



# MES ASMABI COLLEGE

P.VEMBALLUR ,KODUGALLUR,THRISSUR ,KERALA ,680671

[ Govt. Aided, Affiliated to University of Calicut ,Recognized by UGC,  
Minority Institution Certified by National minority Educational Commission]

## PROGRAMME GUIDE

B.Sc. Botany

AN IQAC INITIATIVE

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## ABOUT COLLEGE

The Muslim Educational Society (MES) is an educational organisation established under the leadership of late Dr P.K. Abdul Gafoor in 1964 at Calicut. The organisation is supported by a group of socially committed, well known professionals, industrialists, intellectuals and educationists and has its branches in all districts in Kerala. MES operates 150 educational facilities across Kerala, including professional institutions, Arts and Science colleges, aided and CBSE schools etc. During the last five decades MES played a significant role in upbringing a remarkable and glorious transformation in the educational scenario of the Muslims in Kerala. MES has tried to uplift the backward community of our nation socially, economically and educationally. MES endeavours to help the budding youth to meet all the challenges in the modern society and to emerge themselves as fitting professionals or architects of the new era. MES aims not only to emerge as a centre for teaching technology and management, but also to become a centre for research and development. They carry on with their mission under the inspiring leadership of the present MES president, Dr. P.A. Fazal Gafoor.





## VISION

## MISSION

## CORE VALUE

## VISION

Providing affordable and quality higher education, in tune with national and international standards to all, especially to the backward and marginalized; the Muslims, women, Scheduled Castes and Scheduled Tribes and empowering them through education.

## MISSION

- Empowerment of the downtrodden and backward classes.
- Imparting quality higher education for women.
- Promotion of secularism and democracy.
- Moral uplift and trust in God.
- Moulding a self-reliant and socially-accountable young generation.
- Emphasis on modern methods and tools of teaching and learning, with sufficient accent on value added education.
- Inculcating social responsibility in student clan by involving them in community-oriented activities.
- Promote entrepreneurial, leadership, organizational qualities and life skills in students.
- Creating maintaining an atmosphere of oneness among staff, students and society.
- Evolve a student community having academic and professional excellence.
- Infuse eco-consciousness in students and community

## CORE VALUE

- Pursuit for Academic Excellence
- Inclusivity in Diversity
- Respect for Culture and Heritage
- Honesty and Integrity
- Social Responsibility and Environmental Sustainability
- Pursuit for Academic Excellence



## MESSAGE FROM THE PRINCIPAL

M E S Asmabi College is a renowned institution with rich tradition of fifty five years adhering to its declared vision and mission. The college offers a diverse range of educational opportunities. All programmes of study make the students well-prepared for the workforce upon completion. One of the hallmarks of the College's curriculum is its emphasis on outcome-based syllabi. The college collaborates closely with industry experts and professionals to align its curriculum with the current demands of the job market, promoting the employability of its graduates. By integrating real-world projects, internships, and experiential learning, students graduate from M E S Asmabi College with a strong foundation in their respective fields, ready to make a meaningful impact in their careers. The programmes offered at M E S Asmabi College are not just academically rigorous but also highly practical, ensuring that students are well-prepared to excel in their chosen professions and contribute positively to society.





## ADMINISTRATIVE AND SUPPORT STAFF

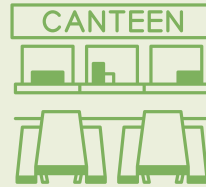


Junior Superintendent	:	Shahina. C.P
Head Accountant	:	Sadaruddeen K.A.
Clerks	:	Haseena M.H. Suresh Babu P.V. Rajeeb P.B. Zeenath P. A. Sajitha P.A. Anees V.A.
Computer Assistant	:	Naseeba P.A.
Office Assistants	:	Sheji Shanoj Muneer K.J. Kareem N.M. Jasmine A.K. Haseena P.H.
System Administrator	:	Jaseer P.M.
Accountant	:	Soudha Ismayl
Supervisor	:	Safaralighan K.K.
Office Administrator	:	P.M. Moideen

# CAMPUS FACILITIES



**Library**



**Canteen**



**Media lab**



**Dubbing studio**



**Coop  
Society**



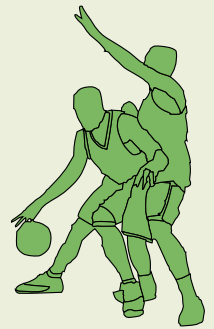
**College Bus**



**Language lab**



**Counseling  
Centre**



**Sports**



**Health club/yoga centre**



**Hostel**



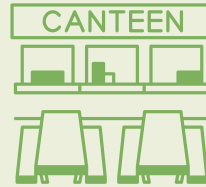
**Day Care Centre**



# CAMPUS FACILITIES



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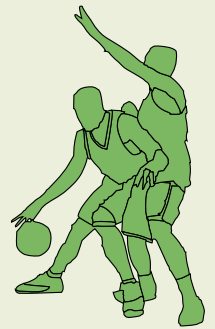
**College Bus**



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**Counseling  
Centre**



**Sports**



**Health club/yoga centre**



**Hostel**



**Day Care Centre**



## National Service Scheme



Dr. Princy Francis,  
Dr. Ansar E.B  
9746568091  
9746227728

## National Cadet Corps



CAPT. Bindil. M.B.  
9847374706

## CLUBS, FORUMS, CELLS

### Anti Ragging Cell



Sri. Shibu A. Nair  
9846262611

### Women Development Cell



Smt. Nasreen. A  
9495871943

### SC/ST Cell



Sri. Sameer Khan. P  
9447515817.

### Minority Cell



Dr. Jaisy David  
9567181928

### OBC Cell



Smt. Jameelathu. K.A  
.9895886131

### Career Guidance Cell



Smt. Mona V.M  
7736364688

### ED Club & IEDC



Smt. Chithra P  
9847440933



## BSC BOTANY



### DEPARTMENT HISTORY

Department of Botany at MES Asmabi College was started in the year 1969 with Pre-degree course. The department was upgraded as U.G. Department in the year 1978 with Botany as main subject and Zoology and Chemistry as subsidiary subjects. Post graduate programme in Plant Science was started in the year 2001, which has been renamed as MSc Botany in 2015. The department has been approved as Research centre in Botany by University of Calicut in 2013 and offers research programme leading to Ph.D in various disciplines of Botany. The department aims to provide basic knowledge in natural world especially concerning the plant life. Plant identification, knowledge about medicinal plants, preparation and distribution of different Biofertilizers and biopesticides , knowledge sharing to other school and college students for Science fair and other project work are some of the extension work the department is offering. The department by doing all these keeps a link with the society for upgrading the knowledge in the field of Science. The Department has established a successful MoU with Western Ghats Hornbill Foundation to work in the tribal and forest areas for the research on Environment and benefits of Tribal community.





## **VISION & MISSION**

**Our vision is to conduct innovative research, teaching and outreach on the patterns and processes of life through a study of plant sciences.**

**We are continuously engaged in consolidating the skills and knowledge base of our students and train the technical staff. The faculty continuously thrives to improvise their professional and pedagogical skills by attending the Faculty Development Programs, conducting research, internships, and publishing manuscripts in addition to the rigorous activities of teaching and learning. Through this endeavour we wish to contribute to a better society**

**To discover, maintain and transmit knowledge concerning plants and their environments at local, regional, and global scales, leading to strengths in the areas of ecology, evolution, and systematics. To expand academic co-operation by offering new courses and upgrading programmes to a wider spectrum of students and researchers by the establishment of linkages with National and International Institutes.**





## FACULTY DIRECTORY



**DR. GIRIJA T. P**  
Assistant Professor, HoD  
& Research Guide  
M.Sc, BEd, Ph.D



**DR. K.H. AMITHA BACHAN**  
Assistant Professor & Research Guide  
M.Sc, Ph.D



**SHAHEEDHA T.M**  
Assistant Professor  
M.Sc, NET



**DR. JISHA K.C**  
Assistant Professor & Research Guide  
M.Sc, M.Phil, NET, Ph.D



**SHEMI C B**  
Assistant Professor  
M.Sc, NET, PGDCA



**NAZEEMA M. K**  
Assistant Professor  
M.Sc, NET



## MESSAGE FROM HOD



**Research and PG Department of Botany is committed to providing a stimulating and enriching environment for research and postgraduate studies in the field of Botany. Through our postgraduate programs, we aim to equip our students with the skills and expertise necessary to become leaders in the field of botany. All faculty members are dedicated to advancing knowledge and understanding in various areas of plant Science, and our research activities cover a wide range of topics including Plant physiology, Phycology, Phytochemistry, Taxonomy and Ecology. We strive to foster a culture of curiosity, critical thinking and innovation. We encourage our students to explore new ideas and push the boundaries of scientific knowledge.**

**DR. GIRIJA T. P**

**9526570267**



## B.Sc. Botany Job Perspectives

The job perspective for individuals with a BSc in Botany is diverse, with opportunities spanning various sectors such as agriculture, environmental conservation, pharmaceuticals, biotechnology, education, and research. Graduates can pursue careers as botanists, plant researchers, conservationists, agronomists, horticulturists, environmental consultants, science educators, and more. They may work in government agencies, botanical gardens, research institutions, biotech companies, educational institutions, or NGOs. With the increasing focus on sustainability, biodiversity conservation, and food security, the demand for skilled botanists is expected to remain strong, offering ample opportunities for career growth and impact. Additionally, further education or specialization through postgraduate studies can enhance job prospects and lead to more advanced roles in academia or industry.





# Internal Assessment

## Internal Assessment

Components with percentage of marks of Internal Evaluation of Theory Courses are-

- Test paper 40%,
- Assignment 20%,
- Seminar 20%
- Attendance 20%.

The Split up of marks for Test paper and Class Room Participation for internal evaluation are as follows.

Range of Marks in test paper	Out of 8 (Maximum internal marks is 20)	Out of 6 (Maximum internal marks is 15)
Less than 35%	1	1
35%- 45%	2	2
45% - 55%	3	3
55% - 65%	4	4
65%-85%	5	5
85% -100%	6	6

### Split up of marks for Attendance

Range of CRP	Out of 4 (Maximum internal marks is 20)	Out of 3 (Maximum internal marks is 15)
$50\% \leq \text{CRP} < 75\%$	1	1
$75\% \leq \text{CRP} < 85\%$	2	2
85 % and above	4	3





# Internal Assessment

## Split up of marks for Seminar

Range of Marks in Seminar	Out of 4 (Maximum internal marks is 20)	Out of 3 (Maximum internal marks is 15)
Content	1	1
Usage of ICT material/ teaching aids	1	0.5
Presentation skills	1	1
Conceptual clarity	1	0.5

## Split up of marks for Seminar

Range of Marks in Seminar	Out of 4 (Maximum internal marks is 20)	Out of 3 (Maximum internal marks is 15)
Content	1	1
Usage of ICT material/ teaching aids	1	0.5
Presentation skills	1	1
Conceptual clarity	1	0.5

## Split up of marks for Assignment

Range of Marks in Assignment	Out of 4 (Maximum internal marks is 20)	Out of 3 (Maximum internal marks is 15)
Timeliness	1	0.5
Organization of content	1	1
Conceptual clarity	1	1
Findings and Insights	1	0.5







## EXAMINATION INFORMATION

### GRADING SYSTEM

Percentage of Marks (Both Internal & External put together)	Grade	Interpretation	Grade point Average (G)	Range of grade points	Class
95 and above	O	Outstanding	10	9.5 -10	First Class with Distinction
85 to below 95	A+	Excellent	9	8.5 -9.49	
75 to below 85	A	Very good	8	7.5 -8.49	
65 to below 75	B+	Good	7	6.5 -7.49	First Class
55 to below 65	B	Satisfactory	6	5.5 -6.49	Second Class
45 to below 55	C	Average	5	4.5 -5.49	
35 to below 45	P	Pass	4	3.5 -4.49	Third Class
Below 35	F	Failure	0	0	Fail
Incomplete	I	Incomplete	0	0	Fail
Absent	Ab	Absent	0	0	Fail

### CRITERIA FOR PASS OR FAIL

**In the event a candidate failing to secure 'P' grade in any Course in a semester, consolidation of SGPA and CGPA will be made only after obtaining 'P' grade in the failed Course in the subsequent appearance.**



# SYLLABUS

## SEMESTER I

<b>I</b>	Common course: English
	Common course: English
	Common course: Additional Language
	Core Course 1: Angiosperm Anatomy, Reproductive Botany & Palynology
	Complementary course: Chemistry
	Complementary course: Zoology

## SEMESTER II

<b>II</b>	Common course: English
	Common course: English
	Common course: Additional Language
	Core Course 2: Microbiology, Mycology, Lichenology & Plant Pathology
	Complementary course: Chemistry
	Complementary course: Zoology

## SEMESTER III

<b>III</b>	Common course: English
	Common course: Additional Language
	Core Course 3: Phycology, Bryology & Pteridology
	Complementary course: Chemistry
	Complementary course: Zoology



# SYLLABUS

## SEMESTER IV

IV	Common course: English
	Common course: Additional Language
	Core Course 4: Methodology and Perspectives in Plant Science
	Core Course 5: Practical of Sem 1- 4 (Paper- I)
	Complementary course: Chemistry
	Complementary course: Chemistry Practical
	Complementary course: Zoology
	Complementary course: Zoology Practical

## SEMESTER V

V	Core Course 6: Gymnosperms, Palaeobotany, Phytogeo. & Evolution
	Core Course 7: Angiosperm Morphology & Systematics
	Core Course 8: Tissue Culture, Horticulture, Economic Bot & Ethnobotany
	Core Course 9: Cell Biology & Biochemistry
	Open Course

## SEMESTER VI

VI	Core Course 10: Genetics & Plant Breeding
	Core Course 11: Biotechnology, Molecular Biology & Bioinformatics
	Core Course 12: Plant Physiology & Metabolism
	Core Course 13: Environmental Science
	Core Course 14: Elective
	Core Course 15: Practical of Sem 5 ( Paper- II)
	Core Course 16: Practical of Sem 6 ( Paper- III)
	Core Course 17: Project Work/ Research methodology paper

**PO = PROGRAM OUTCOME**  
**PSO = PROGRAM SPECIFIC OUTCOME**

- **PO1. Critical Thinking:** The ability to gather and assess relevant information using abstract ideas to interpret it effectively.
- **PO2. Scientific Skills:** Ability to understand scientific principles or concept and demonstrate scientific knowledge and skills in scientific reasoning.
- **PO3. Communication Skills:** Develop oral and written skills to develop the communication, Ability to work productively on team projects with team spirit.
- **PO4. Social Adoptability:** Inculcate values which provide guidelines for social conduct and social interaction, communication skills are the key to build a strong social support network.
- **PO5. Effective Citizenship:** Develop into an ideal citizen who performs the duties towards himself, family, society, community and towards the country.
- **PO6. Environmental Awareness:** Borders understanding of current national and global environmental problem.
- **PO7. Ethics:** Moral and ethical value are at the development of scientific temper of mind, capacity to think and judge about oneself.

- **PSO1. Scope and importance of Botany:** Understand scope and importance of Botany in every field especially in dealing with societal and environmental issues, agriculture, ethics and healthcare.
- **PSO2. Environmental concern:** Understand the and the role of plants in sustaining life on earth and the interrelationship between human beings and nature, create awareness on natural resources and their importance in sustainable development, analyze the importance of biodiversity conservation, estimate biodiversity loss and develop conservation strategies.
- **PSO3. Scientific temper:** Develop scientific temper and undertake scientific projects.
- **PSO4. Practical applications:** Identify and classify plants according to the principles of plant systematics, apply techniques like plant propagation methods, organic farming, mushroom cultivation, preparation of biofertilizers, biopesticides etc. in daily life.
- **5. Awareness on life processes:** Understand plant life processes, biomolecules, basic hereditary and evolutionary principles.



# SYLLABUS

## **BOT1B01T ANGIOSPERM ANATOMY, REPRODUCTIVE BOTANY AND PALYNOLOGY**

### **COURSE OUTCOMES (COs)**

- 1. Demonstrate the ability to differentiate plant organs by observing anatomical features.
- 2. Understand the non-living inclusions of plants and their significance.
- 3. Differentiate tissues and their functions.
- 4. Illustrate primary and secondary (normal and anomalous) structures of plant organs.
- 5. Explain various developmental details of angiosperms.
- 6. Realize the significance and applications of palynology.

### **ANGIOSPERM ANATOMY**

#### **Module - I.**

1. Cell Wall - Structure and development; Growth of Cell wall; cell wall materials
2. Non-living inclusions
  - a. Reserve food materials: carbohydrates, proteins, fats & oils. Carbohydrates: sugars & starch; Starch grains- structure, types with examples; Proteins- Aleurone grains with examples; Fats & oils examples.

#### **Module-II**

1. Tissues: Definition –Types
  - a. Meristematic tissues - classification.
    - i. Theories on apical organization - Apical cell theory, Histogen theory, Tunica Corpus theory

#### **Module – III**

1. Vascular bundles - Origin and types - conjoint, collateral, bi-collateral, open closed, radial, concentric - amphicribal and amphivasal.
2. Primary structure of root, stem & leaf (brief account only)





# SYLLABUS

## Module- IV

1. Normal secondary growth in Dicot stem and Dicot root. Formation of vascular cambial ring - structure and activity of cambium – storied and non-storied, fusiform and ray initials; Formation of secondary wood, secondary phloem, vascular rays, growth ring, heart wood, sapwood.
2. Extra stelar Secondary thickening in stem and root - Periderm formation. Structure - phellogen, phellem, phelloderm, bark, lenticels - structure & function.
3. Anomalous secondary growth - general account with special reference to the anomaly in Dicot stem – Boerhaavia, Bignonia and Monocot stem- Dracaena

## PRACTICAL (ANGIOSPERM ANATOMY)

1. Identification at sight the different types of tissues and vascular bundles.
2. Primary structure of stem, root and leaf of Dicots and Monocots
  - a. Dicot stem : normal – Eupatorium; bi-collateral – Cephalandra
  - b. Dicot root – Pea
  - c. Monocot stem - Bamboo
  - d. Monocot root – Musa
  - e. Dicot leaf – Ixora
  - f. Monocot leaf – Grass
3. Secondary structures: Dicot stem– Vernonia, Dicot root– Tinospora
4. Anomalous secondary thickening in Boerhaavia, Bignonia and Dracaena

## REPRODUCTIVE BOTANY & PALYNOLOGY

1. Introduction to angiosperm embryology with special reference to Indian embryologists
2. Microsporogenesis: structure and function of wall layers, development of male gametophyte, dehiscence of anther
3. Megasporogenesis: development of female gametophyte, embryo sac- development and types- monosporic: Polygonum type, bisporic: Allium type, tetrasporic: Adoxa type.
4. Pollination, fertilization, barriers of fertilization, germination of pollen grains, double fertilization.
5. Structure of embryo dicot (Cypselia), monocot (Sagittaria) and endosperm types.
6. Palynology: pollen morphology, structure of pollen wall, shape of pollen grains, apertural morphoforms, exine ornamentation; pollen allergy, economic and taxonomic importance



# SYLLABUS

## **PRACTICAL (REPRODUCTIVE BOTANY & PALYNOLOGY)**

1. Datura anther T.S. (mature).
2. Types of ovules: Orthotropous, Anatropous and Campylotropous (Slides only, drawing not required)
3. Dicot and monocot embryo of Angiosperms (Slides only, drawing not required)
4. Pollen morphology of Hibiscus, and pollinia of Cryptostegia / Calotropis by acetolytic method
5. Viability test for pollen.
  - a. In vitro germination using sugar solution. (cavity slide method)
  - b. Tetrazolium test
  - c. Acetocarmine test (Acetocarmine & Glycerine 1:1)

## **BOT2B02T MICROBIOLOGY, MYCOLOGY, LICHENOLOGY AND PLANT PATHOLOGY**

### **COURSE OUTCOMES (COs)**

- 1. Understand basics of microbial life and their economic importance.
- 2. Develop general awareness on the diversity of microorganisms, fungi and lichens.
- 3. Analyze the ecological role played by bacteria, fungi and lichens
- 4. Identify plant diseases and find out control measures.
- 5. Realize the significance of plant diseases as far as crop production is concerned.

### **MICROBIOLOGY**

1. Introduction to Microbiology
2. Bacteria –Classification based on morphology and staining, ultra structure of bacteria; Bacterial growth, Nutrition, Reproduction.
3. Viruses – Classification, architecture and multiplication; Bacteriophages, TMV, Retroviruses- HIV, Virioids, Prions.
4. Microbial ecology – Rhizosphere and Phyllosphere.
5. Industrial microbiology –alcohol, acids, milk products single cell proteins
6. Economic importance of bacteria, Vaccines: importance, mechanism.



