage, prevention of feed spoilage from rancidity, fungus formation, and associated toxins/ salmonella, fish disease vectors in feed and quality control, use of natural and synthetic carotenoids, feed additives, feed attractants, growth promoters, Fish Silage Probiotics, antibiotics, coloring and flavouring agents, antioxidants, binders, ecofriendly feed development. Evaluation of feeds based on biological and chemical methods, survival, consumption growth analysis formulae, FCR,FCE, Digestibility, PER, productive protein value, NPU, nutritive and biological value. Nutritional deficiency and metabolic disorders and corrective measures. Nutrition and environment.

Feed types, dry (pellets, flakes, powdered, microparticulate, extruded feed, microencapsulated, microbound, and microcoated) and non dry; feed manufacturing units and processes, feed economics. Live feeds. feed dispensing methods, canal and brood stock nutrition.

Design of experiment in nutritional research, analysis of experimental data employing CRBD, RBD, Lorenz curve, t-test, ANOVA

Syllabus - Fish Business Management

Organizational behaviour, Motivation Theories, Stress Management, Group dynamics, Leadership style and approaches, Conflict Management. Delegation and Decentralization, Total Quality Management, Human resource planning, Recruitment and selection, Training, Performance appraisal, Communication models, Mass communication and Audio visual aids.

World and Indian Fisheries resources and production trends, Fisheries prosecutions, International negotiations and settlement over open sea, Code of Conduct for responsible fisheries, Central and State Legislations, CRZ, Sustainability and Co-management of Fisheries resources. Theories of international trade, WTO regime, Agreement for trade and global price competition in fish and fishery products, EEC & USFDA regulation for export of Seafood, Biodiversity, ITR's, Intellectual property, International law of patents, Indian patent act, Quality control tools, Indian food Laws, international safety guideline, Value addition and different methods of preservation, HACCP principle, Marketing management, Market segmentation, Product decision and mix, Promotion mix, Pricing, Advertising campaign, Sales promotion and publicity, and Market research.

National income accounting, Aggregate demand and supply model, Inflation, Theory of demand, Consumer Behaviour, Different market competition, Law of production, Production function, ABC cost and income concepts, Break even point, Capital market, Money market, Theory of working capital, Cost of capital, Risk and Return, Port folio theory and capital asset pricing model, Accounting principles, Financial accounting, Cost accounting, Project Cycle, Undiscounted and discounted measure of project worth, Ratio analysis, Asset valuation, Computation of depreciation, Financial analysis, and Project management techniques.

Elementary theory of probability, Addition and Multiplication theorems of probability, Bayer's theorem, Probability Distribution-Binomial, Poisson and Normal, Sampling distribution, z ,t , X^2 and F tests, Sampling techniques, Simple correlation and regression, Spearman's rank correlation, Analysis of variance and Control charts, Smoothing and Decomposition methods, Time series analysis, ARMA and ARIMA models, Linear Programming, Transportation and assignment problem, Sequencing and inventory management, Computer types, Input and output devices, Operating systems, Net working and internet concepts, E-business and introduction to web page designing.

READY RECKONER FOR CALCULATION OF ACADEMIC SCORE
(for admission of Ph.D. Courses)

Situation A : Marks at all examinations are in percentage

(i) $Y = X1 + 0.60x2 + 0.25x3 + 0.15x4$

Where $Y =$ Total academic score
 $X1 =$ Percentage of marks in M.F.Sc. examination
 $X2 =$ Percentage of marks in B.F.Sc. examination
 $X3 =$ Percentage of marks in H.Sc. examination.
 $X4 =$ Percentage of marks in Matriculation or High School examination.

(ii) If a candidate has done M.F.Sc. (X1), B.F.Sc. (X2) and Higher Secondary (X3), his academic score will be obtained as :

$$Y = X1 + 0.60x2 + 0.40x3$$

If any of X1, X2, X3 and X4 is greater than 80% then the value will be taken as 80% only.

Situation B : If a candidate has obtained his degree in G.P.A. System, the

following relation may be used :

- (i) 3 GPA system : $Y = 26.7G1 + 16.0G2 + 6.7G3 + 4.0G4$
(ii) 4 GPA system : $Y = 20 G1 + 12 G2 + 5 G3 + 3 G4$
(iii) 5 GPA system : $Y = 16.0G1 + 9.5 G2 + 4.0 G3 + 2 G4$
(iv) 10 GPA system : $Y = 8.0 G1 + 4.75 G2 + 2.0 G3 + 1.25 G4$

Where G1, G2, G3, and G4, represent OGPA obtained in M.F.Sc., B.F.Sc., H.Sc. and Matriculation examinations respectively.