# SYLLABUS

## **PRACTICAL (MICROBIOLOGY)**

1. Simple staining
2. Gram staining – Curd, root-nodules
3. Culture and isolation of bacteria using nutrient agar medium (demonstration only)

## **MYCOLOGY**

1. General characters and phylogeny of the kingdom Fungi, the concept of anamorph and teleomorph.
2. General characters, distribution, and biology of the following groups of fungi
  - a) Mastigomycotina. Type: Pythium
  - b) Zygomycotina. Type: Rhizopus
  - c) Ascomycotina. Type:, Xylaria, Aspergillus
  - d) Basidiomycotina. Types: Agaricus, Puccinia
3. Economic importance of fungi: medicinal, industrial, agricultural. Fungi as model organisms for research.
4. Ecological importance of fungi: different modes of nutrition (pathogenic/parasitic, saprobic, symbiotic)

## **PRACTICAL (MYCOLOGY)**

1. Micropreparation – Lactophenol cotton blue – Slides of the above mentioned types.

## **LICHENOLOGY**

1. Introduction: Type of Interaction between the components symbiosis – mutualism.
2. Classification, growth forms, structure, reproduction, economic importance. Type: Usnea
3. Toxicology, Lichens as food, Bioremediation, Ecological indicators, Pollution indicators, Lichen in Soil formation and pioneers of Xerosere.

## **PRACTICAL (LICHENOLOGY)**

1. Identification of different forms of Lichens.
2. Usnea : structure of thallus, fruiting body



# SYLLABUS

## **PLANT PATHOLOGY**

1. Introduction – Concepts of plant disease, pathogen, causative agents, symptoms
2. Symptoms of diseases: spots, blights, wilts, rots, galls, canker, gummosis, necrosis, chlorosis, smut, rust, damping off.
3. Control measures: Chemical, biological and genetic methods, quarantine measures.
4. Brief study of Plant diseases in South India (Name of disease, pathogen, symptom and control measures need to be studied)
  1. Citrus Canker
  2. Mahali disease of arecanut
  3. Blast of paddy
  4. Quick wilt of pepper
  5. Mosaic disease of tapioca
  6. Bunchy top of banana
  7. Grey leaf spot of coconut

## **PRACTICAL (PLANT PATHOLOGY)**

Identification of the disease, pathogen, symptoms and control measures of the following:  
(drawing not required)

- a. Citrus canker
- b. Mahali disease
- c. Tapioca mosaic disease
- d. Blast of Paddy
- e. Quick wilt of pepper
- f. Bunchy top of banana
- g. Grey leaf spot of coconut

## **SUBMISSION (PLANT PATHOLOGY)**

Students are expected to submit five properly identified Pathology specimens /herbarium during the practical examination of Paper-I held at the end of 4th semester. Diseases mentioned in the syllabus or any locally available common diseases of crop plants can be selected for submission.





# SYLLABUS

## BOT3B03T PHYCOLOGY, BRYOLOGY AND PTERIDOLOGY

### COURSE OUTCOMES (COs)

- 1. Appreciate the diversity and evolutionary significance of lower plant groups.
- 2. Classify algae, bryophytes and pteridophytes.
- 3. Understand the economic and ecological importance of lower plant groups.

### PHYCOLOGY

1. Introduction, Range of thallus structure, pigments, reproduction
2. Life cycle, Classification of Algae proposed by FE Fritsch (1935).
3. General Features: Occurrence, thallus structure, reproduction, and life cycle of the types given below:
  - a. Cyanophyceae : Nostoc
  - b. Chlorophyceae: Chlorella, Volvox, Oedogonium, Chara.
  - c. Xanthophyceae: Vaucheria.
  - d. Bacillariophyceae: Pinnularia.
  - e. Phaeophyceae: Sargassum.
  - f. Rhodophyceae: Polysiphonia.
4. Economic Importance: Algae as food, fodder, green manure, bio-fuels, pollution indicators, research tools, medicinal uses of algae, Commercial Products – carrageenin, agar-agar, alginates, diatomaceous earth. Harmful effects – water bloom, eutrophication, neurotoxins, parasitic algae.

### PRACTICAL (PHYCOLOGY)

1. Identification of the vegetative and reproductive structures of the types studied.



# SYLLABUS

## **BRYOLOGY**

1. Introduction, general characters and classification by Stotler & Stotler (2008)
2. Study the distribution, morphology, anatomy, reproduction, life cycle and affinities of the following types (Developmental details not required)
  - a. Riccia (Marchantiophyta)
  - b. Anthoceros (Anthocerotophyta)
  - c. Funaria (Bryophyta)
3. Economic importance of Bryophytes
4. Fossil Bryophytes

## **PRACTICAL (BRYOLOGY)**

1. Riccia – Habit, Anatomy of thallus, V.S. of thallus through antheridium, archegonium and sporophyte.
2. Anthoceros- Habit, Anatomy of thallus. V.S. of thallus through antheridium, archegonium and sporophyte.
3. Bryum (due to non-availability of Funaria at lower altitudes) - Habit, structure of antheridial cluster, archegonial cluster, L.S. of sporophyte.

## **PTERIDOLOGY**

1. Introduction, general characters and classification (Smith et al., 2008 – brief outline only).
2. Study the distribution, morphology, anatomy, reproduction, life cycle and affinities of the following types (Developmental details are not required)
  - a. Psilotum (Psilotopsida)
  - b. Selaginella (Lycopsida).
  - c. Equisetum (Equisetopsida)
  - d. Pteris (Polypodiopsida)
3. Apogamy and apospory in Pteridophytes; Stellar evolution in Pteridophytes; Heterospory and seed habit; Affinities of Pteridophytes; Economic importance of Pteridophytes.



# SYLLABUS

## **PRACTICAL (PTERIDOLOGY)**

1. Psilotum- habit, T.S. of stem, C.S. of synangium (slides only)
2. Selaginella – habit, T.S. of stem, T.S. of rhizophore, L.S. of strobilus
3. Equisetum - habit, T.S. of stem, L.S. of strobilus
4. Pteris - habit, T.S. of stem, C.S. of sporophyll

## **BOT4B04T METHODOLOGY AND PERSPECTIVES IN PLANT SCIENCE**

### **COURSE OUTCOMES (COs)**

- 1. Develop scientific temper and problem solving skills.
- 2. Undertake scientific projects and prepare project reports
- 3. Summarize, organize and display quantitative data and derive conclusions
- 4. Prepare permanent slides, applying the histochemical techniques

## **MICROTECHNIQUE**

### **Module – 1**

1. Principles of microscopy and parts of microscopes
2. Types of microscopes: Light microscope, Compound microscope, Phase contrast microscope, Fluorescent microscope, Electron microscope: Transmission Electron Microscopy (TEM) and Scanning Electron Microscopy (SEM)
3. Micrometry: Stage micrometer, Ocular micrometer, Calibration and working.
4. Illustrations using digital camera and Photomicrography.



# SYLLABUS

## Module – II

1. General account of Killing and fixing, agents used for killing and fixing. Common fixatives – Formalin – Acetic – Alcohol, Carnoy's fluids I & II, Chromic acid – Acetic acid – Formation (CRAF)
2. Dehydration and infiltration – general account of dehydration (Ethanol, Isopropyl alcohol, Acetone, Glycerine). Ethanol – Xylene series and Tertiary Butyl Alcohol Series.
3. Infiltration: paraffin wax method, embedding.
4. Free hand sectioning; Microtome (Rotary and sledge) serial sectioning and its significance.
5. Staining – General account, Classification: natural dyes, coal tar dyes. Double staining, Vital staining
6. Mounting, whole mounting, maceration and smears

## PRACTICALS (MICROTECHNIQUE)

1. Parts of microscope and its operation (drawing not required)
2. Free hand sectioning of stem, leaves, Staining and mounting.
3. Measurement of pollen size using micrometer.
4. Demonstration of dehydration, infiltration, embedding and microtoming.



# SYLLABUS

## **BOT5B06T GYMNOSPERMS, PALAEOBOTANY, PHYTOGEOGRAPHY AND EVOLUTION**

### **COURSE OUTCOMES (COs)**

- 1. Understand the role of gymnosperms as a connecting link between pteridophytes and angiosperms
- 2. Appreciate the process of organic evolution.
- 3. Realize the importance of fossil study.
- 4. Understand the climatic conditions of the past and realize the changes happened
- 5. Recognize the phytogeographic zones of India.

### **GYMNOSPERMS**

1. Introduction, General characters and classification of Gymnosperms (Sporne, 1965)
2. Distribution, morphology, anatomy, reproduction, life cycle and affinities of the following types (Developmental details not required): Cycas, Pinus and Gnetum
3. Evolutionary trends in Gymnosperms; Affinities of Gymnosperms with Pteridophytes and Angiosperms
4. Economic importance of Gymnosperms.

### **PRACTICAL (GYMNOSPERMS)**

1. Cycas- Habit, coralloid root, T.S. of coralloid root, T.S. of leaflet, T.S. of rachis, male cone and L.S. of male cone, microsporophyll, megasporophyll, T.S. of microsporophyll, L.S. of ovule and seed.
2. Pinus- branch of unlimited growth, spur shoot, T.S. of stem and needle, male cone and female cone, L.S. of male cone and female cone, seed.
3. Gnetum- Habit, stem T.S., leaf T.S., male and female cones, L.S. of ovule, seed.

### **PALAEOBOTANY**

1. Introduction and objectives
2. Fossil formation and types of fossils
3. Geological time scale- sequence of plants in geological time
4. Fossil Pteridophytes- Rhynia, Lepidodendron and Calamites
5. Fossil gymnosperms- Williamsonia
6. Important Indian Paleobotanical Institutes.





# SYLLABUS

7. Indian Palaeobotanists: Birbal Sahni and Savithri Sahni
8. Applied aspects of Palaeobotany- exploration of fossil fuels

## **PRACTICAL (PALAEOBOTANY)**

- 1 Fossil Pteridophytes - Rhytnia stem, Lepidodendron and Calamites
  - 2 Fossil gymnosperms- Williamsonia
- (Drawings may be replaced by photos with critical notes in the record)

## **PHYTOGEOGRAPHY**

1. Definition, concept, scope and significance of phytogeography.
2. Patterns of plant distribution - continuous distribution and discontinuous distribution, vicarism, migration and extinction
3. Continental drift -Evidences and impact.
4. Glaciation: Causes and consequences.
5. Theory of land bridges.
6. Endemic distribution, theories on endemism, age and area hypothesis.
7. Phytogeographical zones (phytochoria) of India.

## **PRACTICAL (PHYTOGEOGRAPHY)**

- 1 Mark the phytogeographic zones of India.

## **EVOLUTION**

1. Theories on Origin of Universe, Earth and Origin of life. Condensation and Polymerization; Protenoids and Prions – Oparin's concept; Miller's experiment. (3 hrs)
2. Evolution of prokaryotic and eukaryotic cells, archaeobacteria, early fossilized cells.
3. Theories on origin and evolution of species: Darwinism; Neo-Darwinism and its objection; Arguments and support for Darwinism, Modern concept of evolution.
4. Evidences of organic evolution from Morphology, Anatomy, Embryology, Palynology, Genetics and Molecular Biology.
5. Genetic Constancy and Creation of Variability: Cell divisions and genetic constancy; Genetic variability by recombination, Chromosomal variations, Gene mutations, Selection and genetic drift.
6. Speciation: Isolating mechanism, Modes of speciation: sympatric and allopatric



# SYLLABUS

## BOT5B07T ANGIOSPERM MORPHOLOGY AND SYSTEMATICS

### COURSE OUTCOMES (COs)

- 1. Appreciate the diverse morphology of angiosperms.
- 2. Identify and classify plants based on taxonomic principles.
- 3. Make scientific illustrations of vegetative and reproductive structures of plants.
- 4. Develop the skill of scientific imaging of plants.
- 5. Realize the importance of field study.
- 6. Change their attitude towards over exploitation of rare/endemic plants.

### ANGIOSPEM MORPHOLOGY

1. Technical description of a flowering plant (brief)
2. Inflorescence: racemose, cymose and specialised (cyathium, hypanthodium, coenanthium, verticillaster, thyrsus)
3. Flower: Flower as a modified shoot, detailed structure of flowers, floral parts –their arrangement, relative position, cohesion and adhesion - symmetry of flowers.
4. Fruits– simple, aggregate and multiple with examples; Seed structure - dicot and monocot -albuminous and exalbuminous, aril, caruncle; Dispersal of fruits and seeds - types and adaptations.

### PRACTICAL (ANGIOSPEM MORPHOLOGY)

1. Identify the types of inflorescence and fruits mentioned in the syllabus.
2. All the types mentioned under inflorescence and fruits must be represented in the photo album.  
(All drawings in records are replaced by photo album submission).

### SYSTEMATICS

#### Module-I

1. Components of systematics: identification, description nomenclature and classification; objectives and importance of systematics
2. Systems of classification: Artificial– Linnaeus; Natural– Bentham and Hooker; Phylogenetic – Hutchinson; Angiosperm Phylogeny Group system



# SYLLABUS

## Module – II

1. Detailed study (systematic position, distribution, common members, diagnostic features, description from habit to fruit and economic importance of the following families. Annonaceae, Malvaceae, Meliaceae, Fabaceae with sub families, Myrtaceae, Cucurbitaceae, Rubiaceae, Asteraceae, Apocynaceae, Solanaceae, Acanthaceae, Lamiaceae, Euphorbiaceae, Liliaceae, Orchidaceae and Poaceae.

## Module- III

1. Taxonomic structure: Hierarchy; Concepts of taxa; Species: Biological, Phenetic and Phylogenetic; Genus; Family.
2. Taxonomic character – concept, primitive and advanced characters, sources, comparative morphology, vegetative, reproductive, macro and micromorphology; modern trends in taxonomy, cytotaxonomy, chemotaxonomy, numerical taxonomy, molecular taxonomy and phylogenetics.
3. Contributions of eminent Taxonomists viz Hendrik van Rheede, William Roxburgh, Robert Wight, J. S. Gamble and EK Janaki Ammal.

## Module – IV

1. Plant Nomenclature – Limitations of common name, ICN - Principles (introduction only); Typification (holotype, isotype, syntype paratype and lectotype); Priority– merits and demerits; Effective and valid publication; Author citation.
2. Plant identification – Keys; indented and bracketed, construction and applications.
3. Taxonomic information resources – Herbarium preparation and maintenance, Herbarium types: International- Kew (K); National-Central national herbarium (CAL), MH Coimbatore, Virtual herbarium, Botanic Gardens: RBG, Kew; IGB, Kolkotta; JNTBGRI Thiruvananthapuram and MBGIPS, Kozhikode.
4. Taxonomic literature- Floras, e-Flora, Monographs, Revisions, Journals and online resources & Databases.



# SYLLABUS

## **PRACTICAL (SYSEMATICS)**

1. Students are expected to work out at least two members of each family mentioned in the syllabus and make suitable diagrams (floral diagram and floral formula not needed). Describe them in technical terms and identify up to species using the Flora. Orchidaceae may be excluded from practical examination scheme.
2. Students shall be able to prepare artificial key to segregate any five given plants. This must be recorded.
3. Familiarization of herbarium techniques (Demonstration only).
4. Mounting of a properly dried and pressed specimen of any common wild plant (rare, endangered or endemic plants should not be collected for the purpose) from any one of the families mentioned in the syllabus, with proper herbarium label (to be submitted in the record book).
5. Every student shall submit original images of plants, at least one from each family mentioned in the syllabus, duly certified by Head of the department, at the time of examination. The images of plants should be properly identified and they should carry details like systematic position, GPS location, date, name and reg. no. of the student etc. Habitat, Habit, Inflorescence and single flower should be represented. Web sourced and outsourced images should not be used. The images can be submitted along with the photo album containing images of inflorescence and fruits mentioned under morphology. Individuality should be strictly maintained while preparing the photo album.
6. It is compulsory that every student has to undertake field study trips of 3-5 days to study vegetation of ecologically different areas, under the guidance of teachers. Visits to standard Herbaria, Organizations/ Institutes involved in exploring plant resources, Botanical museums etc. may be conducted as part of study tour. Local habitats like sacred groves, rice fields, wetlands, forests, grasslands etc. also can be selected for field trips. Avoid visit to tourist places with meager plant diversity and of having only entertainment value. Submit a field visit report countersigned by the Head of the department during the practical examination.
7. If a student fails to undergo the study tour he /she may not be permitted to attend the examination.



# SYLLABUS

## **BOT5B08T TISSUE CULTURE, HORTICULTURE, ECONOMIC BOTANY AND ETHNOBOTANY**

### **COURSE OUTCOMES (COs)**

- 1. Critically evaluate the advantages of tissue culture and horticulture over conventional methods of propagation.
- 2. Apply various horticultural practices in the field.
- 3. Experiment on the subject and try to become entrepreneurs.
- 4. Identify the economically important plants.

## **TISSUE CULTURE**

### **Module-1**

1. Plant tissue culture – Principles and techniques; Cellular totipotency; in vitro differentiation – de differentiation and re-differentiation.
2. Tissue culture medium – Basic components in tissue culture medium – Solid and liquid medium; Murashige and Skoog medium – composition and preparation.
3. Aseptic techniques in in vitro culture – sterilization – different methods – sterilization of instruments and glassware, medium, explants; working principle of laminar air flow and autoclave.
4. Preparation of explants– surface sterilization, inoculation, incubation, subculturing.
5. Micropropagation - Different methods – apical, axillary bud proliferation, direct and indirect organogenesis and somatic embryogenesis.
6. Different phases of micropropagation – multiple shoot induction, shoot elongation, in vitro and in vivo rooting hardening, transplantation and field evaluation; advantages and disadvantages of micropropagation, somaclonal variation.





# SYLLABUS

## Module – II

1. Methods and Applications of tissue culture:
  1. Shoot tip and meristem culture.
  2. Somatic embryogenesis and synthetic seed production.
  3. Embryo culture.
  4. Protoplast isolation culture and regeneration: transformation and transgenics
  5. Somatic cell hybridization, cybridization.
  6. In vitro secondary metabolite production: cell immobilization, bioreactors
  7. In vitro production of haploids – anther and pollen culture
  8. In vitro preservation of germplasm

## PRACTICAL (TISSUE CULTURE)

1. Preparation of nutrient medium – Murashige and Skoog medium using stock solutions.
2. Familiarize the technique of preparation of explants, surface sterilization, inoculation and subculturing.
3. Preparation of synthetic seeds.
4. Demonstration of anther culture.

## HORTICULTURE

### Module - I

1. Introduction, scope and significance; branches of horticulture.
2. Soil- components of soil, types of soil.
3. Fertilizers – Chemical, organic, biofertilizer, compost.
4. Pots & potting – earthen, fibre, polythene bags, potting mixture, potting, repotting, top dressing.
5. Irrigation – Surface, sprinkle, drip and gravity irrigation.

### Module – II

1. Seed propagation –seed quality tests, seed treatment, essential condition for successful propagation: raising of seed beds, transplanting techniques.
2. Vegetative propagation:
  1. Cutting (stem, roots)
  2. Grafting (approach, cleft)
  3. Budding (T-budding, patch)
  4. Layering (simple, air).



# SYLLABUS

## Module - III

1. Gardening – site selection; propagating structure: green house, poly house, moist chamber, net frame – Garden tools and implements.
2. Indoor gardening – selection of indoor plants, care and maintenance of indoor plants, Bonsai – Principle, creating the bonsai.
3. Outdoor gardening; landscaping- goals, types.
4. Cultivation and post-harvest management of vegetables and ornamental plants.
5. Protection of horticultural plants: Precautions to avoid pests and diseases, biopesticides.
6. Mushroom cultivation – Oyster mushroom

## PRACTICAL (HORTICULTURE)

1. Preparation of nursery bed and polybag filling.
2. Preparation of potting mixture – Potting, repotting.
3. Field work in cutting, grafting, budding, layering (drawing not required).
4. Familiarizing gardening tools and implements. (drawing not required)
5. Establishment of vegetable garden/ Visit to a horticulture station.
6. A brief report of item no. 5 may be recorded.

## ECONOMIC BOTANY

Study the different category of economically important plants their Binomial, Family and Morphology of useful part, products and uses:

1. Cereals and Millets – Rice, Wheat, Maize and Ragi
2. Pulses and legumes – Green gram, Bengal gram, Black gram
3. Sugar – Sugar cane
4. Fruits – Apple, Pine Apple, Papaya, Banana, Mango, Guava, Jack, Grapes, Sapota
5. Vegetables – Carrot, Beet Root, Corm, Potato, bitter gourd, Cucumber, Snake gourd, Ladies finger, Cabbage, Amaranthus
6. Ornamentals – Rose, Anthurium, Jasmine
7. Masticatories – Betel vine, Betel nut, Tobacco
8. Beverages – Coffee, Tea, Cocoa
9. Fibre – Coir, Cotton, Jute
10. Timber – Teak, Rose wood, Jack, Ailanthus.



# SYLLABUS

11. Fats and oils – Coconut, Gingelly, Sun flower
12. Latex – Rubber
13. Gums and Resins – Dammar, Gum Arabic, Asafoetida
14. Spices – Pepper, Ginger, Cardamom, Clove, Nutmeg, Allspice, Cinnamon
15. Medicinal – Adhatoda, Catharanthus, Phyllanthus, Rauwolfia, Aloe

## **PRACTICAL (ECONOMIC BOTANY)**

1. Students shall be able to identify plants or plant products (raw or processed) studied in theory and shall be able to write Botanical names, Family and morphology of useful parts of source plants.
2. Students need not make any illustrations but make a table in the record giving the details of the items mentioned in the theory syllabus.

## **ETHNOBOTANY**

1. Introduction, scope and significance
2. Major tribes of South India. Importance of Traditional Botanical Knowledge, TBGRI model of Benefit Sharing.
3. Ethnobotanical significance of the following:
  1. *Aegle marmelos*
  2. *Ficus religiosa*
  3. *Curcuma longa*
  4. *Cynadon dactylon*
  5. *Ocimum sanctum*
  6. *Trichopus zeylanicus*

## **PRACTICAL (ETHNOBOTANY)**

Students are expected to identify the plants mentioned in the Ethnobotany syllabus and it must be given as a table showing Common name, Binomial, Family and Ethnobotanical significance in the record book. (Drawing not required)



# SYLLABUS

## BOT5B09T CELL BIOLOGY AND BIOCHEMISTRY

### COURSE OUTCOMES (COs)

- 1. Appreciate the ultra-structure of a plant cell.
- 2. Enumerate the functions of each cell organelle.
- 3. Draw and explain the structure of biomolecules.

### CELL BIOLOGY

#### Module – I

1. Architecture of cells. Prokaryotic and Eukaryotic cells.
2. Structure and function of the following: Cell membrane (fluid mosaic model), Endoplasmic reticulum, Golgi complex, mitochondria, chloroplast, Lysosomes Glyoxisomes Ribosomes Cytoskeleton Cytosol Vacuole.
3. Nucleus - Nuclear membrane; Nuclear pore complex; organization of interphase Nucleus; Euchromatin and heterochromatin; Nucleolus.
4. Chromosomes - Morphology, classification, Centromere and Telomere, Chemical Composition and organization.

#### Module-II

1. Special types of chromosomes–Polytene chromosomes, lampbrush chromosomes
2. Cell division - cell cycle - Mitosis & Meiosis – significance- molecular control of cell division
3. Chromosomal changes: structural aberrations: deletion, duplication, inversion, translocation - their meiotic consequences and significance
4. Numerical aberration - Definition - Basic chromosome number (Genomic Number) Aneuploidy, Haploidy and Polyploidy - their meiotic behaviour and significance.

### PRACTICAL (CELL BIOLOGY)

1. Mitosis - Acetocarmine squash preparation of Onion root tip.
2. Calculation of mitotic index
3. Demonstration of meiosis in Rhoeo/ Chlorophytum/ Maize and identification of different stages of Meiosis.



# SYLLABUS

## BIOCHEMISTRY

1. Macromolecules: building block biomolecules, metabolic intermediates, precursors)
2. Carbohydrates. Classification; structure and functions of simple sugars and compound carbohydrates.
3. Lipids. Classification. Complex lipids, Simple lipids and derived lipids; Fatty acids saturated and unsaturated, triacyl glycerols, phospholipids, sphingolipids.
4. Amino acids, peptides and proteins. Amino acids: classification based on polarity; zwitterions, dipeptides.
5. Proteins: Primary, secondary, tertiary and quaternary structures of proteins. Native conformation and biological functions of proteins. Denaturation and renaturation.
6. Nucleotides: structure, Functions of nucleotides and nucleotide derivatives.
7. Secondary metabolites. A brief account of secondary metabolites, physiological roles. Significance: ecological importance.
8. Enzymes Classification (IUB), Mechanism of enzyme action, optimization of weak interactions in the transition state. Co-enzymes, inhibition, regulation: allosteric enzymes, covalently modulated enzymes. Isoenzymes.

## PRACTICAL (BIOCHEMISTRY)

1. Qualitative tests for monosaccharides, and reducing non reducing oligosaccharides, starch, amino acids and protein.
  1. Molisch's test for all carbohydrates
  2. Benedict's test for reducing sugars
  3. Barfoed's test for monosaccharides
  4. Seliwanoff's test for ketoses
  5. Fearson's test (methyl amine test) for reducing disaccharides
  6. Iodine test for starch
  7. Ninhydrin test for amino acids and protein
  8. Xanthoproteic test for amino acids with aromatic R-groups
  9. Millon's test for tyrosine
  10. Hopkins- Cole test for tryptophan
  11. Biuret test for peptide linkage and proteins
2. Quantitative estimation of protein by Biuret method. (Demonstration only)
3. Quantitative estimation of DNA and RNA by colorimetric/ spectrophotometric method (Demonstration only)
4. Colorimetric estimation of reducing sugars in germinating seeds (Demonstration only)





# SYLLABUS

## BOT6B10T GENETICS AND PLANT BREEDING

### COURSE OUTCOMES (COs)

- 1. Appreciate the facts behind heredity and variations.
- 2. Understand the basic principles of inheritance.
- 3. Solve problems related to classical genetics.
- 4. Predict the pattern of inheritance.
- 5. Understand various plant breeding techniques.
- 6. Realize the role of plant breeding in increasing crop productivity.

### GENETICS

#### Module – I

1. Introduction- Mendel's life history (brief), Mendelian experiments: Monohybrid cross and dihybrid cross, Mendelian ratios, Laws of inheritance; Back cross, test cross.
2. Modified Mendelian ratios:
  - a. Allelic interactions: dominant – recessive, Incomplete dominance – flower color in *Mirabilis*; Co dominance – Coat colour in cattle, Blood group in human beings; Lethal genes – Sickle cell anemia in Human beings. Modified dihybrid ratios by incomplete dominance of one pair of gene (3:6:3:1:2:1) and both pairs (1:2:1:2:4:2:1:2:1).
  - b. Interaction of genes: Non epistatic - Comb pattern inheritance in poultry (9:3:3:1): Epistasis: dominant - Fruit colour in summer squashes; Recessive epistasis - Coat color in mice; Complementary gene interaction- flower color in *Lathyrus*.
3. Multiple alleles- general account: ABO blood group in man, Self sterility in *Nicotiana* Coat colour in Rabbits.
4. Quantitative inheritance / polygenic inheritance / continuous variation- Skin color in human beings, Ear size in maize.

#### Module –II

1. Linkage and crossing over- importance of linkage, linkage and independent assortment. Complete and incomplete linkage. Crossing over general account, 2 point and 3 – point crossing over, cytological



# SYLLABUS

evidence of genetic crossing over. Determination of gene sequences; interference and coincidence; mapping of chromosomes.

2. Extra nuclear inheritance- general account- maternal influence- plastid inheritance in *Mirabilis*, Shell coiling in snails.

3. Population genetics; Hardy –Weinberg law and equation

## **PRACTICAL (GENETICS)**

1. Students are expected to work out problems related to the theory syllabus. One problem each from all the types mentioned should be recorded.

- a. Monohybrid cross
- b. Dihybrid cross
- c. Test cross and back cross
- d. Determination of genotypic and phenotypic ratios and genotype of parents
- e. Non epistasis
- f. Complementary gene interaction
- g. Epistasis: dominant and recessive
- h. Polygenic interaction
- i. Multiple allelism
- j. Chromosome mapping
- k. Calculation of Coincidence and interference

## **PLANT BREEDING**

### **Module-I (4 hrs)**

1. Definition and objectives of Plant breeding – Organization of ICAR and its role in plant breeding.
2. Plant Genetic Resources - Components of Plant Genetic Resources.

### **Module-II (14 hrs)**

1. Breeding techniques

1. Plant introduction: Procedure, quarantine regulations, acclimatization- agencies of plant introduction

in India, major achievements.

2. Selection -mass selection, pureline selection and clonal selection, genetic basis of selection, significance and achievements.



# SYLLABUS

3. Hybridization – procedure; intergeneric, interspecific and intervarietal hybridization with examples; composite and synthetic varieties.
4. Heterosis breeding - genetics of heterosis and inbreeding depression.
5. Mutation breeding – methods - achievements.
6. Polyploidy breeding
7. Breeding for disease and stress resistance
2. Modern tools for plant breeding: Genetic Engineering and products of genetically modified crops (brief mentioning only).

## **PRACTICAL (PLANT BREEDING)**

1. Techniques of emasculation and hybridization of any bisexual flower.
2. Floral biology of Paddy, any one Pulse and Coconut tree.
3. Visit to a plant breeding station and submission of its report.

# **BOT6 B11T BIOTECHNOLOGY, MOLECULAR BIOLOGY AND BIOINFORMATICS**

## **COURSE OUTCOMES (COs)**

- 1. Analyze the role of biotechnology in daily life.
- 2. Understand the basic aspects of bioinformatics.
- 3. Explain the concepts in molecular biology.

## **BIOTECHNOLOGY**

### **Module –I**

1. Introduction, concept, history of biotechnology
2. Recombinant DNA Technology: Gene cloning strategies – recombinant DNA construction–cloning vectors –plasmids pBR322, bacteriophage based vectors, Ti plasmids. Restriction endonucleases and ligases transformation and selection of transformants –using antibiotic resistances markers, southern blotting; PCR.
3. Different methods of gene transfer – chemically stimulated DNA uptake by protoplast, electroporation, microinjection, biolistics. Agrobacterium mediate gene transfer gene library, gene banks.



# SYLLABUS

## Module –II

### 1. Applications of Biotechnology

- a. Medicine - Production of human insulin, human growth hormone and
- b. Forensics - DNA finger printing.
- c. Agriculture -Genetically modified crops –Bt crops, Golden rice, Flavr Savr Tomato, Virus, herbicide resistant crops, Edible vaccines.
- d. Environment- Bioremediation- use of genetically engineered bacteria-super bug.
- e. Industry- Horticulture and Floriculture Industry, production of vitamins, amino acids and alcohol.

## PRACTICAL (BIOTECHNOLOGY)

1. Extraction of DNA from plant tissue.
2. Study of genetic engineering tools and techniques using photographs/diagram (Southern blotting, DNA finger printing, PCR).

## MOLECULAR BIOLOGY

1. Nucleic acids - DNA– the genetic material; the discovery of DNA as the genetic material; bacterial transformation (Griffith's & Avery's experiments); Hershey and Chase experiment; Structure of DNA, Watson & Crick's Model, Types of DNA- (A,B,Z); Replication: semi conservative replication–Meselson and Stahl's experiment; Molecular mechanism of Replication, RNA- structure, types and properties.
2. Gene action - One gene - one enzyme hypothesis, one cistron one polypeptide hypothesis; concept of colinearity; modern concept of gene- cistrons, recons and mutons
3. Genetic code - Characters of genetic code
4. Central dogma protein synthesis; Transcription, post-transcriptional modification of RNA, translation; Teminism.
5. Gene regulation in prokaryotes - operon concept, (Lac operon, trp. operon)
6. Gene regulation in eukaryotes (brief account)
7. Mutation-spontaneous and induced; causes and consequences. Types of mutagens and their effects. Point mutations- molecular mechanism of mutation-Transition, Transversion and substitution

## SUBMISSION (MOLECULAR BIOLOGY)

Visit a research station with well-equipped Biotechnology / Molecular biology lab and submit a duly certified detailed report of the same during the practical examination



# SYLLABUS

## BIOINFORMATICS

### Module-I

1. IT in teaching, learning and research: Web page designing and web hosting. Academic web sites, e-journals, Open access initiatives and open access publishing, education software, academic services - INFLIBNET, NICNET, BRNET.
2. E-wastes and green computing.
3. Futuristic IT - Artificial intelligence, virtual reality, bio-computing.

### Module- II

1. Introduction to Bioinformatics, brief history, scope and relevance, wet lab to web lab
2. Basics of Genomics, Proteomics and comparative genomics
3. Biological data bases:  
Nucleotide sequence database – EMBL, Gen Bank, DDBJ.  
Protein database – SwissProt, PDB.  
Organismal database /Biodiversity database – Species 2000 /Human genome database
4. Information retrieval from Biological database, sequence alignment types and tools: pair wise sequence alignment, multiple sequence alignment, BLAST, Clustal W.

### Module- III

1. Genomics: DNA sequencing, Sangers procedure, automation of DNA sequencing, genome sequence assembly.
2. Genome projects – Major findings and relevance of the following genome projects – Human, Arabidopsis thaliana, Rice, Haemophilus influenza.
3. Proteomics: Protein sequencing- automation of sequencing, protein structure prediction and modelling (Brief account only)

### Module- IV

A brief account on

1. Molecular phylogeny and phylogenetic trees.
2. Molecular visualization – use of Rasmol.
3. Molecular docking and computer aided drug design.





# SYLLABUS

## **PRACTICAL (BIOINFORMATICS)**

1. Familiarizing with the different data bases mentioned in the syllabus.
2. Molecular visualization using Rasmol.
3. Blast search of nucleotide sequences.

## **BOT6B12T PLANT PHYSIOLOGY AND METABOLISM**

### **COURSE OUTCOMES (COs)**

- 1. Identify the physiological responses of plants.
- 2. Analyze the role of external factors in controlling the physiology of plants.
- 3. Explain the metabolic processes taking place in each cell.
- 4. Appreciate the energy fixing and energy releasing processes taking place in cells.

### **Module - 1.**

1. Plant cell and Water. Water as a solvent, cohesion and adhesion. Diffusion, osmosis, imbibition, plant cell as an osmotic system, osmotic pressure, osmotic potential, turgor pressure, wall pressure, water potential and its components.
2. Transpiration. Types and process. Mechanism of guard cell movement. K<sup>+</sup> ion mechanism. Why transpiration? Antitranspirants.
3. Absorption of water by transpiration pull and cohesion of water molecules. Radial movement of water through root. Soil-plant-atmosphere continuum of water.

### **Module-II**

1. The ascent of sap; Transpiration pull and cohesion of water molecules. Merits and demerits of cohesion-tension theory.
2. Plants and inorganic nutrients. Macro and Micro nutrients. Uptake of mineral elements. Difference between passive uptake and active uptake. Simple and facilitated diffusion. Active uptake. Carrier concept. Evidences.



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## Module - III

1. Photosynthesis in higher plants: Photosynthetic apparatus. Electromagnetic radiation. Absorption of light. Fluorescence and phosphorescence. Organization of light harvesting antenna pigments. Photochemical and chemical phases of photosynthesis and its evidences. Red drop and Emerson enhancement effect. Two pigment systems, components. Photosynthetic electron transport and photophosphorylation. Assimilatory powers- ATP and NADPH. Photosynthetic carbon reduction cycle (PCR), RUBISCO, C3, C4, and CAM pathways. Ecological significance of C4, and CAM metabolism. Photorespiration.
2. Biological nitrogen fixation, symbiotic nitrogen fixation in leguminous plants. Biochemistry of Nitrogen fixation, Ammonia assimilation, assimilation of nitrate. Biosynthesis of amino acids.
3. Translocation and distribution of photo assimilates. Mechanism of phloem transport. Phloem loading and unloading; pressure flow hypothesis.

## Module - IV

1. Plant growth and development. Auxins, gibberellins, cytokinins, abscisic acid and ethylene, their physiological roles. Photoperiodism and vernalization.
2. Plant movements- phototropism, gravitropism. nyctinastic and seismonastic movements.
3. Photomorphogenesis: Phytochrome: chemistry and physiological effects.
4. Seed dormancy and germination.

## Module – V

1. Intermediary metabolism: anabolism, catabolism, amphibolic pathways and anapleurotic reactions.
2. Catabolism of hexoses. Glycolysis: Two phases of glycolysis. Overall balance sheet. Fate of pyruvate under aerobic and anaerobic conditions. Citric acid cycle: Formation of acetate, Reaction of citric acid cycle, Anapleurotic reactions of citric acid cycle. Amphibolic nature of citric acid cycle.
3. Oxidation of fatty acids.  $\beta$  oxidation of saturated fatty acids in plants.
4. Oxidative phosphorylation: Electron transport reactions in mitochondrion. Electron carriers, redox potential, electron carriers functioning as multienzyme complexes, ATP synthesis. Chemiosmotic hypothesis, cyanide-resistant respiration, factors affecting respiration.



# SYLLABUS

## PRACTICAL

Students should familiarize experiments and details must be recorded. (Drawing not required)

1. Fruit ripening/Rooting from cuttings (Demonstration only).
2. Relation between water absorption and transpiration.
3. Separation of leaf pigments by paper chromatography/ column chromatography /TLC.
5. Effects of light intensity on photosynthesis by Wilmot's bubbler.
4. Thistle funnel osmoscope
5. Ganong's Potometer
6. Ganong's light-screen
7. Ganong's respirometer
8. Kuhne's fermentation vessel
9. Mohl's half-leaf experiment
10. Absorbotranspirometer
11. Demonstration of gravitropism using Klinostat.

## BOT6B13T ENVIRONMENTAL SCIENCE

### COURSE OUTCOMES (COs)

- 1. Realize the importance of ecological studies.
- 2. Develop environmental concern in all their actions and practise Reduce, Reuse and Recycle.
- 3. Try to reduce pollution and environmental hazards and change their attitude towards throwing away plastic wastes.
- 4. Spread awareness of the need of conservation of biodiversity and natural resources.
- 5. Analyze the reasons for climate change and find out ways to combat it.

## ENVIRONMENTAL SCIENCE

### Module - I

1. Ecosystem: Definition, abiotic and biotic factors, trophic structure, Food chain and food web, Ecological pyramids, Energy flow, Productivity of ecosystems.
2. Biogeochemical cycles (Carbon, Nitrogen, Phosphorous)



# SYLLABUS

3. Plant adaptations: Adaptations in Hydrophytes, Xerophytes, Halophytes, Epiphytes and Parasites.
4. Plant Succession: Definition – Primary and Secondary succession; Autogenic and allogenic succession; Mechanism of plant succession–Xerosere and Hydrosere

## Module-II

- 1 Biodiversity and Conservation: Definition; Biodiversity - Global and Indian Scenario; Megadiversity nations and hotspots: Biosphere reserves; Biodiversity centres in India.
- 2 Threats to biodiversity; Endangered and endemic plant species, Red data book, Exotic and indigenous plant species, Keystone species, Flagship species, Umbrella species, Indicator species.
- 3 Conservation strategies ex situ and in situ methods. Organizations– IUCN, UNEP & WWF; (NBPGR), Kerala state Biodiversity Board (KSBB).

## Module-III

- 1 Pollution: Sources and types of pollution – air, water, soil, thermal and noise; biodegradable and non-biodegradable pollutants; biomagnification; BOD.
- 2 Global environmental changes – climatic changes – global warming and greenhouse gases, acid rains, el-nino, efforts of world organizations in the regulation of greenhouse gases emission.
- 3 Management of environmental pollution – conventional and phytotechnological approaches – solid wastes management including e-wastes- environmental legislations in India (Prevention and Control of Pollution act, 1981).

## Module- IV

- 1 Major ecosystems of the Biosphere; Sea; Estuarine ecosystem; Lentic ecosystem: lake, Pond; Lotic ecosystem: river; Desert; Forest; Grass land.
- 2 Techniques in plant community studies – Quadrat and transect methods– species area curve– density, frequency, abundance, dominance of populations– importance value index – construction of phytographs.

## PRACTICAL

1. Construct a food web from the given set of data, (Representative of a natural ecosystem). (Drawing not required).
2. Construct ecological pyramids of number, biomass and energy from the given set of data (Representative of a natural ecosystem). (Drawing not required).
3. Study of plant communities: Determination of density, abundance, dominance, frequency by quadrat method.



# SYLLABUS

4. Demonstration of determination of Dissolved Oxygen by Winkler's method.
5. Study of morphological and anatomical characteristics of plant groups: Hydrophytes, Xerophytes, halophytes, epiphytes, parasites. (Drawing not required).

## **BOT6 B14T (E3) ELECTIVE-3 : GENETICS AND CROP IMPROVEMENT**

### **COURSE OUTCOMES (COs)**

- 1. Understand various techniques employed for increasing crop productivity.
- 2. Identify diseases affecting crop plants.
- 3. Attain general awareness on various crop research stations of the country.

### **GENETICS AND CROP IMPROVEMENT**

#### **Module -1.**

Crop genetics - General account of origin, genetic variability, floral biology, breeding techniques and achievements in: Rice, Coconut, Rubber, Arecanut, Cashew and Pepper.