If a candidate has only M.F.Sc. (G1), B.F.Sc. (G2) and Higher Secondary (G3) his score will be obtained as :

- (i) 3 GPA system : $Y = 26.7G1 + 16.0G2 + 6.7G3 + 10.7 G3$
(ii) 4 GPA system : $Y = 20 G1 + 12 G2 + 6.7 G3 + 8 G4$
(iii) 5 GPA system : $Y = 16.0G1 + 9.5 G2 + 6.7 G3 + 6.5 G4$
(iv) 10 GPA system : $Y = 8.0 G1 + 4.75 G2 + 3.25 G3$

Situation C : If a candidate has got grade point average in some examination and percentage of marks in other examination a combination of the two systems as per example given below :

Example : A candidate has obtained 60% marks in Matric and 70% in intermediate examination and 2.5 OGPA in B.F.Sc. and 3.0 OGPA in M.F.Sc. His academic score (Y) will be :

- (i) In 3 GPA system : $Y = (26.7 \times 3.0) + (16 \times 2.5) + (0.25 \times 70) + (0.15 \times 60)$
- (ii) In 4 GPA system : $Y = (20.0 \times 2.5) + (12 \times 2.5) + (0.25 \times 70) + (0.15 \times 60)$
- (iii) In 5 GPA system : $Y = (16.7 \times 3.0) + (9.5 \times 2.5) + (0.25 \times 70) + (0.15 \times 60)$
- (iv) In 10 GPA system : $Y = (8 \times 3.0) + (4.75 \times 2.5) + (0.25 \times 70) + (0.15 \times 60)$

NOTE :

- (ii) If a candidate has done Intermediate after Higher Secondary the marks obtained in Higher Secondary only will be taken into account and the Intermediate marks are not considered.
- (iii) In case of candidate who has taken more than one examination, the percentage of marks obtained in Higher Secondary or Pre-University / Pre-Medical / Pre-Professional which ever is beneficial to the candidate is taken into consideration.

Important Instruction :

In no case GPA should be converted into percentage of marks or vice-versa in calculating the academic score.

FORM OF CASTE CERTIFICATE

Form of certificate to be produced by candidate belonging to SC or ST in support of his/her claim.

This is to certify Shri/Smt./Kumari* _____

Son/daughter* _____ of village/Town* _____

In District/Division* _____ of the State/Union Territory* _____

Belongs to the _____ Caste/Tribe* which is recognized as SC/ST* under

The Constitution (Schedule Castes) Order, 1950.

The Constitution (Schedule Tribes) Order, 1950.

The Constitution (Schedule Castes) Union Territories Order, 1951.

The Constitution (Schedule Tribes) Union Territories Order, 1951 as amended by SCs and STs Lists (modification) Order 1956, the Bombay Reorganisation Act, 1960, the Punjab Reorganisation Act, 1966, the State of HP Act, 1970, the North Eastern Areas (Reorganisation) Act, 1971 and the SCs and STs Order (Amendment) Act, 1976.

The Constitution (Jammu & Kashmir) SCs Order, 1956.

The Constitution (Andaman & Nicobar Island) SCs Order, 1959. as amended by SCs and STs Order (Amendment) Act, 1976.

The Constitution (Dadra & Nagarhaveli) SCs Order, 1962.

The Constitution (Dadra & Nagarhaveli) STs Order, 1962.

The Constitution (Pondicherry) SCs Order, 1964.

The Constitution (Uttar Pradesh) STs Order, 1967.

The Constitution (Goa, Daman & Diu) SCs Order, 1968.

The Constitution (Goa, Daman & Diu) STs Order, 1968.

The Constitution (Nagaland) STs Order, 1970.

The Constitution (Sikkim) SCs Order, 1968.

2. Applicable in the case of SC/ST persons who have migrated from one State/Union Territory/Administration.

The Certificate is issued on the basis of the SC/ST certificate to Shri/Smt./Kumari* _____ father/mother* of Shri/Smt./in district/Division* _____ of the State/Union Territory* _____ Who belongs to the _____ caste/tribe* which is recognized as Schedule Caste/Schedule Tribe* in the State/Union Territory _____ issued by the (Name of the prescribed authority) vide their No. _____ date _____ Shri/Smt./Kum.* and/or* family ordinarily reside(s) in village/town* of District _____ of State/Union Territory* of

Place _____

Signature _____

State/Union Territory* _____

*Designation _____

(with seal of Office)

***Please delete the words which are not applicable**

Please quote specific Presidential Order.

Delete the paragraph which is not applicable.

NOTE : The term “Ordinarily reside(s)” used here will have the same meaning as in Section 20 of the Representation of the Peoples Act, 1950.

**** List of authorities empowered to issue SC/ST Certificates :**

1. District Magistrate / Additional District Magistrate / Collector / Deputy Commissioner / Additional District Magistrate / Collector /Deputy Commissioner/Additional Deputy Commissioner/Deputy Collector/1st class Stipendiary Magistrate / City Magistrate / Sub-divisional Magistrate / Taluka Magistrate/ Magistrate / Executive Magistrate / Extra Asstt. Commissioner not below the rank of 1st Class Stipendiary Magistrate.
2. Chief Presidency Magistrate/Additional Chief Presidency Magistrate/ Presidency Magistrate.
3. Revenue Officers not below the rank of Tahsildar.
4. Sub-division Officer of the area where the candidate and/or his family normally resides.
5. Administrator/Secretary to Administrator/Development Officer. (Lakshadweep Islands).