#### **Module –II**

1. Plant genetic resources- Definition; Classification of Plant Genetic resources.

Activities– exploration, conservation, evaluation, documentation and utilization.

2. Agencies involved in plant genetic resources activities – NBPGR and IPGRI

3. International institutes for crop improvement – IRRI, ICRISAT, CIMMYT, IITA. Brief account on research activities and achievements of national institutes – IARI, CCMB, IISc, BARC, CPCRI, IISR, RRII, CTCRI, KFRI, JNTBGRI.

#### **Module- III**

1. Methods of crop Improvement

1. Plant introduction

2. Selection - Principles, Selection of segregating populations, achievements

3. Hybridization – Interspecific hybridization; intergeneric – achievements. Genetics of back crossing, Inbreeding, Inbreeding depression, Heterosis and Heterobeltiosis



# SYLLABUS

## Module - IV

- 1 Heteroploidy in crop improvement – achievements and future prospects – Significance of haploids and polyploids
- 2 Mutations in crop improvement – achievements and future prospects
- 3 Genetics of nitrogen fixation – Use of biofertilizers in crop improvement
- 4 Genetics of photosynthesis

## Module- V

1. Breeding for resistance to abiotic stresses – Introduction, importance of abiotic and biotic stresses and its characteristics.
  1. Breeding for drought resistance: Genetics of drought resistance; Breeding methods and approaches; Difficulties in breeding for drought resistance.
  2. Breeding for mineral stress resistance: Introduction, Salt affected soils, Management of salt affected soils: Salinity resistance –general account.
2. Breeding for resistance to biotic stresses.
  1. Disease resistance – History of breeding for disease resistance; Genetics of pathogenicity – Vertical and horizontal resistance; Mechanism of disease resistance; Genetics of disease resistance– Oligogenic, polygenic and cytoplasmic inheritance –Sources of disease resistance – Methods of breeding for disease resistance.
  2. Insect resistance – Introduction, Mechanism, Nature and genetics of insect resistance, Oligogenic, Polygenic and cytoplasmic resistance, sources of insect resistance, Breeding methods for insect resistance, Problems in breeding for insect resistance, Achievements, Breeding for resistance to parasitic weeds.

## PRACTICAL

1. Visit a leading breeding station in South India and a detailed report should be included in the practical record. The record duly certified by HoD should be submitted at the time of practical examination of core practical paper III.
2. Make illustrations on the floral biology of Rice, Cashew and Solanum spp.
3. Demonstration of hybridization in Rice, Cashew and Solanum and describe the procedure.
4. Study the variability under induced stress (salinity and moisture) of seedlings of rice and green gram and record the observations.





## COMPLEMENTARY COURSES (CHEMISTRY)

### CHE1C01 GENERAL CHEMISTRY

#### COURSE OUTCOMES (COs)

- 1. To understand and to apply the theories of quantitative and qualitative analysis.
- 2. To understand the theories of chemical bonding.
- 3. To appreciate the uses of radioactive isotopes.
- 4. To understand the importance of metals in biological systems.

#### Module I: Analytical Chemistry

Atomic mass - Molecular mass - Mole concept – Molar volume - Oxidation and reduction – Oxidation number and valency - Equivalent mass. Methods of expressing concentration: Molality, molarity, normality and mole fraction. Calculation of concentration on dilution of given solution (problems). Theory of volumetric analysis – Acid-base, redox and complexometric titrations – Acidbase, redox and complexometric indicators. Double burette method of titration: Principle and advantages. Principles in the separation of cations in qualitative analysis - Applications of common ion effect and solubility product - Microanalysis and its advantages. Accuracy & Precision (mention only).



# SYLLABUS

## Module II: Atomic Structure and Chemical Bonding

Atomic Structure: Bohr atom model and its limitations, de Broglie equation - Heisenberg uncertainty principle - Schrödinger wave equation (mention only) - Atomic orbitals - Quantum numbers and their significance - Pauli's Exclusion principle - Hund's rule of maximum multiplicity - Aufbau principle – Electronic configuration of atoms. Chemical Bonding: Introduction – Type of bonds. Ionic bond: Factors favouring the formation of ionic bonds - Lattice energy of ionic compounds and its application.

Covalent bond: Lewis theory – Coordinate bond.

VSEPR theory: Shapes of  $\text{BeCl}_2$ ,  $\text{BF}_3$ ,  $\text{SnCl}_2$ ,  $\text{CH}_4$ ,  $\text{NH}_3$ ,  $\text{H}_2\text{O}$ ,  $\text{NH}_4^+$ ,  $\text{SO}_4^{2-}$ ,  $\text{PCl}_5$ ,  $\text{SF}_4$ ,  $\text{ClF}_3$ ,  $\text{XeF}_2$ ,  $\text{SF}_6$ ,  $\text{IF}_5$ ,  $\text{XeF}_4$ ,  $\text{IF}_7$  and  $\text{XeF}_6$ .

Valence Bond theory - Hybridisation involving s, p and d orbitals: sp (acetylene), sp<sup>2</sup> (ethylene), sp<sup>3</sup>(CH<sub>4</sub>), sp<sup>3</sup>d (PCl<sub>5</sub>), sp<sup>3</sup>d<sup>2</sup> (SF<sub>6</sub>).

Molecular Orbital theory: LCAO – Electronic configuration of H<sub>2</sub>, B<sub>2</sub>, C<sub>2</sub>, N<sub>2</sub>, O<sub>2</sub> and CO – Calculation of bond order – determination of HOMO and LUMO – Explanation of bond length and bond strength.

Intermolecular forces - Hydrogen bonding in H<sub>2</sub>O - Dipole-dipole interactions.

## Module III: Nuclear Chemistry

Natural radioactivity – Modes of decay – Group displacement law. Nuclear forces - n/p ratio - Nuclear stability - Mass Defect - Binding energy. Isotopes, isobars and isotones with examples.

Nuclear fission - Atom bomb - Nuclear fusion – Hydrogen bomb - Nuclear reactors Application of radioactive isotopes – <sup>14</sup>C dating, Rock dating, Isotopes as tracers, Radio diagnosis, Radiotherapy.

## Module IV: Bioinorganic Chemistry

Metal ions in biological systems - Biochemistry of iron – Haemoglobin and myoglobin - O<sub>2</sub> and CO<sub>2</sub> transportation (mechanism not required) - Chlorophyll and photosynthesis (mechanism not expected) – Elementary idea of structure and mechanism of action of sodium potassium pump - Biochemistry of zinc and cobalt.



## CHE2C02 PHYSICAL CHEMISTRY

### COURSE OUTCOMES (COs)

- 1 To understand the importance of free energy in defining spontaneity.
- 2 To realise the theories of different states of matter and their implication.
- 3 To understand the basic principles of electrochemistry.

### Module I: Thermodynamics

Definition of thermodynamic terms - System – Surroundings - Types of systems. First law of Thermodynamics - Internal energy - Significance of internal energy change – Enthalpy. Second law of Thermodynamics - Entropy and spontaneity - Statement of second law based on entropy. Entropy change in phase transitions (derivation not required) - Entropy of fusion, vaporization and sublimation. The concept of Gibbs free energy -Physical significance of free energy - Conditions for equilibrium and spontaneity based on  $\Delta G$  values - Effect of temperature on spontaneity of reaction. Third law of Thermodynamics.

### Module II: Gaseous and Solid States

Gaseous State: Introduction - Kinetic molecular model of gases – Maxwell distribution of velocities and its use in calculating molecular velocities – Average velocity, RMS velocity and most probable velocity (derivations not required) – Boyle's law – Charles's law – Ideal gas equation – Behaviour of real gases – Deviation from ideal behavior - van der Waals equation (derivation not required). Solid State: Introduction - Isotropy and anisotropy - Symmetry elements in crystals - The seven crystal systems – Miller indices - Bravais lattices – Bragg's equation (derivation required) and its applications (mention only). Defects in crystals: Non-stoichiometric and stoichiometric defects - Extrinsic and intrinsic defects.



# SYLLABUS

## **Module III: Liquid State and Solutions**

Liquid State: Introduction - Vapour pressure, surface tension and viscosity – Explanation of these properties on the basis of intermolecular attraction. Solutions: Kinds of solutions - Solubility of gases in liquids – Henry's law and its applications - Colligative properties - Osmotic pressure - Laws of osmotic pressure - Reverse osmosis and its applications - Determination of molecular mass using colligative properties.

## **Module IV: Electrochemistry**

Specific conductance, equivalent conductance and molar conductance - Variation of conductance with dilution - Kohlrausch's law - Degree of ionization of weak electrolytes - Application of conductance measurements – Conductometric titrations. Galvanic cells - Cell and electrode potentials - IUPAC sign convention – Reference electrodes – Standard Hydrogen electrode – Calomel electrode - Standard electrode potential - Nernst equation - H<sub>2</sub>-O<sub>2</sub> fuel cell. Ostwald's dilution law – Buffer solutions – Buffer action [acetic acid/sodium acetate & NH<sub>4</sub>OH/NH<sub>4</sub>Cl], applications of buffers.



## CHE3C03 ORGANIC CHEMISTRY

### COURSE OUTCOMES (COs)

- 1 To understand the basic concepts involved in reaction intermediates.
- 2 To realise the importance of optical activity and chirality.
- 3 To appreciate the importance of functional groups and aromatic stability.
- 4 To understand the basic structure and importance of carbohydrates, nucleic acids, alkaloids and terpenes.

### Module I: Organic Chemistry – Some Basic Concepts

Introduction: Homolysis and heterolysis of bonds – Electrophiles and nucleophiles.

Reaction Intermediates: Carbocations, carbanions and free radicals (types, hybridization and stability). Types of organic reactions: Addition, elimination, substitution and rearrangement reactions (definition and one example each). Electron Displacement Effects: Inductive effect: Definition –

Characteristics - +I and –I groups. Applications: Explanation of substituent effect on the acidity of aliphatic carboxylic acids. Mesomeric effect: Definition – Characteristics - +M and –M groups.

Applications: Comparison of electron density in benzene, nitrobenzene and aniline. Hyperconjugation: Definition – Characteristics. Example: Propene. Applications: Comparison of stability of 1-butene & 2-butene. Electromeric effect: Definition – Characteristics - +E effect (addition of H<sup>+</sup> to ethene) and –E effect (addition of CN to acetaldehyde). Steric effect (causes and simple examples).

### Module II: Stereochemistry

Conformations: Conformations of ethane, cyclohexane and methylcyclohexane –

Explanation of stability. Geometrical Isomerism: Definition – Condition – Geometrical isomerism in but-2-ene and but-2-ene-1,4-dioic acid – Methods of distinguishing geometrical isomers using melting point and dipole moment. Optical Isomerism: Optical activity – Chirality – Enantiomers – Meso compounds – Diastereoisomers – Optical isomerism in lactic acid and tartaric acid.



# SYLLABUS

## **Module III: Aromatic Hydrocarbons**

Nomenclature and isomerism in substituted benzene. Structure and stability of benzene: Kekule, resonance and molecular orbital description. Mechanism of aromatic electrophilic substitution: Halogenation, nitration, sulphonation and Friedel-Craft's reactions – orientation effect of substituents. Aromaticity and Huckel's rule: Application to benzenoid (benzene, naphthalene and anthracene) and nonbenzenoid (pyrrole, pyridine and indol) aromatic compounds.

## **Module IV: Chemistry of Functional Groups – I**

Halogen Compounds: Preparation of alkyl halides from alkanes and alkenes – Wurtz reaction and Fittig's reaction – Mechanism of SN1 and SN2 reactions of alkyl halides – Effect of substrate and stereochemistry. Alcohols: Preparation from Grignard reagent – Preparation of ethanol from molasses – Wash, rectified spirit, absolute alcohol, denatured spirit, proof spirit and power alcohol (mention only) – Comparison of acidity of ethanol, isopropyl alcohol and tert-butyl alcohol – Haloform reaction and iodoform test – Luca's test – Chemistry of methanol poisoning – Harmful effects of ethanol in the human body. Phenols: Preparation from chlorobenzene – Comparison of acidity of phenol, p-nitrophenol and p-methoxyphenol – Preparation and uses of phenolphthalein

## **Module V: Chemistry of Functional Groups – II**

Aldehydes & Ketones: Preparation from alcohols – Nucleophilic addition reactions (HCN and bisulphite) – Comparison of nucleophilic addition rate of aliphatic aldehydes and ketones. Carboxylic Acids: Preparation from Grignard reagent – Decarboxylation – Kolbe electrolysis. Amines: Preparation from nitro compounds – Hofmann's bromamide reaction – Hofmann's carbylamines reaction. Basicity: Comparison of basicity of ammonia, methyl amine and aniline. Diazonium Salts: Preparation and synthetic applications of benzene diazonium chloride – Preparation and uses of methyl orange.





# SYLLABUS

## **Module VI: Biomolecules**

Carbohydrates: Classification with examples - cyclic structures of glucose and fructose - Applications of carbohydrates. Proteins: Amino acids – Classification – Zwitter ion formation – Peptide linkage – Polypeptides and proteins – Primary, secondary and tertiary structure of proteins – Globular and fibrous proteins – Denaturation of proteins. Enzymes: Characteristics and examples.

Nucleic acids: Structure of pentose sugar, nitrogenous base, nucleoside and nucleotide – Double-helical structure of DNA – Difference between DNA and RNA – DNA fingerprinting and its applications.

## **Module VII: Alkaloids and Terpenes**

Alkaloids: Classification – Source, structure and physiological functions of nicotine, coniine and piperine. Terpenes: Classification with examples – Isoprene rule – Isolation of essential oils by steam distillation – Uses of lemongrass oil, eucalyptus oil and sandalwood oil – Source, structure and uses of citral and menthol – Natural rubber – Vulcanization and its advantages.

Note: Structural elucidation not expected in any case.



## CHE4C04 PHYSICAL AND APPLIED CHEMISTRY

### COURSE OUTCOMES (COs)

- 1 To understand the basic concepts behind colloidal state and nanochemistry.
- 2 To understand the importance of green chemistry and pollution prevention.
- 3 To appreciate the importance of different separation methods and spectral techniques.
- 4 To understand the extent of chemistry in daily life.

### Module I: Colloidal Chemistry

True solution, colloidal solution and suspension. Classification of colloids: Lyophilic, lyophobic, macromolecular, multimolecular and associated colloids with examples. Purification of colloids by electro dialysis and ultrafiltration. Properties of colloids: Brownian movement – Tyndall effect – Electrophoresis. Origin of charge and stability of colloids – Coagulation - Hardy Schulze rule – Protective colloids - Gold number. Emulsions. Applications of colloids: Delta formation, medicines, emulsification, cleaning action of detergents and soaps.

### Module II: New Vistas in Chemistry

Nanochemistry: Introduction – classification of nanomaterials (0D, 1D, 2D) - size dependence of material properties (optical, electrical and catalytic) - surface to volume ratio and its significance - application of nanomaterials in electronics, optics, catalysis and medicine (detailed discussion not expected). Green Chemistry: Definition and need of green chemistry - principles (detailed discussion not expected) - atom economy - green solvents - green synthesis of Ibuprofen.

### Module III: Chromatography

Chromatography- Introduction - Adsorption and partition chromatography - Principle and applications of column, thin layer, paper and gas chromatography - R<sub>f</sub> value – Relative merits of different techniques.



# SYLLABUS

## Module IV: Spectroscopy

Origin of spectra - Interaction of electromagnetic radiation with matter. Different types of energy levels in molecules: Rotational, vibrational and electronic levels. Statement of Born Oppenheimer approximation - Fundamental laws of spectroscopy and selection rules (derivations not required).

IR Spectroscopy: Introduction - Group frequency concept - Characteristic stretching frequencies of O-H, N-H, C-H, C=C, C=N and C=O functional groups - Fingerprint region in IR spectra.

UV-Visible Spectroscopy: Introduction - Beer-Lambert's law - Electronic transitions in molecules ( $\sigma \rightarrow \sigma^*$ ,  $n \rightarrow \sigma^*$ ,  $\pi \rightarrow \pi^*$  and  $n \rightarrow \pi^*$ ) - Chromophore and auxochrome - Red shift and blue shift.

NMR Spectroscopy: Introduction - Chemical shift and spin-spin coupling - Application in elucidating the structure of ethanol, dimethyl ether, propanal and acetone (detailed study not required).

## Module V: Polymers

Classification of polymers - Addition and condensation polymers – Thermoplastics and thermosetting plastics - Structure and applications of synthetic rubbers (Buna-S, Buna-N and neoprene), synthetic fibres (Nylon 66, Nylon 6 and dacron), thermoplastics (polyethene, polystyrene, PVC and teflon) and thermosetting plastics (bakelite and melmac). Uses of kevlar, nomex and lexan – Biodegradable polymers (PGA, PLA and PHBV) and their applications.

## Module VI: Environmental Pollution

Definition – Types of pollution.

Air pollution: Pollution by oxides of nitrogen, carbon and sulphur. Effects of air pollution:

Depletion of ozone, green house effect and acid rain.

Water pollution: Pollution due to sewage, industrial effluents, soaps, detergents, pesticides, fertilizers and heavy metals – Eutrophication - Biological magnification and bioaccumulation - Effects of water pollution. Water quality parameters – DO, BOD and COD (elementary idea only).

Soil pollution – Pollution due to plastics.

Thermal pollution and radioactive pollution: Sources, effects and control measures.



# SYLLABUS

## Module VII: Chemistry in Daily Life

Petrochemicals: Name, carbon range and uses of fractions of petroleum distillation – Octane number - Cetane number – Flash point. LPG and CNG: Composition and uses.

Pharmaceuticals: Drug - Chemical name, generic name and trade names with examples.

Antipyretics, analgesics, antibiotics, antacids, antiseptics (definition and examples, structure not expected).

Dyes: Definition – Requirements of a dye - Theories of colour and chemical constitution – Structure and applications of martius yellow, indigo and alizarin.

Food: Food additives: Food preservatives, artificial sweeteners and antioxidants (definition and examples, structures not required) Commonly used permitted and non-permitted food colours (structures not required).

Cement: Manufacture, composition and setting.

Glass: Types of glasses and uses.

## CHE4C05(P) CHEMISTRY PRACTICAL

### COURSE OUTCOMES (COs)

- 1 To understand the basic concepts of inter group separation.
- 2 To enable the students to develop analytical and preparation skills.

## Module I: Laboratory Safety, First Aid and Treatment of Fires

Importance of lab safety – Burns – Eye accidents – Cuts – Gas poisoning – Electric shocks – Treatment of fires – Precautions and preventive measures.

## Module II: Volumetric Analysis

1. Weighing using chemical balance and electronic balance.
2. Preparation of standard solutions.
3. Neutralization Titrations
  - (i) Strong acid – strong base.
  - (ii) Strong acid – weak base.
  - (iii) Weak acid – strong base.



# SYLLABUS

## 4. Redox Titrations

Permanganometry:

- (i) Estimation of oxalic acid.
- (ii) Estimation of  $\text{Fe}^{2+}/\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ /Mohr's salt

Dichrometry:

- (i) Estimation of  $\text{Fe}^{2+}/\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ /Mohr's salt using internal indicator.
- (ii) Estimation of  $\text{Fe}^{2+}/\text{FeSO}_4 \cdot 7\text{H}_2\text{O}$ /Mohr's salt using external indicator.

Iodimetry and Iodometry:

- (i) Estimation of iodine.
- (ii) Estimation of copper.
- (iii) Estimation of chromium.

## 5. Complexometric Titrations

- (i) Estimation of zinc.
- (ii) Estimation of magnesium.
- (iii) Determination of hardness of water.

## Module III: Gravimetric Analysis

1. Determination of water of hydration in crystalline barium chloride.
2. Estimation of  $\text{Ba}^{2+}$  as  $\text{BaSO}_4$ .

## Module IV: Inorganic Qualitative Analysis

- (a) Reactions of Cations: Study of the reactions of the following cations with a view of their identification and confirmation.  $\text{Pb}^{2+}$ ,  $\text{Bi}^{3+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Cd}^{2+}$ ,  $\text{Fe}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Al}^{3+}$ ,  $\text{Ni}^{2+}$ ,  $\text{Co}^{2+}$ ,  $\text{Mn}^{2+}$ ,  $\text{Zn}^{2+}$ ,  $\text{Ba}^{2+}$ ,  $\text{Sr}^{2+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$  and  $\text{NH}_4^+$ .
- (b) Systematic qualitative analysis of a solution containing any two cations from the above list.

## Module V: Determination of Physical Constants

1. Determination of boiling point.
2. Determination of melting point.



## Module VI: Organic Preparations

1. p-Bromoacetanilide from acetanilide.
2. p-Nitroacetanilide from acetanilide.
3. Benzoic acid from benzaldehyde.
4. Benzoic acid from benzamide.

## COMPLEMENTARY COURSE (ZOOLOGY )

### ZOL1C01T ANIMAL DIVERSITY AND WILDLIFE CONSERVATION

#### COURSE OUTCOMES (COs)

- 1 Describe the general characters of protists and salient features of phylum – Rhizopoda, Ciliophora, Dinoflagellata and Apicomplexa
- 2 Enumerate the salient features and examples of Phylum – Porifera, Coelenterata, Platyhelminthes, Aschelminthes, Annelida, Arthropoda, Onychophora, Mollusca and Echinodermata, and the structural organization of Peneaus sp.
- 3 Describe the characteristic features and classification of phylum Chordata with examples and, structural organization of *Oryctolagus cuniculus*
- 4 Explain levels of biodiversity, threats to biodiversity, biodiversity hotspots, importance and strategies for conservation of wildlife and sustainable development

#### MODULE 1. Kingdom Protista

General characters.

Salient features of protozoans.

Phylum Dinoflagellata: e.g. *Noctiluca*

Phylum Ciliophora: e.g. *Vorticella*

Phylum Rhizopoda: e. g. *Amoeba*

Phylum Apicomplexa: e.g. *Plasmodium* (exclude life cycle)





# SYLLABUS

## **MODULE 2: Animal diversity: Nonchordata - Part I**

Salient features of phyla, classification down to classes

Phylum Porifera: e.g. Leucosolenia

Phylum Coelenterata: e.g. Obelia, Aurelia, Sea anemone

Phylum Platyhelminthes: e.g. Fasciola, Schistosoma

Phylum Aschelminthes: e.g. Ascaris, Enterobius

Phylum Annelida: e.g. Arenicola, Hirudinaria, Megascoclex

Phylum Arthropoda: e.g. Limulus, Sacculina, Eupagurus,

Phylum Onychophora: e.g. Peripatus

Phylum Mollusca: e.g. Perna, Teredo, Sepia, Pinctada

Phylum Echinodermata: e.g. Asterias, Holothuria, Sea urchin

Type: Penaeus sp. (Exclude details of larval stages)

## **MODULE 3. Animal diversity: Chordata - Part II**

Phylum Chordata: Salient features, Mention classes

Sub phylum Urochordata e.g. Ascidia

Subphylum Cephalochordata e.g. Branchiostoma

Subphylum Vertebrata:

Div I. Agnatha e.g. Petromyzon, Myxine

Div II: Gnathostomata

Super class: Pisces

Class: Chondrichthyes: e.g. Narcine

Class: Osteichthyes: e.g. Echeineis, Hippocampus, Heteropneustes, Scomberomorus, Pomfret

Super class: Tetrapoda

Class Amphibia: e.g. Ichthyophis, Salamandra, Rhacophorus, Duttaphrynus, Mention -

Nasikabatrachus sahyadrensis

Class Reptilia: e.g. Chamaeleo, Chelone, Naja, Bungarus, Daboia

Class Aves e.g. Columba

Class Mammalia e.g. Pteropus

Type: Oryctolagus cuniculus

External features, skeletal system, digestive system, respiratory system, circulatory system, sense organs and nervous system. [Exclude skin, skull bones, arterial system, venous system, lymphatic system, autonomous nervous system and endocrine system].



# SYLLABUS

## **MODULE 4. Conservation Biology**

I. Biodiversity, Levels of biodiversity (brief), significance and uses of biodiversity, threats to biodiversity- (fragmentation, invasive species, over exploitation, poaching, climate change), extinction of species, concept of threatened species.

II Biodiversity hot spots, brief notes on hot spots that include Indian region (Western Ghats and Sri Lanka, Indo Burma, Himalayas and Sundaland); endemism.

III Wild life management and conservation- Importance of wild life, strategies of conservation (Ex situ and In situ), mention Protection Acts- The Wildlife Protection Act, 1972.

IV Sustainable development (concept)

V. Red Data Book, IUCN, WWF (Brief account)

### **Topics for Assignments/Seminars**

(Topics allotted for assignments/ seminars should be considered for internal assessments only, and can be subdivided among students)

1. Project Tiger
2. Project Elephant
3. Operation Rhino
4. Ramsar sites

## **ZOL2C02T ECONOMIC ZOOLOGY**

### **COURSE OUTCOMES (COs)**

- 1 Explain parasitism and the major protist, cestode, trematode and nematode parasites of man and major insect vectors of human diseases and their control
- 2 Understand major beneficial and harmful insects, damages caused to host plants and their control measures
- 3 Understand pisciculture, prawn, mussel and pearl culture



# SYLLABUS

## **MODULE 1: Parasitism in relation to man**

### **Introduction, classification of parasites and hosts**

Obligatory, facultative, external, internal, hyperparasites. Definitive, intermediate, carrier and reserve hosts. Infection and infestation - Mention Hyper infection and Auto infection. Modes of infection - Inoculative, contaminative, direct and retroinfection, zoonotic diseases

### **Human Parasites**

Parasitic Protists – *Plasmodium vivax*, *Entamoeba histolytica*

Cestodes – *Taenia solium*, mention *T. saginata* and *Echinococcus granulosus*

Trematodes (Flukes) – *Schistosoma haematobium*

Nematodes – *Ancylostoma duodenale*, *Wuchereria bancrofti* and *Enterobius vermicularis*

### **Vectors of human diseases**

Insect vectors of human diseases and their control. Anophales, *Culex*, *Aedes*, *Xenopsylla*, *Cimex*, *Pediculus* and *Pthirus* (Diseases like malaria, filariasis, yellow fever, typhus fever, dengue, plague, chikungunya, kala azar).

## **MODULE 2. Useful Insects, Insect Pests and their control**

### **Insect Pests**

Definition of Pests, Kinds of Pests, Causes of pest outbreak.

Nature of damage to host plants and control measures of the following pests.

(Exclude structure and Life history of Pests).

a) *Spodoptera* sp. (rice swarming caterpillar)

b) *Leptocorisa* sp. (rice bug)

c) *Rhynchophorus* sp. (red palm weevil)

d) *Opisina* sp. (Black headed caterpillar, mention biological control)

e) *Aceria* sp. (Coconut mite)

f) *Helopeltis* sp. (tea bug)

g) *Cosmopolites* sp. (Banana rhizome weevil)

h) *Bactrocera* sp. (Fruit fly)

i) *Batocera* sp. (mango stem borer)

j) *Sitophilus* sp. (rice weevil)



# SYLLABUS

## **Insect control**

Basic principles of chemical control and biological control. Integrated Pest Management (IPM) (Brief notes).

## **Useful Insects**

Apiculture, Sericulture & Lac culture: Economic importance. Predatory insects, insect parasitoids.

## **MODULE 3. Aquaculture and Fishery Biology**

### **Brief Introduction mentioning its scope in Kerala.**

#### **Pisciculture**

Egg collection and hatching, induced spawning. Nursery ponds, manuring, feeding and harvesting, Ornamental fish farming (brief account). Mention common species. Fish utilization

#### **Prawn culture.**

Breeding and spawning of prawns, seed collection and culture, types of prawn farms, mention common species.

#### **Mussel farming**

Seed collection, artificial collection of seeds, induced spawning, rearing of larvae, farming methods and harvesting.

#### **Pearl Culture**

Preparation of nuclei, preparation of host and graft tissue, implantation and nursing

## **Topics for Assignments/Seminars**

(Topics allotted for assignments/ seminars should be considered for internal assessments only, and can be subdivided among students)

1. *Callosobruchus chinensis* (Pulse beetle).
2. *Eomenacanthus stramineus* (Chicken louse).
3. *Hippobosca maculata* (house fly).
4. *Tabanus striatus* (horse fly).
5. *Pediculus humanus* (head louse)



## ZOL3C03T PHYSIOLOGY AND ETHOLOGY

### COURSE OUTCOMES (COs)

- 1 Describe the structure of plasma membrane and the various trans-membrane transport mechanisms
- 2 Enumerate the constituents of normal diet and the mechanism of digestion and absorption of carbohydrates, proteins and lipids and the regulation of gastrointestinal function
- 3 Explain the mechanism of transport of respiratory gases, control of respiration, respiratory problems and artificial ventilation
- 4 Explain the structure and working of human heart and mechanism of regulation of heart beat; constituents of human blood and blood transfusion and cardiovascular problems
- 5 Illustrate the structure of human kidney, the mechanism of urine formation, hormonal control of kidney function and kidney disorders; osmoregulation and urea cycle
- 6 Enumerate the structure of myofibrils and myofilaments; muscle contractile and regulatory proteins and mechanism of muscle contraction
- 7 Explain different types of nerve cells and glial cells, maintenance of resting membrane potential, generation and propagation of action potential and synaptic transmission
- 8 Describe innate behavior, learned behavior, patterns of behavior and factors that affect behavior
- 9 Enumerate biological rhythms, communication in animals and social organization in mammals

### MODULE 1. Trans-membrane transport mechanisms

Structure of Plasma membrane. Fluid mosaic model. Trans-membrane transport - passive & active mechanisms, vesicular transport

### MODULE 2. Nutrition

Constituents of normal diet. Digestion of carbohydrates, proteins and lipids. Absorption of nutrients (brief account). Brief account on the neural and hormonal control of gastrointestinal function. BMR and obesity



# SYLLABUS

## **MODULE 3. Respiration**

Gaseous exchange and transport. Respiratory pigment – haemoglobin – properties. Control of respiration – neural & chemical (brief account). Respiratory problems - hypoxia, asphyxia, CO poisoning. Respiratory problem of high altitudes. Physiological adaptive mechanisms of diving mammals. Artificial ventilation; heart lung machine.

## **MODULE 4. Body fluids and circulation**

Constituents of human blood. Agglutination, coagulation of blood and haemostasis Haemolysis. Blood transfusion (short notes). Brief account on the structure and working of human heart. Pacemaker and conducting system of heart. Cardiac cycle and regulation of heart beat. Blood pressure and pulse. Cardiovascular problems (brief account) - arteriosclerosis and atherosclerosis, myocardial infarction, hypertension and thrombosis.

## **MODULE 5. Osmoregulation and Excretion**

Osmoconformers and osmoregulators. Water retention and conservation in desert animals. Urea cycle. Ammonotelism, ureotelism and uricotelism. Hormonal control of kidney function. Kidney disorders, renal hypertension, nephritis and renal failure. Dialysis and kidney transplantation (short notes)

## **MODULE 6. Muscle Physiology**

EM structure of myofibrils and myofilament. Muscle - contractile proteins and major regulatory proteins. Chemistry and mechanism of muscle contraction. Energy for muscle contraction. Muscle twitch and muscle tetanus, isometric and isotonic contraction. All-or-none law and summation of stimuli. Muscle fatigue and rigor mortis.

## **MODULE 7. Nerve physiology**

Mention different types of nerve cells and glial cells. Maintenance of resting membrane potential; generation and propagation of action potential. Threshold stimulus, all or none response. Synapse, types of synapses, synaptic transmission and neurotransmitters.





# SYLLABUS

## **MODULE 8. Behaviour**

### **Innate behaviour**

Orientation, taxes and kinesis, simple reflexes and instincts, drive and motivation

### **Learned behaviour**

Habituation, conditioned reflex, trial and error learning, latent learning, imprinting, insight learning

### **Patterns of behaviour**

Habitat selection, sexual selection, co-operation, territoriality, aggression, courtship and agonistic behaviour.

### **Proximate factors**

Neurological basis of behaviour, mention hormonal, biochemical, environmental and genetic factors that influence behaviour.

## **MODULE 9: Biological clocks/rhythms**

Photoperiod, circadian rhythm, migration, navigation and homing instinct, diapause, hibernation and aestivation. Communication in animals. Social organization in mammals – Elephant as example

### **Topics for Assignments/Seminars**

(Topics allotted for assignments/ seminars should be considered for internal assessments only, and can be subdivided among students)

1. Role of enzymes in digestion of Carbohydrates, proteins and lipids.
2. Absorption of carbohydrates, proteins, and lipids.
3. Problems of Alcoholism
4. Common renal problems - Renal hypertension, nephritis, renal failure, edema, acidosis, uremia, haematuria and calculi.
5. Minamata disease



## ZOL4C04T GENETICS AND IMMUNOLOGY

### COURSE OUTCOMES (COs)

- 1 Describe human karyotype , chromosomal anomalies and polygenic inheritance
- 2 Explain the mechanisms of sex determination
- 3 Enumerate the concept of genes, gene expression, genetic code, transcription and translation
- 4 Illustrate the mechanism of recombinant DNA technology and its practical applications
- 5 Explain the types of cancer, causes of transformation and characteristics of transformed cells
- 6 Identify the cells and organs of immune system, antigens and antibodies
- 7 Enumerate antigen-antibody interaction, generation of B-cell and T-cell response and major immunotechniques
- 8 Explain primary and secondary immunodeficiency diseases, autoimmune diseases, vaccination and vaccines

### MODULE 1. Human Genetics

Normal human karyotype: Classification and grouping of human chromosomes (Patau's & Denver schemes). Chromosomal anomalies and disorders (short note only). Autosomal anomalies: Phenyl ketonuria & Sickle cell anemia. X-linked – Haemophilia and Colour blindness. Y-linked – Y-Chromosome infertility. Polygenic inheritance - Cleft palate or Cleft lip and diabetes mellitus. Prenatal diagnosis. Genetic counselling. Eugenics, Euthenics and Euphenics.

### MODULE 2. Genetic Control of Sex

Autosomes and sex chromosomes: Mention Barr body and its significance. Chromosomal mechanism of sex determination: genic balance theory. Control of sex; hormonal influence of sex determination; sex mosaics; gynandromorphism



# SYLLABUS

## **MODULE 3. Genes and gene expression**

Modern concept of genes, split genes, pseudogenes, overlapping genes and transposons. Gene expression. Genetic code, transcription and translation (brief account)

## **MODULE 4. Genetic Engineering**

Brief account of recombinant DNA technology – role of enzymes (restriction endonucleases, exonucleases, DNA polymerase, DNA ligase, reverse transcriptase, alkaline phosphatase, polynucleotide kinase and terminal transferase). Cloning vectors – plasmid vectors (mention pBR322), phage vectors, cosmids, viruses and YAC vector. Construction of recombinant DNA (preparation of vector DNA and donor DNA, joining of vector and donor DNAs, introduction of recombinant DNA into the host cell and selection of transformants). Methods of gene transfer. Practical applications, advantages and potential hazards.

## **MODULE 5. Cytogenetics of Cancer**

Types of cancer: brief account of sarcomas, carcinomas, melanomas, leukemia, lymphomas and blastomas. Characteristics of cancer cells: uncontrolled multiplication, loss of contact inhibition, metastasis, reduced cellular adhesion, metaplasia, invasiveness, growth factor secretion, cell surface alterations, alterations in transcriptome and proteome and protease secretion. Origin of Cancer: Carcinogens, oncogenic viruses, polygenic basis, hereditary predisposition to cancer

## **MODULE 6. Cells and organs of immune system, antigens and antibodies Cells and organs of immune system**

Innate and adaptive immunity. Cells of immune system- B cell, T cell, NK cell and Antigen Presenting Cells (dendritic cells, macrophage cells). Organs of the immune system- Primary lymphoid Organs (Thymus, Bone Marrow), Secondary lymphoid Organs (Spleen, lymph node, MALT)

### **Antigens**

Antigenicity, Immunogenicity and Haptens. Factors influencing immunogenicity. Mention human immunoglobulin gene families –  $\lambda$  and  $\kappa$  light chain families and heavy chain family and major histocompatibility complex (MHC) group of genes.

### **Antibodies**

Structure, different classes and Function. Monoclonal antibodies-Hybridoma technology and applications.



# SYLLABUS

## **MODULE 7. Antigen-Antibody interaction & Generation of B-cell and T-cell response**

### **Antigen - antibody interaction**

Strength of Antigen-Antibody interaction. Cross reactivity, Precipitation reactions, and Agglutination reactions. Immunotechniques – Detection of biomolecules using ELISA, RIA, and Western blot. Southern blot, Northern blot and DNA Fingerprinting (Brief)

### **Generation of B cell and T-cell response:**

Humoral and cell-mediated response. Properties of B-cell and T-cell- epitopes. Activation and differentiation of B and T cells. Cytokines- brief

## **MODULE 8. Immunodeficiency diseases, vaccines & vaccination**

### **Immunodeficiency diseases**

Primary (Bruton's disease, Di-george syndrome & SCID). Secondary types: AIDS Mention Acute, Chronic and Crisis phase, Window period. Autoimmune disease Mention Hashimoto's thyroiditis, Grave's disease, Myasthenia gravis and Systemic Lupus Erythematosus.

### **Vaccines and Vaccination**

Principle of vaccination; mention Attenuated vaccines, Inactivated vaccines, Toxoid vaccines and DNA vaccines.

### **Topics for Assignments/Seminars**

(Topics allotted for assignments/ seminars should be considered for internal assessments only, and can be subdivided among students)

1. Human genome
2. DNA tumor viruses
3. Human genome project
4. Structure of immunoglobulins and T-cell receptors



## ZOL4C05P PRACTICAL

### COURSE OUTCOMES (COs)

- 1 Identify the salient features of the phylum; taxonomic position, habit, habitat, adaptations/importance of selected protists, non-chordates and chordates
- 2 Describe major human parasites and economically important insects, molluscs and fishes
- 3 Perform detection of human blood groups and prepare human blood smear as per laboratory standards; mounting of specialized organs of selected nonchordates and chordates, and demonstrate the presence of biomolecules in samples by standard laboratory protocols
- 4 Illustrate the normal and selected abnormal human karyotypes and mode of inheritance of selected human genetic disorders and perform the dissection of earthworm and sardine to demonstrate the alimentary canal and *Penaeus* to demonstrate the nervous system.

### FIRST SEMESTER COMPLEMENTARY COURSE [PRACTICAL I \*A]

#### A. Animal Diversity

Phylum Dinoflagellata : Noctiluca

Ciliophora : Vorticella

Porifera : Leucosolenia

Coelenterata : Obelia, Physalia, Rhizostoma (Any 2).

Platyhelminthes : Fasciola

Aschelminthes : Ascaris

Annelida : Chaetopterus / Arenicola, Hirudinaria.

Arthropoda : Eupagarus, Belostoma, Limulus, Sacculina (Any 3).

Onychophora : Peripatus

Mollusca : Chiton, Sepia/ Loligo, Octopus (Any 2)

Echinodermata : Asterias, Holothuria.



# SYLLABUS

## Chordata

Prochordates : Ascidia/ Branchiostoma.

Cyclostomata : Petromyzon.

Superclass: Pisces : Narcine, Echeneis, Hippocampus, Heteropneustes, Anguilla, Pomfret (Any 3)

Class Amphibia : Ichthyophis, Axolotl larva, Rhacophorus (Any 2)

Class Reptilia : Chamaeleo, Daboia, Bungarus

Class Aves : Columba

Class Mammalia : Pteropus or any other Bat.

B. Histology: Study of the T.S. of Hydra, Ascaris, Earth worm (through typhlosolic region).

C. Osteology: Dentition (Rabbit), Pectoral and Pelvic girdles, typical vertebra

**B. Histology:** Study of the T.S. of Hydra, Ascaris, Earth worm (through typhlosolic region).

**C. Osteology:** Dentition (Rabbit), Pectoral and Pelvic girdles, typical vertebra

## SECOND SEMESTER COMPLEMENTARY COURSE [PRACTICAL I \*B]

### Study of the following items

#### Parasites

Entamoeba, Plasmodium, Schistosoma, Taenia, Ancylostoma, Enterobius, Wuchereria, Hirudinaria, Cimex (Any 5).

#### Insect pests

Spodoptera, Leptocorisa, Oryctes, Rhynchophorus, Opisina; Batocera, Termite, Sitophilus (Any 5).

#### Useful insects

Apis (worker), Bombyx female (any one)

#### Ornamental fishes

Poecilia reticulata (guppy), Poecilia sphenops (Black molly), Carassius auratus (Goldfish), Puntius denisonii, Pterophyllum scalare (Angel fish), Colisa sp. (Gaurami), Betta sp. (Fighting fish), Danio malabaricus (Giant Danio) (Any three)





# SYLLABUS

## **Culture fishes**

Catla catla (Catla), Labeo rohita (Rohu), Cirrhinus mrigala (Mrigal), Ctenopharyngodon idellus (Grass Carp) (Any three)

## **Economically important items**

Perna, Pinctada, Teredo, Loligo, Penaeus, Scoliodon, Sardinella, Rastrelliger, Cybium (Any 5).

## **THIRD SEMESTER COMPLEMENTARY COURSE [PRACTICAL I \*C]**

### **Section A: Physiology**

1. Blood smear preparation and study of RBC and different types of WBCs.
2. Human blood grouping – ABO and Rh systems.
3. Detection of monosaccharides, polysaccharides, proteins & lipids.

### **Section B: Mounting**

1. Earth worm: Setae in situ (minor), Spermatheca (minor)
2. Penaeus: Appendages (minor)
3. Cockroach: Salivary apparatus (major).
4. Honeybee: Mouth parts (minor).
5. Shark: Placoid scales (minor).

## **FOURTH SEMESTER COMPLEMENTARY COURSE [PRACTICAL I \*D]**

### **Section A: Dissections**

- Earthworm: Alimentary canal upto 25th segment (minor)  
Penaeus: Nervous system (major)  
Sardinella: Alimentary canal (major)



## Section B: Genetics

Study of the following (use slides/ models / charts / photographs)

1. Study of sex linked inheritance (haemophilia, sickle cell anaemia, color blindness)
2. Study of normal human karyotype (male and female) and abnormal karyotypes – Down's syndrome, Klinefelter's syndrome, Turners syndrome, Edwards syndrome ( Any two)

## OPEN COURSE

### BOT5D02T APPLIED BOTANY

#### COURSE OUTCOMES (COs)

- 1. Develop general awareness on applied aspects of Plant science.
- 2. Realize the role of plants in everyday life.
- 3. Apply vegetative propagation methods in everyday life.
- 4. Realize the economic importance of plants

#### Module –I Plant Propagation

1. Seed propagation – Seed dormancy, seed treatment, conditions for successful propagation, rising of seed beds, care of seedling, transplanting techniques.
2. Vegetative propagation:
  - (a) Cutting (stem, roots)
  - (b) Grafting (approach, cleft)
  - (c) Budding (T-budding, patch)
  - (d) Layering (simple, air)
3. Micro propagation- General account

#### Module – II Steps of Growing Plants

1. Soil- Composition, Types, Texture, Soil pH, Correcting pH, Humus
2. Pots & Potting – Earthen, Fiber, Polythene bags, Potting mixture, Potting, Depotting, Repotting.
3. Chemical fertilizers: types, application, merits and demerits



# SYLLABUS

4. Organic manure; types, application, merits and demerits
5. Need of water: Irrigation – Surface, spray, drip irrigation, sprinklers.
6. Plant protection: Biological, Physical and mechanical, Chemical, biopesticide

## **Module – III. Botany in Everyday life**

1. Vegetable gardening
2. Mushroom cultivation
3. Vermicomposting- technique
4. Biofertilizer Technology
5. Orchid and Anthurium cultivation
6. Creating Bonsai

## **Module – IV. Economic Botany**

1. General account on various plants of economic importance
2. Study the Binomial, Family, Morphology of the useful part of the following plants.  
Cereals and Millets – Rice, Wheat  
Pulses -Greengram, Bengalgram, Blackgram  
Beverages – Coffee, Tea, Cocoa.  
Fibre – Coir, Cotton  
Timber – Teak, Rose wood, Jack  
Spices – Pepper, Ginger, Cardamom  
Medicinal – Adhatoda, Phyllanthus, Rauwolfia  
Oil- coconut, Gingelly  
Ornamental plants of economic importance – Rose, jasmine  
Fruit – Mango, Banana



# GENERAL ADMISSION RULE



## GENERAL ADMISSION RULES

Admission to various UG and PG programs are conducted as per the university of Calicut rules in force. University conducts centralized allotment process (CAP) for both UG and PG programs and the candidates should register through the online portal provided by University of Calicut.

The seats for each aided program of this college will be distributed as open quota (40%), SC (15%), ST (5%), Community Quota (Only for Muslim Community) (20%) and Management quota (20%), For Self-financing programs, it is distributed as merit quota (50%) and Management quota (50%).

Students seeking admission under management quota should submit management quota form along with their application which are available from the college office.

The students eligible for admission should accompany their parent/guardian during the interview.

- The candidates should produce the following documents in original before the principal of the college at the time of admission
- Admit Card
- The print outs of the application
- Receipt/Chalan of the Mandatory fee remitted for acceptance of allotment.
- Qualifying Certificate.
- Mark List(s) of the qualifying examination.
- Transfer Certificate received from the institution last studied.
- Conduct Certificate.
- S.S.L.C
- Those candidates who have passed examinations others than HSE/VHSE except CBSE/CISCE should produce Equivalency/Recognitions Certificate from University of Calicut.



**എം.ഇ.എസ്. അസ്മാബി കോളേജ്**  
**ഡിഗ്രി / പി.ജി. വിദ്യാർത്ഥികളുടെയും**  
**അവരുടെ രക്ഷകർത്താക്കളുടെയും ശ്രദ്ധയ്ക്ക്**



1. ഹൈക്കോടതി വിധിക്കനുസൃതമായി കോളേജ് കമ്പസിനുള്ളിൽ രാഷ്ട്രീയ പ്രവർത്തനം നിരോധിച്ചിരിക്കുന്നു. വിദ്യാർത്ഥികൾ കമ്പസിനുള്ളിൽ ഔദ്യോഗികമല്ലാത്ത ധാരതാരൂ മീറ്റിംഗുകളും സംഘടിപ്പിക്കുവാനോ അവയിൽ പങ്കെടുക്കുവാനോ പാടില്ല.
2. ജൂനിയർ കുട്ടികളെ റാഗ് ചെയ്യുക, വാക്കുകൾ കൊണ്ടും പ്രവൃത്തികൊണ്ടും വേദനിപ്പിക്കുക, അധിക്ഷേപിക്കുക, അപമാനയായി പെരുമാറുക ഇവയെല്ലാം കഠിനശിക്ഷ ലഭിക്കുന്ന ക്രിമിനൽ പ്രവർത്തനങ്ങളാണ്. ഇങ്ങനെയുള്ള പെരുമാറ്റങ്ങൾ കോളേജിൽ വെച്ചോ പുറത്തുവെച്ചോ ജൂനിയർ വിദ്യാർത്ഥികൾക്ക് ഉണ്ടായാൽ ഉടൻ തന്നെ പ്രിൻസിപ്പാളിനെ അറിയിക്കേണ്ടതാണ്.
3. ബുധൻ ഒഴികെയുള്ള എല്ലാ പ്രവൃത്തിദിവസങ്ങളിലും കോളേജ് യൂണിഫോം നിർബന്ധമാണ്. ടി ഷർട്ട്, ലോവേസ്റ്റ് ജീൻസ് / ട്രൗസർ, ഇറുകിപ്പിടിച്ച വസ്ത്രങ്ങൾ എന്നിവ ധരിച്ച് കമ്പസിൽ വരാൻ പാടില്ല.
4. വിദ്യാർത്ഥികൾ കോളേജിനുള്ളിൽ നിർബന്ധമായും ഐഡന്റിറ്റി റ്റാഗ് വ്യക്തമായി കാണത്തക്കവിധം ധരിച്ചിരിക്കണം.
5. പുകവലി, മദ്യപാനം, പുകയില, മയക്കുമരുന്ന് എന്നിവ കമ്പസിൽ കർശനമായി നിരോധിച്ചിരിക്കുന്നു.
6. കമ്പസിനുള്ളിൽ മൊബൈൽ ഫോൺ നിരോധിച്ചിരിക്കുന്നു. ഉപയോഗിക്കുന്നത് ശ്രദ്ധയിൽപെട്ടാൽ ഫോൺ പിടിച്ചെടുക്കുന്നതാണ്. യാതൊരുകാരണവശാലും മടക്കി നൽകുന്നതല്ല.
7. ക്ലബ്ബ് സമയത്തിന് ശേഷം കാരണമില്ലാതെ കമ്പസിനുള്ളിൽ നിൽക്കുവാൻ അനുവദിക്കുന്നതല്ല.
8. പ്രിൻസിപ്പാളോ നിയമാനുസരണം സംഘടിപ്പിക്കപ്പെട്ട മറ്റു കമ്മ്യൂണിക്കേഷൻ കോളേജിൽ അച്ചടക്ക സംബന്ധമായും ഭരണപരമായും കാലാകാലങ്ങളിൽ പുറപ്പെടുവിക്കുന്ന എല്ലാ നിയമങ്ങളും, നിർദ്ദേശങ്ങളും പാലിക്കാൻ ഞാൻ തയ്യാറാണ്.
9. കമ്പസിന്റെ ഭിത്തികളിലോ, മതിലുകളിലോ എഴുതുന്നതും, പോസ്റ്റർ, സ്റ്റിക്കർ എന്നിവ പതിക്കുന്നതും കർശനമായി നിരോധിച്ചിരിക്കുന്നു.
10. ക്ലബ്ബ് മുറിയിലെ മതിൽ, ഡെസ്ക്, ബെഞ്ച് എന്നിവയിൽ എഴുതുകയോ കേടുപാടുകൾ വരുത്തുകയോ, ചെയ്യരുത്. നിയമങ്ങൾ പാലിക്കാതെ വന്നാൽ എന്നെ കോളേജിൽ നിന്നും ഒരു വിശദീകരണവും കൂടാതെ പുറത്താക്കാൻ സമ്മതമാണ്.
11. വിദ്യാർത്ഥികളുടെ വാഹനങ്ങൾ പാർക്കിംഗിന് അനുവദിച്ച സ്ഥലത്ത് മാത്രം സ്വന്തം ഉത്തരവാദിത്വത്തിൽ സൂക്ഷിക്കുക.

**വിദ്യാർത്ഥി**

**രക്ഷകർത്താവ്**

പേര്.....  
 ഒപ്പ്.....  
 തിയ്യതി.....

പേര്.....  
 ഒപ്പ്.....

സുപ്രണ്ട്  
 (എം.ഇ.എസ്. അസ്മാബി കോളേജ്)

പ്രിൻസിപ്പാൾ  
 (എം.ഇ.എസ്. അസ്മാബി കോളേജ്)



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# MES ASMABI COLLEGE

P.VEMBALLUR ,KODUGALLUR,THRISSUR ,KERALA ,680671

[ Govt. Aided, Affiliated to University of Calicut ,Recognized by UGC,  
Minority Institution Certified by National minority Educational Commission]

## PROGRAMME GUIDE

**B.Voc. FISH PROCESSING TECHNOLOGY**

AN IQAC INITIATIVE



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JOB PERSPECTIVES**

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**SYLLABUS,PO,PSO&CO**

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## ABOUT COLLEGE

The Muslim Educational Society (MES) is an educational organisation established under the leadership of late Dr P.K. Abdul Gafoor in 1964 at Calicut. M.E.S. Asmabi College, a premier educational institution managed by the Muslim Educational Society (Regd.) Calicut, owes its existence to the remarkable foresight and unremitting zeal of the late Dr. P.K. Abdul Gafoor, the late P.K. Abdulla I.A.S., Dr. M.A. Abdulla and late Dr. A.K. Siddiq Karikulam Azhikode. The institution was established in the year 1968 at P.Vemballur, Kodungallur, a remote coastal backward village in the S.N. Puram Panchayath, of Thrissur District. The main objective of the institution is to uplift the educationally backward community, especially Muslims of the area who had been denied of the right to education for generations.

The college now caters to the needs of the students throughout Kerala and Lakshadweep, cutting across the barriers of class, caste, creed and religion. Hajee Ismail Essa Sait of Cochin initially donated the land and building and the college was named after his mother "Asmabi".

The college which enjoys 2F and 12B status of the U.G.C. is affiliated to the Calicut University. At present it provides higher education to 2500 above students in seventeen Under Graduate Programmes, six Post Graduate Programmes and three Research centres.



## VISION

## MISSION

## CORE VALUE

## VISION

Providing affordable and quality higher education, in tune with national and international standards to all, especially to the backward and marginalized; the Muslims, women, Scheduled Castes and Scheduled Tribes and empowering them through education.

## MISSION

- Empowerment of the downtrodden and backward classes.
- Imparting quality higher education for women.
- Promotion of secularism and democracy.
- Moral uplift and trust in God.
- Moulding a self-reliant and socially-accountable young generation.
- Emphasis on modern methods and tools of teaching and learning, with sufficient accent on value added education.
- Inculcating social responsibility in student clan by involving them in community-oriented activities.
- Promote entrepreneurial, leadership, organizational qualities and life skills in students.
- Creating maintaining an atmosphere of oneness among staff, students and society.
- Evolve a student community having academic and professional excellence.
- Infuse eco-consciousness in students and community

## CORE VALUE

- Pursuit for Academic Excellence
- Inclusivity in Diversity
- Respect for Culture and Heritage
- Honesty and Integrity
- Social Responsibility and Environmental Sustainability
- Pursuit for Academic Excellence





## MESSAGE FROM THE PRINCIPAL

M E S Asmabi College is a renowned institution with rich tradition of fifty five years adhering to its declared vision and mission. The college offers a diverse range of educational opportunities, including vocational, commerce, science, arts and language programmes and three research centres in Botany, English and Commerce. The course profile at the College is designed to cater to a wide array of academic interests and career aspirations with a futuristic angle. Certificate and add-on courses are in place to ensure holistic development of student clan. All programmes of study make the students well-prepared for the workforce upon completion.

One of the hallmarks of the College's curriculum is its emphasis on outcome-based syllabi. This approach ensures that students not only gain theoretical knowledge but also develop practical skills and competencies that are directly relevant to their chosen field. The college collaborates closely with industry experts and professionals to align its curriculum with the current demands of the job market, promoting the employability of its graduates. By integrating real-world projects, internships, and experiential learning, students graduate from M E S Asmabi College with a strong foundation in their respective fields, ready to make a meaningful impact in their careers. The programmes offered at M E S Asmabi College are thus not just academically rigorous but also highly practical, ensuring that students are well-prepared to excel in their chosen professions and contribute positively to society.



## ADMINISTRATIVE AND SUPPORT STAFF



Junior Superintendent	:	Shahina. C.P
Head Accountant	:	Sadaruddeen K.A.
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Supervisor	:	Safaralighan K.K.
Office Administrator	:	P.M. Moideen
Audit Assistant	:	Suharabee A.A.

# CAMPUS FACILITIES



**Library**



**Canteen**



**Media lab**



**Dubbing studio**



**Coop Society**



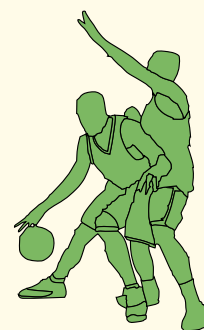
**College Bus**



**Language lab**



**Counseling Centre**



**Sports**

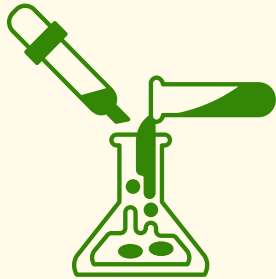


**Health club/yoga centre**

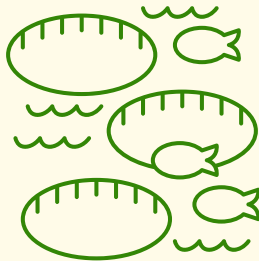




# CAMPUS FACILITIES



**Laboratories**



**Zoology/Aqua culture**



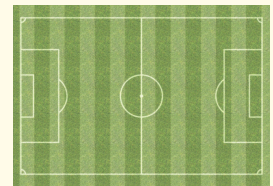
**Prayer Room**



**Research Room**



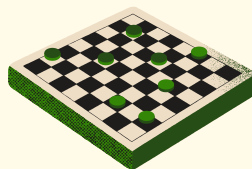
**Outdoor Gymnasium**



**Play Ground**



**Incubation Centre**



**Room for Board Game**



**Audio , visual Studio**



## National Service Scheme



Dr. Princy Francis,  
Dr. Ansar E.B  
9746568091  
9746227728

## National Cadet Corps



CAPT. Bindil. M.B.  
9847374706

## Anti Ragging Cell



Sri. Shibu A. Nair  
9846262611

## CLUBS, FORUMS, CELLS

### Women Development Cell



Smt. Nasreen. A  
9495871943

### SC/ST Cell



Sri. Sameer Khan. P  
9447515817.

### Career Guidance Cell



Smt. Mona V.M  
7736364688

### OBC Cell



Smt. Jameelathu. K.A  
.9895886131

### Minority Cell



Dr. Jaisy David  
9567181928

### ED Club & IEDC



Smt. Chithra P  
9847440933

### Internal Quality Assurance Cell



Dr. Shafeer P.S.  
98472 50464

**II**



Dr. Dhanya K  
9496129594

### **Science Forum**



Dr. Jisha. K.C  
9846514038

### **Bhoomithra Sena Club**



Dr. Amitha Bachan K.H  
9497627870

### **P.T.A**



Dr. Sefiya. K.M  
9495667609

### **Alumni Association**



Dr. K.P. Sumedhan  
9747949608

### **Computer Labs**



Smt. Jabin T.H  
9747724640

## **CLUBS, FORUMS, CELLS**

### **College Magazine**



Dr. Jaisy David  
9567181928

### **Health Club**



CAPT. Bindil. M.B.  
9847374706

### **Counselling Centre**

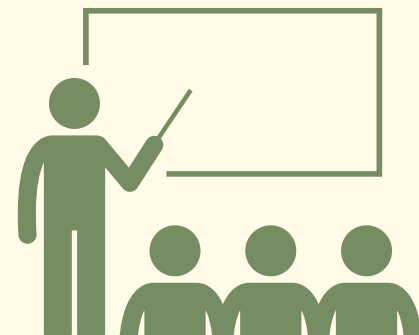


Sri.Lathif Penath  
9946238540

### **Mental Health Club**



Smt. Minsila Hilal  
9072131763







## B.Voc. FISH PROCESSING TECHNOLOGY



### **Department History**

The Department of Fish Processing Technology started in 2018 as part of the newly launched BVOC courses in the college to meet the increasing demand for well qualified and fish processing professionals required by the seafood industry. Since its inception, the department has been offering a BVOC course in Fish Processing Technology, a six semester (3 year) job-oriented course. It was an aided course in the first three years and college decided to continue it as a self-financing course since 2021-22 academic year. It is a course in which the students are given on-the-job training in various seafood processing plants in order to equip them for employment as successful researchers, managers and supervisors



## B.Voc. FISH PROCESSING TECHNOLOGY



### **VISION**

The course enables to provide a highly motivated and learned society of fisheries professionals within the limit of national and international regulation.

### **MISSION**

Transforming an enlightened society towards a broad development of fisheries there by becoming a participant in the food security of the nation.



## B.Voc. FISH PROCESSING TECHNOLOGY

### FACULTY DIRECTORY



**DR. SAYANA K . A.**  
Assistant Professor



**SUGAINA SULAIMAN M.S.**  
Assistant Professor



**UJJWALA NAVAS**  
Assistant Professor



**VAISHNA P U**  
Assistant Professor

## MESSAGE FROM HOD

As the Head of the Department, it is my great pleasure to extend a warm welcome to each of you as you embark on your journey in the field of fish processing. Your decision to pursue a degree in fish processing signifies a commitment to understanding and contributing to the sustainable utilization of aquatic resources. Throughout your academic journey, you will be exposed to a diverse range of topics, from the latest advancements in processing technologies to the intricacies of fisheries management. Our esteemed faculty members are dedicated to providing you with a comprehensive and enriching education that combines theoretical knowledge with practical skills. I look forward to witnessing your growth and success during your time in our department. Feel free to reach out to me or any faculty member if you have questions or need guidance. Together, let us make your educational journey at our institution both fulfilling and transformative

+91 96332 64761

DR. SAYANA K . A.





## COURSE OFFER



### **B.Voc. FISH PROCESSING TECHNOLOGY**



### **B.VOC FISH PROCESSING TECHNOLOGY**

#### **PROGRAMME OVERVIEW**

The B.Voc Fish Process Technology programme provides students with a comprehensive understanding of the various processes involved in fish processing, from harvesting to packaging. This vocational course focuses on equipping students with practical skills essential for the efficient and sustainable handling of fish resources through a blend of theoretical knowledge and hands-on training. Students learn about the principles of fish biology, processing techniques, quality control, and safety standards. The curriculum emphasizes the application of modern technology in fish processing, ensuring graduates are well-prepared for roles in the fisheries industry, contributing to the responsible and effective utilization of aquatic resources



## JOB PERSPECTIVE

Graduates of the B.Voc Fish Process Technology programme are well-positioned for a range of rewarding careers in the fisheries and seafood industry. They can pursue roles such as fish processing technician, quality control supervisor, seafood product development specialist, or production manager in fish processing units. With their expertise in handling and processing fish, graduates contribute significantly to ensuring product quality, adherence to safety standards, and the overall efficiency of fish processing operations. Additionally, they may find opportunities in research and development, working on innovative solutions for sustainable and responsible fish processing practices. The demand for skilled professionals in this field, coupled with the program's practical focus, makes B.Voc Fish Process Technology graduates valuable contributors to the thriving seafood industry





## B.Voc. FISH PROCESS TECHNOLOGY

### EXAMINATION INFORMATION

#### GRADING SYSTEM

Percentage of Marks (Both Internal & External put together)	Grade	Interpretation	Grade point Average (G)	Range of grade points	Class
95 and above	O	Outstanding	10	9.5 -10	First Class with Distinction
85 to below 95	A+	Excellent	9	8.5 -9.49	
75 to below 85	A	Very good	8	7.5 -8.49	
65 to below 75	B+	Good	7	6.5 -7.49	First Class
55 to below 65	B	Satisfactory	6	5.5 -6.49	
45 to below 55	C	Average	5	4.5 -5.49	Second Class
35 to below 45	P	Pass	4	3.5 -4.49	Third Class
Below 35	F	Failure	0	0	Fail
Incomplete	I	Incomplete	0	0	Fail
Absent	Ab	Absent	0	0	Fail

#### CRITERIA FOR PASS OR FAIL

In the event a candidate failing to secure 'P' grade in any Course in a semester, consolidation of SGPA and CGPA will be made only after obtaining 'P' grade in the failed Course in the subsequent appearance.





# SYLLABUS



## SEMESTER I

1.1	A01	ENG1 A01	3	4	15	60	75
1.2	A02	ENG1A02	3	4	15	60	75
1.3	A07	MAL1A07(3)	4	4	20	80	100
		HIN 1A07 (3)	4	4	20	80	100
		ARA1A07(3)	4	4	20	80	100
1.4	SDC1FI01	Fish Harvesting Technology	4	3	20	80	100
1.5	SDC1FI02	Basic microbiology	4	4	20	80	100
1.6	SDC1FI03	Technology of Food Preservation	4	4	20	80	100
1.7	SDC1FI04(P)	Taxonomy, Fisheries and Fishing Technology	4	3	20	80	100
1.8	SDC1FI05(P)	Basic microbiology	4	4	20	80	100

## SEMESTER II

2.1	A03	ENG2A03	4	4	20	80	100
2.2	A04	ENG2A04	4	4	20	80	100
2.3	A08	MAL2A08 (3)	4	4	20	80	100
		HIN 2A08 (3)	4	4	20	80	100
		ARA2A08(3)	4	4	20	80	100
2.4	SDC2FI06	Fish Biochemistry and Spoilage	3	4	15	60	75
2.5	SDC2FI07	Post-Harvest Handling of Fish	3	3	15	60	75
2.6	SDC2FI08	Food Safety in Seafood Industry	4	4	20	80	100
2.7	SDC2FI09(P)	Fish biochemistry	4	4	40	160	200
2.8	SDC2FI10(P)	Utilization of Shellfish Waste/Water Quality Status in Ice Plants	4	3	40	160	200



# SYLLABUS



## SEMESTER III

3.1	A11*	Biodiversity – scope and relevance	4	4	20	80	100
3.2	A12*	Research methodology	4	4	20	80	100
3.3	SDC3FI11	Fishery microbiology	3	3	15	60	75
3.4	SDC3FI12	Freezing Technology in Seafood Plants	4	4	20	80	100
3.5	SDC3FI13	Fishery By-products and Value Addition	4	4	20	80	100
3.6	SDC3FI14(PJ)	Project work/Field Visit/Study Tour	3	3	15	60	75
3.7	SDC3FI15	Operation Management in Fish Processing Plants	4	4	20	80	100
3.8	SDC3FI16(P)	By-products and value-added products	4	4	20	80	100

## SEMESTER IV

4.1	A13*	Natural resource management	4	4	20	80	100
4.2	A14*	Intellectual Property Rights	4	4	20	80	100
4.3	SDC4FI17	Thermal Processing of Fishery Products	4	4	20	80	100
4.4	SDC4FI18	Cured and Dried Fishery Products	4	4	20	80	100
4.5	SDC4FI19(P)	Fishery microbiology	4	4	20	80	100
4.6	SDC4FI20(P)	Biostatistics and Computer Applications	3	3	15	60	75
4.7	SDC4FI21(PJ)	Project work/Field Visit/Study Tour	3	3	15	60	75
4.8	SDC4FI22(PJ)	Traditional Methods of Fish Preservation/ Development of Value-Added Products	4	4	40	160	200







# SYLLABUS



## SEMESTER V

SDC5FI24(E01)	Instrumentation in Fish Processing Analysis	4	4	20	80	100
SDC5FI24(E02)	Fisheries Economics and Extension	4	4	20	80	100
SDC5FI24(E03)	Fisheries and Population Dynamics	4	4	20	80	100
SDC5FI25	Quality Control, Inspection and Certification in Seafood	4	4	20	80	100
SDC5FI26	Economics and Marketing in Seafood Trade	4	4	20	80	100
SDC5FI27	Packing and Labelling of Fish and Fishery Products	4	4	20	80	100
SDC5FI28(P)	Fish processing	4	4	20	80	100
SDC5FI29(P)	Quality control in seafood processing	4	4	20	80	100

## SEMESTER VI

6.1	SDC6FI30(TP)	Term paper	2		50	--	50
6.2	SDC6FI31	Project: A fish processing plant model preparation/ Microbiological quality of seafood exported from India	14		40	160	200
		Six months internship and a project (900 hrs)	14		40	160	200





## PROJECT REPORT

### PROJECT REPORT



- For doing the project, the student may choose any topic from the specified areas in syllabus.
- The candidate shall prepare and submit a project report to the Department.
- The report shall be in English with not less than 30 pages, printed or typed (A4 size paper, 1.5 line spacing, Times New Roman font, font size (12) and spiral bound.
- The project report should be submitted to the Head of the Department one week before the last working day of the specified semester, duly certified by the Guide.

#### PROJECT WORK SHALL HAVE THE FOLLOWING STAGES:

- PROJECT PROPOSAL PRESENTATION
- FIELD WORK AND OR LABORATORY PROCEDURE
- DATA ANALYSIS
- REPORT WRITING
- DRAFT PROJECT REPORT PRESENTATION
- FINAL PROJECT REPORT SUBMISSION







- The project can be done individually or as a group of five students (maximum) on the same topic and present the report. However, the project supervisor should make sure that each supervisor shall keep a diary in which the chronological record of the students visit to the supervisor for the project discussions shall be maintained. The work of each student shall be guided by one Faculty member.
- The candidate shall prepare at least two copies of the report; one copy for submission to the Department and another copy for the student which he/she has to bring with him/her at the time of viva voce. More copies may be prepared if the organization or the guide or both ask for.
- Duration of project work: The duration of the project work shall be one semester.
- A certificate showing the duration of the project work shall be obtained from the supervising teacher or from the organization for which the project work was done and it shall be included in the project report.

### **STRUCTURE OF THE REPORT TITLE PAGE**

Declaration of the student Certificate from the supervising teacher / organization (for having done the project work) Acknowledgements

#### **CONTENTS:-**

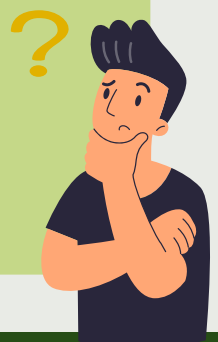
Chapter I : Introduction (Organization profile, Research problem, Objectives of the study, Research methodology etc.)

Chapter II : Review of Literature

Chapter III : Materials and Methods

Chapter IV : Results and discussion

Chapter V : Conclusion.





## EVALUATION OF PROJECT REPORT

The project report shall be subject to internal and external evaluation. The internal evaluation shall be carried out by the supervising teacher and external evaluation is done jointly by the internal examiner and the external examiners appointed by the University inclusive of Viva-voce examination. The marks should be awarded on the basis of the following:-

- **Evaluation of the Project Report shall be done under Mark System.**
- **Marks secured for the project will be awarded to candidates, combining the internal and external Marks.**
- **The internal to external components is to be taken in the ratio 1:4.**  
**Assessment of different components may be taken as below:**

<b>Marks Distribution</b>	<b>External</b>	<b>Internal</b>
Theory/ Algorithm/Flow diagram	40	5
Implementation	80	20
Result/Output	20	5
Record	10	5
Viva	10	5
<b>Total</b>	<b>160</b>	<b>40</b>





- **Submission of the Project Report and presence of the student for viva are compulsory for internal evaluation. No marks shall be awarded to a candidate if she/he fails to submit the Project Report for external evaluation.**
- **The student should get a minimum of 40 % marks in the aggregate and 40% separately for external for pass in the project**
- **There shall be no improvement chance for the Marks obtained in the Project Report.**
- **In an instance of inability of obtaining a minimum of 40% marks, the project work may be re- done and the report may be re-submitted along with subsequent exams through the department, as per the existing rule of the University examinations.**

### **VIVA-VOCE**

**Viva will be conducted on the Projects and internship. Based on the project reports and internship reports, viva voce will be conducted by the university with an external examiner. The Practical in charge teachers and training Coordinator will be charge of Viva. Marks will be awarded based on the report and their performance during trainings and students are supposed to clarify the queries regarding their internship.**

### **INDUSTRIAL VISIT**

**The third and fourth semester students of BVOC Fish Processing Technology programme shall be taken under the supervision of faculty members to research institutes or industrial units so as to enable them to have first-hand knowledge about the location, layout, managerial functions, process flow, laboratory procedures or any area of study as per curriculum. Study tour to an industrial/business centre will form part of curriculum. The report submitted by the student in this respect shall be considered for valuation by an external examiner appointed by the university.**



**PO = PROGRAM OUTCOME**  
**PSO = PROGRAM SPECIFIC OUTCOME**

- **PO.1. Create scientific knowledge and skills**
- **PO.2. Create ability for critical thinking**
- **PO.3. Able to systematic problem solving**
- **PO.4. Environmental awareness and social commitment**
- **PO.5. Human values and friendliness**
- **PO.6. Experience a comprehensive range of scientific and systematic techniques.**
- **PO.7. Supplement trained manpower in fisheries sector**
- **PO.8. Able to impart technical skill necessary in fishery industry**
- **PO.9. Create local and global solutions for the challenges in fishery sector**

- **PSO.1. Develop a mix of skills relating to a profession and appropriate content of General Education**
- **PSO.2. Able to achieve fisheries (food) sector opportunities at graduate**
- **PSO.3. Graduates apart from meeting the needs of local and national industry are also expected to be equipped to become part of the global workforce.**
- **PSO.4. Students have adequate knowledge and skills, so that they are work ready at each exit point of the programme**
- **PSO.5. Emphasis to Communication skill, Presentation skill, Health and Safety, Industrial Psychology, Environmental awareness, Entrepreneurship development and other relevant subjects in the field.**
- **PSO.6. Language skills enhances the employability outside the state**
- **PSO.7. Computer and network awareness helps to keep updated in the fisheries field**



# SYLLABUS

## GEC5EP12 Entrepreneurship in Food Industries

### Course Outcomes

- a) To understand and apply Types and trends in Entrepreneurial ventures in foods and nutrition
- b) To understand and apply Steps involved to start an entrepreneurial venture
- c) To understand and apply Funding sources in India for entrepreneurial venture

### Module I

Entrepreneurship in food service- Definition and meaning of entrepreneurship-Types, Classification and trends of Entrepreneurial ventures in foods and nutrition- Qualities and skills of an entrepreneur. Resources required for a business- Project formulation, evaluation and feasibility analysis.

### Module II

Idea generation- Market research- Project selection- Project evaluation using appropriate industry standards-Business planning-Importance, purpose and efficiency of a plan-Business acquisition, franchising and outsourcing-Legal, ethical and environmental considerations of the entrepreneurial venture-Overview of business regulation by the government-Inspection, Licensing-Patent, trademark and intellectual property rights registration and accreditations.

### Module III

Financial considerations of entrepreneurship funding for the business proposal- Government and non-government opportunities for funds and resources. Franchising opportunities. Product pricing and profit generation-Tools of analysis of costing, cost control and budgeting. Investing resources into the business

### References:

1. Kotler, P. (2003) Marketing management 11th ed. Pearson Education (Singapore) Pte. Ltd. Delhi
2. Agarwal, T. (2007) Strategic human resource management Oxford University Press New Delhi.
3. Aswathappa, K. (2005). Human resource and personnel management – Text and Cases Tata McGraw – Hill Publishing Co. Ltd. New Delhi.
4. Boyd, H.W., Walker, O.C. and Larreche, J. (1995) Marketing management – A strategic approach with a global orientation 2nd ed. Irwin Chicago.



# SYLLABUS

5. Cartwright, R., Collins, M., Green, G. and Candy, A. (2001). The handbook for managing resources and information Infinity books, New Delhi.
6. Ivancevich, J.M., Donnelly, J.H. and Gibson, J.L. (1996). Management – principles and functions (4th ed.) All India Traveller Bookseller. Delhi.
7. Kale, N.G. (2003) Principles and practice of marketing. Vipulprakashan – Mumbai.

## SDC1FI01 Fish Harvesting Technology

- C01 To learn about Indian Marine Fishery Resources
- C02 To learn about Indian Inland Fishery Resources
- C03 To make an understanding on Different kinds of fishing crafts and gears and its operations
- C04 To learn Fishing methods followed in India

### Module I

Fisheries resources of India, potential and trends in fish production, EEZ and FAO's code of conduct of responsible fisheries. Marine capture fisheries, fishery of commercially important pelagic and demersal fishes, crustaceans and molluscs.

### Module II

Oceanic and deep-sea fisheries resources. Inland capture fishery resources and production in India. Fisheries in major riverine systems, estuaries, reservoirs and lakes of India. Cold water fisheries of India.

### Module III

Fishing Crafts and Gears: Classification of fishing crafts; Dimensions and design of boats; Safety and stability of fishing boats; Care and maintenance of boats; Fishing accessories and deck equipments; Types of marine engines.

### Module IV

Fishing methods of India. Modern commercial fishing methods- trawling, purse seining, gill netting and long lining. Classification of gears. Preservation of fishing gears.

### References:

1. Balachandran, K.K, Post-Harvest Technology of fish and fish products.
2. Shahul Hameed, M, Boopendranath M. R, Modern fishing gear technology.





# SYLLABUS

3. Sen DP, Advances in Fish Processing Technology.
4. Jhingran V.G., Fish and Fisheries of India
5. Jhingran V.G. and Talwar S.K., Fisheries of India (Vol 1 &2).
6. Bal J and Rao S.R., Fishes of India.

## SDC1FI02 Basic microbiology

- C01 Identify and characterize the microorganisms associated with daily life
- C02 Recognize the significance of microorganisms in daily life
- C03 Analyse the conditions for microbial multiplication
- C04 Differentiate the microorganisms with their specific features
- C05 Application of microorganisms in industrial (food) basis
- C06 Identify the cause and sources of Food borne infections
- C07 Summarize the symptoms associated with microbial food infection
- C08 Apply the knowledge in reducing the risk associated with microbes in routine practice

### Module I

**Introduction to Microbiology** - Microbiology in daily life, Characteristics and morphology of bacteria, fungi, virus, protozoa & algae

### Module II

**Microbial Growth** – Growth curve, Effect of pH, Water activity, O<sub>2</sub> availability & temperature on the growth of microorganisms

### Module III

**Cultures and Media** – Different types of media- Selective media and differential media; Preparation of media – PDA media, Nutrient agar, Mac Conkey agar, Culturing techniques – Pour plate, spread plate and streak plate.

### Module IV

**Beneficial microorganisms** – SCP – Microorganisms used, raw materials used as substrate, condition for growth and production, nutritive value and use of SCP, Microorganisms of industrial importance, biomass, fermentation, enzymes & hormones, Antibiotics & Vaccines, Microorganisms & effluent treatment



# SYLLABUS

## Module V

Foodborne Diseases- Types – foodborne infections, foodborne intoxications and toxic infection. Common and recent examples – Botulism, Typhoid and Paratyphoid, Clostridium perfringens, Listeriosis, Salmonellosis, Shigellosis etc.,

### References:

1. Frazier William C and Westhoff, Dennis C. Food Microbiology, TMH, New Delhi, 2004
2. Jay, James M. Modern Food Microbiology, CBS Publication, New Delhi, 2000
3. Garbutt, John. Essentials of Food Microbiology, Arnold, London, 1997
4. Pelczar MJ, Chan E.C.S and Krieg, Noel R. Microbiology, 5th Ed., TMH, New Delhi, 19.

## SDC1FI03 Technology of Food Preservation

- C01 To understand Types of foods and its preservation
- C02 To learn Food preservation methods by low temperature
- C03 To learn Food preservation methods by high temperature
- C04 To learn Methods of food preservation by controlling moisture
- C05 To learn Methods of food preservation by applying irradiation

## Module I

Definition of food, classification of foods- based on origin, pH, nutritive value, functions of food, Health food, ethnic food, organic food, functional food, nutraceuticals, fabricated foods, convenience foods, GM food and space foods. Introduction to food preservation, Principles of Food Preservation, definition of shelf life, perishable foods, semi perishable foods, shelf-stable foods. Introduction to smoking

## Module II

Food Preservation by Low temperature- Introduction to Freezing and chilling cool storage and freezing, definition, principle of freezing, changes occurring during freezing, types of freezing i.e., slow freezing, quick freezing, introduction to thawing, changes during thawing and its effect on food different thawing methods

## Module III

Food Preservation by high temperature - Thermal Processing- Commercial heat preservation methods: Sterilization, commercial sterilization, Pasteurization, and blanching.



# SYLLABUS

## Module IV

Food Preservation by Moisture control- Drying and Dehydration - Definition, drying as a means of preservation, differences between sun drying and dehydration (i.e., mechanical drying), heat and mass transfer, factors affecting rate of drying, normal drying curve, names of types of driers used in the food industry. Evaporation – Definition, factors affecting evaporation, names of evaporators used in food industry.

## Module V

Food Preservation by Irradiation - Introduction, units of radiation, kinds of ionizing radiations used in food irradiation, mechanism of action, uses of radiation processing in food industry, concept of cold sterilization.

## References

1. B. Srilakshmi, Food science, New Age Publishers, 2002
2. Meyer, Food Chemistry, New Age, 2004
3. Bawa. A.S, O.P Chauhan et al. Food Science. New India Publishing agency, 2013
4. Frazier WC and Westhoff DC, Food Microbiology, TMH Publication, New Delhi

## SDC1FI04(P) Taxonomy, Fisheries and Fishing Technology

- C01 Identify and classify important fishes, molluscs and crustaceans.
- C02 Identify fishing implements.

### Experiments/ activities:

1. Identification of fishes up to species level- 20 nos. from different families
2. Identification of prawns of commercial importance
3. Identification of commercially important molluscs
4. Identification of traditional fishing gears
5. Different types of hooks
6. Identification of fishing accessories
7. Identification of synthetic and natural fibres
8. Artificial and live baits
9. Identification of modern gears
10. Fish detection devices - On board visit.



# SYLLABUS

## **Collection:**

1. Different commercially important fishes/ crustaceans/ molluscs

## **Field visit:**

1. Visit to fishing harbour

## **Institutional visit:**

1. Visit to CIFT, NIFPNATT, CIFNET etc.

## **SDC1FI05(P) Basic microbiology**

- C01 Basic rules and requirements of a microbiology laboratory
- C02 Give emphasis towards the preparation of biological stains, reagents, media and the composition.
- C03 To get thorough different methods for staining of microorganisms.

### **Module-1**

Microbiology laboratory basic rules and requirements. Laboratory rules- basic rules of a microbiology lab, basic requirements of a microbiological lab- common glass ware; test tube, culture tube and screw capped tubes, Petri dish, pipette, Pasteur pipette, glass spreader, inoculation needle, Bunsen burner, water bath, autoclave, laminar air flow, incubator, hot air oven, Quebec colony counter, centrifuge, microscope. Disposal of laboratory waste and culture.

### **Module 2**

Staining of microorganisms. Methods for detection of specific bacteria: wet mount preparation for motile bacteria, hanging drop mount method, Methods for staining of micro organism: Simple staining (Monochrome staining) Gram staining for differentiation of bacteria Negative staining of bacteria Endospore staining.

### **Module-3**

Composition, preparation and sterilization of media. PDA media Nutrient agar media Mac-Conkey agar media

### **Module-4**

Demonstration of techniques for pure culture of microorganisms. Streak plate method, Pour plate method, Serial dilution agar plate method.



# SYLLABUS

## References

1. Dubey, R.C. and Maheshwari, D.K. Practical microbiology. S.Chand and Company Limited, Ramnagar. New Delhi 2002.

## SDC2FI06 Fish Biochemistry and Spoilage

- C01 To understand and analyse Biochemical constituents in fish, Crustaceans and Molluscs
- C02 To understand and analyse fatty acid composition and its significance in fishes
- C03 To understand and analyse Carbohydrate , composition and its significance in fishes
- C04 To understand and analyse Causes and indices of seafood spoilage
- C05 To understand and analyse Post mortem changes occurring in chemical composition of fish muscle

### Module I

Biochemical constituents of fish, crustaceans and molluscs. Biochemistry of fish proteins, structure of fish muscles, effect of processing on proteins. On-protein nitrogenous compounds in fishes. Classification. Sarcoplasmic proteins, Myofibrillar proteins and Stroma proteins.

### Module II

Fatty acid composition of fish liver and body oils, auto-oxidation of fatty acids, rancidity, lipasas and phospholipases, pro- and anti-oxidants, oxidation indices, lipid-protein interactions, oxidized lipids-protein interactions and their impact on quality.

### Module III

Definition, classification and biological significance of carbohydrates; Chemical reactions; stereoisomerisms and mutarotation, structure and properties of monosaccharides, disaccharides, polysaccharides and mucopolysaccharides. Structure, functions and properties of nucleic acids; Structure of purines, pyrimidine; DNA and RNA; Flavour and pigments; amines, volatile fatty acids, carbonyls, sulphur containing compounds, carotenoids, isoprenoids in fish.



# SYLLABUS

## Module IV

Post mortem changes occurring in fish muscle. Chemical, microbial and enzymatic action during fish spoilage Stages of fish spoilage- Rigor mortis, Autolysis, microbial changes, Belly burst, Rancidity. Causative agents for fish spoilage. Role of bacteria in fish spoilage, Effect of temperature, pH, Oxygen, Salinity etc. on bacterial growth, methods of controlling spoilage

### References:

1. George, M.P. & Barbec, W.T., Seafood effects of Technology and Nutrition.
2. Joe, M. R. & Carrie, E.R, Food protein chemistry.
3. Lehninger, A.L., Principles of Biochemistry.
4. Michael Eskin N.A., Biochemistry of foods.
5. Owen, R.F., Food chemistry.
6. Pare J.R.J. & Belanger J.M.R., Instrumental Methods in Food Analysis.
7. Pomeranz, Y. & Meloan, C.E., Food Analysis Theory and Practice.
8. Ranganatha Rao, Textbook of Biochemistry.
9. Regenstein, J. M. & Regenstein C.E., Food Protein Chemistry.
10. Robert, G.A., Marine, Biogenic Lipids Fats and oils Vol.II.
11. Roy, E. M. & George, J.F., The sea food industry.
12. Roy, E.M., George, J.F. & Donn, R.W., Chemistry and Biochemistry of marine food.
13. Smith, E.L., *et al.*, The principles of Biochemistry.
14. Stewart K.K., Modern Methods of Food Analysis.
15. Whitaker, J.R. & Tannenbaum, Food Proteins, AVI Publishing Company.
16. Balachandran K.K., Post-Harvest Technology of Fish & Fishery Products.
17. Govindan T.K., Fish Processing Technology.
18. Chicheste C.O. and Graham H.D., Microbial Safety of fishery Products.





# SYLLABUS

## SDC2FI07 Post-Harvest Handling of Fish

- C01 To understand and apply Hygienic handling practices of fish on board
- C02 To understand and apply Methods and significance pre- treatment of fish on-board
- C03 To understand and apply Types of freezing techniques in seafood industry
- C04 To understand and apply Sanitary facilities in seafood industry

### Module I

Hygienic handling of fish on board fishing vessel and on shore, Manufacture and storage of ice, Quality of ice, Use of ice for handling, , Quality of water to be used in fish processing, Chlorination of water, Refrigerated sea water and Chilled sea water for fish preservation. Insulated containers for fresh fish transportation.

### Module II

Pre-treatment of fish-washing, gutting, filleting, beheading, peeling, deveining etc. Preservatives used in fishery industry: bio preservatives, chemical preservatives etc.

### Module III

Post-harvest losses in fish and seafood (main type of post-harvest fish losses, physical loss quality loss, losses due to insect infestation, economic losses, quality losses in post-harvest handling etc.) Post-harvest handling of low-value fish products and threats to nutritional quality, losses due to traditional processing.

### Module IV

Good manufacturing practices, Basics of Sanitation standard operating procedure, Sanitary and phytosanitary requirements for maintenance of quality during post-harvest handling of fish. Quality management of fish and fishery products

### References:

1. Connell, J.J, Control of fish quality.
2. Fennema, K, Powrie, W.D & Marth, E.H., Low Temperature Preservation of Foods and Living Matter.
3. Gopakumar K., Text Book of Fish Processing Technology.
4. Hall, G.M, Fish Processing Technology..



# SYLLABUS

## SDC2FI08 Food Safety in Seafood Industry

- C01 To understand and apply Microbial standards to be followed in seafood industry
- C02 To understand and apply Food borne pathogens associated with seafood
- C03 To understand and apply Isolation and identification of microorganisms associated with seafood
- C04 To understand and apply Quality control measures in seafood industry
- C05 To understand and apply Packaging materials and types for seafood products

### Module I

Microbiological standards in seafood industry. Sanitary measures adopted to reduce microbial load in fish. Food borne non- bacterial infections and intoxications: Aflatoxins, patulin, ochratoxin and other fungal toxins found in food.

### Module II

Food borne pathogens: Emerging food-borne pathogens. Water borne diseases. Bacteria of public health significance in fish/fishery products/environments *Salmonella*, *Clostridia*, *Staphylococcus*, *E. coli*, *Vibrio*, *Listeria*

### Module III

Hazard assessment in seafood (physical hazard: hooks, fishing nets, plastic, pieces of glass, wood, personal ornaments, biological hazard: pathogenic bacteria, viruses, and parasites, chemical hazard: pesticides, polychlorinated biphenyls (PCBs), heavy metals, veterinary medicines, dioxins, polycyclic aromatic hydrocarbons, marine biotoxins and biogenic amines) Risks and benefits of seafood consumption.

### Module IV

Quality control of Laboratories. Good Laboratory Practices (GLP). General requirements for a food laboratory. (Lay out, Environmental requirements, Safety requirements etc) laboratory safety rules cross-contamination. Norms for using antimicrobial systems in food processing and preservation. Food Safety, Risk analysis. risks associated with fish products.



# SYLLABUS

## References:

1. Chincheste, C.O and Graham, H.D, Microbial safety of Fishery products.
2. Frasier, W.C and Westhoff, D.C, Food Microbiology.
3. Jay, J.M. Van Nostrand. D., Modern Food Microbiology.
4. Amerine, M.A, Pangborm, R.M, Principles of sensory evaluation of food.
5. Connell. J.J, Control of fish Quality.
6. Sali A.J., Fundamental Principles of Bacteriology.
7. Schlegel, General Microbiology.

## SDC2FI09(P) Fish biochemistry

- C01 To learn to assess the biochemical composition of commercially available fish
- C02 To learn to assess the biochemical composition of fishery products

## Experiments

1. Estimation of moisture content by hot air–oven method
2. Estimation of crude fat content
3. Estimation of crude protein content by Micro-Kjeldahl method
4. Estimation of total ash content
5. Determination of soluble protein content by Lowry method
6. Determination of iodine number of a fat sample
7. Determination of saponification value of fats and oils
8. Estimation of glucose in a given sample

## Field visit:

Visit to fish processing plant and laboratory

## Institutional visit:

Visit to CIFT, NIFPNATT, CIFNET etc



# SYLLABUS

## SDC3FI11 Fishery microbiology

- C01 Identify the microorganisms associated with fish and fishery products
- C02 Summarize the sources of microorganisms in fish C03 Identify the product characteristics that entice the microbial growth
- C04 Identify the preventive measures to be adopted to reduce the microbial load in fish
- C05 Summarize the culture techniques for microorganisms associated with fishery products
- C06 Isolation and identification of microorganisms associated with fishery products
- C07 Rapid detection methods of microorganisms and its application in food industry
- C08 Understanding about different microbiological analysis methods
- C09 Summarize the microbiological sampling in seafood industry
- C010 Summarize the microbiological standards in seafood industry

### Module I

Introduction – Microbiology of Raw and Processed fish & shellfish, intrinsic and extrinsic parameters of fish that affect microbial growth.

### Module II

Sources of microorganism to fish –Micro flora associated with the habitat, body surface and internal organs of fish and shell fish. Sanitary measures adopted to reduce microbial load in fish.

### Module III

Cultivation of Microorganisms - qualitative and quantitative enumeration of Microorganisms, Total plate count, Coliforms-concept- indicator organism-MPN, estimation, isolation and identification of faecal coliforms, Salmonella, Vibrio, Streptococcus, Staphylococcus, Listeria spp. Rapid Methods of Detection of pathogens, General understanding about different microbiological methods. (FDA, CFIA, FSIS,AOAC).

### Module IV

Microbiological criteria for fish and Fishery products – Quality control and regulation for microbial quality of fish and shellfish, sampling for microbiological testing, microbiological standards for seafood products



# SYLLABUS

## Reference:

1. Chincheste, C.O and Graham, H.D. Microbial Safety of Fishery products,
2. Frasier, W.C and Westhoff,D.C Food Microbiology ,
3. Jay, J.M. Van Nostrand.D. Modern Food Microbiology
4. Amerine,M.A, pangborm,R.M Principles of sensory evaluation of food
5. Connell.J.J Control of fish Quality,
6. Sali A.J. Fundamental Principles of Bacterio
7. Schlegel General Microbiology
8. Maat A.G. and Wiley A Microbial Physiology
9. Pelezar Read and Chan Microbiology
10. Collins C.H. and Lyns P.M. Microbiological Methods
11. Lengeler Biology of Prokaryotes

## SDC3FI12 Freezing Technology in Seafood Plants

- C01 To understand and analyse Techniques and principles of freezing in seafood industry
- C02 To understand and analyse kinds of freezing techniques used in seafood industry
- C03 To understand and analyse Treatments of products prior to freezing
- C04 To understand and analyse Physical and chemical changes of stored frozen products
- C05 To understand and analyse Preparation and grading of the seafood for freezing
- C06 To understand and analyse Cold storage facilities of a seafood industry

### Module I

Freezing: Structure of water and ice, Influence of solutes on the structure of water and ice, freezing curve for fish. Determination of freezing points from time- temperature plots, calculation of freezing time, Crystallization, super cooling, crystal growth, eutectic point, location of ice crystals in tissue, physical changes during freezing.



# SYLLABUS

## **Module II**

Technological aspects of freezing. Different freezing methods, freezing of fishery products and the steps involved. Slow freezing vs Quick freezing. Different types of freezers- Air-blast freezers, Contact plate freezers, Spray and Immersion freezers, Other types of freezers, Freezing time and freezer operating temperatures.

## **Module III**

Chemical treatment prior to freezing: antioxidants, cryoprotectants and other additives, theories of cryopreservation, glazing. Frozen storage: Physical and chemical changes - freezer burn and recrystallisation, different types of recrystallisation.

## **Module IV**

Chemical changes in lipids, proteins and nucleotides, freeze denaturation and theories on denaturation, changes in pH, bacterial changes, sensory changes, texture, taste, odour, effect of post-mortem condition on sensory qualities.

## **Module V**

Filleting of fish, treatments, glazing, packaging and freezing. Processing of prawns, lobster, squid, cuttle fish, crab etc. for freezing. Freezing of shrimps in different styles like whole, HL, PD, PUD, CPD, Block and IQF products.

## **Module VI**

Arrangements within a cold storage, handling and stacking systems, space requirement, precautions to reduce temperature increase in a cold storage. Different methods of thawing frozen fish, advantages and disadvantages. Recent advances in fishthawing.

## **References:**

1. Balachandran, K.K., Post-harvest Technology of fish and fish products.
2. Cleland C Andrew, Food Refrigeration Processes.
3. Clucas, I.J., Fish Handling, Preservation and Processing in the Tropics.
4. Fennema, K. et al., Low Temperature Preservation of Foods and Living Matter.
5. Fennema, O.R., Principle of Food Science.
6. Gopakumar K., Text Book of Fish Processing Technology.
7. Hall G.M., Fish Processing Technology.





# SYLLABUS

## SDC3FI13 Fishery By-products and Value Addition

- CO1 To understand, analyse and apply Nutritional importance of fish meal and quality requirements
- CO2 To understand, analyse and apply Nutritional importance of fish oil and methods to impart stability to fish oils on storage
- CO3 To understand, analyse and apply Shrimp waste, crab shell and squilla utilization
- CO4 To understand, analyse and apply Fish protein concentrate
- CO5 To understand, analyse and apply Fish silage
- CO6 To understand, analyse and apply Miscellaneous by-products
- CO7 To understand, analyse and apply Production and trend of value-added products

### Module I

Nutritional importance of fish meal and quality requirements -Raw material quality and changes during processing and storage. Production of fish meal - dry and wet process, machinery, control of quality of products, specifications, packaging and storage.

### Module II

Fish body and liver oils. Nutritional importance of fish oil and methods to impart stability to fish oils on storage, Unsaponifiables in fish liver oils. Enzyme hydrolysis of fish, fish hydrolysates, fish peptones, hydrolysates enriched food beverages

### Module III

Shrimp waste, crab shell and squilla utilization: Resources and composition, conventional uses, feeds and manure, conversion to useful materials like chitin, chitosan, glucosamine hydrochloride, shrimp extract, commercial production, production and use of protein isolates from squilla and shrimp waste.

### Module IV

Fish protein concentrate: Different methods of production, functional properties, different types of FPC, texturised products and comparison of FPC to fish meal. Production of fish flour, quality standards and applications



# SYLLABUS

## **Module V**

Fish silage: Acid silage and fermented silage, advantages over fish meal, nutritional value of silage. Fish hydrolysates: Production and utilization, biochemical composition and importance in food and nutrition.

## **Module VI**

Miscellaneous by-products: Fish maws, shark liver oil, squalene, ambergris, shark skin, shark cartilage, isinglass, pearl essence, fertilizer, beche-de-mer, fish glue, agar agar, alginic acid, carrageenan. Extraction of collagen from fish processing wastes, properties and application. Preparation of biological membranes using collagen and chitosan for biomedical applications.

## **Module VII**

Value Added Products: Present market trends, scope of value addition, Types of value addition, Important value-added products. Coated products – Principles and type of coating, Coating functions, in gradients, Batter classification, Mechanical properties of batter, Bread crumbs, Flavorings, Seasonings and Hydrocolloids in coatings, Fat and oils in coated food, Application of batters and breading to seafood.

## **References**

1. Balachandran, K.K., Post Harvest Technology of fish and fish products.
2. Gopakumar K., Text Book of Fish Processing Technology.
3. Hall, G.M., Fish Processing Technology.
4. Hui, Y.H., M.D. Pierson & J.R. Gorham Food borne Disease
5. Wheaton & Lawson, Processing Aquatic Food Products.
6. Windsor, M. & Barlow, Introduction to Fishery Byproducts, Fishing



# SYLLABUS

## SDC3FI15 Operation Management in Fish Processing Plants

- C01 To understand, analyse and apply Fundamentals of processing plant design and lay-out
- C02 To understand, analyse and apply Preventive maintenance of machinery and equipment of fish processing plants
- C03 To understand, analyse and apply Legislation and standards of effluent discharge
- C04 To understand, analyse and apply Measurement techniques and instruments used in seafood industry
- C05 To understand, analyse and apply Mechanisms and modes of fishery extension and their impact on capture fisheries and fisher livelihoods

### Module I

Plant design: Fundamentals of processing plant design: Site selection, design and preparation of layout of processing plants - freezing plant, cold storage, canning plant, dryers etc. Site building, water supply, equipment and clothing.

### Module II

Preventive maintenance of machinery and equipment of fish processing plants, IQF, Canning plant, sausage plant, artificial dryers, smoking chambers etc., safety controls for freezing and canning plant.

### Module III

Effluent treatment: Legislation and standards of effluent discharge, water pollution control measures in the food industry, waste water treatment process; dissolved air flotation, sedimentation, chemical treatment, biological treatment, aeration, carbon adsorption, granular media filtration and sludge handling.

### Module IV

Measurement techniques; Sensors, active and passive sensors, characteristic of sensors for the measurement of temperature, relative humidity, aw value, gel strength, moisture, freshness, pH, conductivity, DO, redox potential, salinity, air velocity, solar energy and brine concentration. Instrumentation techniques: General configuration of instrumentation system. Instrumentation for measurement of aw value, temperature, pH, freshness, gel strength, salinity, brine concentration. Thermometers: Different types of thermometers, characteristics and application.



# SYLLABUS

## Module V

Principles of fisheries extension. Mechanisms and modes of extension and their impact on capture fisheries and fisher livelihoods. National and international organization, institutions and agencies in fisheries extension. Seafood export promotion and organization involved. Role of co-operatives in fisheries.

### References:

1. Chupakhim and Dormenko., Fish processing equipments. MIRPublishers.
2. Heid & Joslyn., Food processing operations.
3. Slade., Food processing plants. Wheaton & Lawson., Processing Aquatic Food Products.

## SDC3FI16(P) By-products and value-added products development

- CO1 Prepare important value-added products
- CO2 Identify and/or prepare important fishery by products

### Experiments

1. Preparation of fish meal,
2. Preparation of FPC,
3. Preparation of fish oils,
4. Preparation of chitin,
5. Preparation of chitosan,
6. Preparation of glucosamine hydrochloride,
7. Preparation of fish maws,
8. Preparation of isinglass,
9. Preparation of agar,
10. Preparation of alginic acid
11. Preparation of FISH glue
12. Preparation of pearl essence
13. Preparation of fish sauce
14. Preparation of fish wafers
15. Preparation of fish fingers
16. Preparation of cutlets
17. Preparation of pickles



# SYLLABUS

## SDC4FI17 Thermal Processing of Fishery Products

- CO1 To understand and analyse Principles and concepts in thermal processing of fishery products
- CO2 To understand and analyse Sterility and pasteurization techniques of fishery products
- CO3 To understand and analyse Principles and method of canning process in seafood
- CO4 To understand and analyse Application of hurdle technology in preserving seafood products
- CO5 To understand and analyse Principles of irradiation process
- CO6 To understand and analyse Changes occurring in irradiated products

### Module I

Principles of thermal processing. Mechanism of heat transfer: conduction, convection, radiation and dielectric and microwave heating, heat resistance of bacteria and spores, decimal reduction time, thermal death time, "Z" and "F" values, 12D concept, heat penetration, cold point, determination of process time. F0 value, cook value, D value, integrated F value and their inter-relationship. Heating equipment.

### Module II

Classification of foods: low acid, medium acid and acidic foods, absolute sterility, statistical sterility, commercial sterility, pasteurisation and sterilisation.

### Module III

Canning process, steps involved, process flow, additives, HTST processing and aseptic canning, principles and process details, value added and ready to use canned products.

### Module IV

HACCP and Safety of canned foods and unreliability of post process sampling of canned foods to ensure sterilization. Thermo-bacteriology, death of bacteria, autosterilisation bacteriology of canned/heat processed fishery products, examination of cans and seams.



# SYLLABUS

## Module V

Hurdle technology: Combination with heat, heat and hydrostatic pressure, heat and low pH, heat and NaCl and nitrite, combination with ionising radiation, irradiation and hydrostatic pressure, irradiation and NaCl, irradiation and other adjuncts, heat and irradiation, irradiation and low temperature, low pH and specific acids, low aw and adjuncts like Nisin to reduce severity of heat processing.

## Module VI

Irradiation: Radiation sources, units, dose levels, radappertization, radicidation, radurization, effects of irradiation on protein, lipids, vitamins, bacteriological aspects, physical properties, shelf life and irradiated fish products.

## References:

1. Balachandran, K.K., Fish Canning Principles and Practices.
2. Gopakumar K., Text Book of Fish Processing Technology.
3. Hall, G.M., Fish Processing Technology.
4. Hersom, A. C & Hull and, E.D., Canned Foods.
5. Larousse, J & Brown, B.E., Food Canning Technology.
6. Stumbo, Thermo Bacteriology in Food Processing.
7. Thorne, S., Food Irradiation.
8. Venugopal, V., Seafood Processing.
9. Warne, D., Manual on Fish Canning.
10. Zeathen, P., Thermal processing and quality of foods.





# SYLLABUS

## SDC4FI18 Cured and Dried Fishery Products

- C01 To understand, analyse and apply water activity and sorption behaviours of foods
- C02 To understand, analyse and apply Principles of drying and dehydration
- C03 To understand, analyse and apply Curing of fish
- C04 To understand, analyse and apply Different types of curing
- C05 To understand, analyse and apply Fermented products

### Module I

Principles of drying and dehydration. Natural drying, solar drying and mechanical drying. Different types of dryers: tunnel drier, vacuum drier, drum drier, solar drier etc. Freeze drying, preparation and its nutritive value. Dehydration of fish products: dehydration ratio, precautions to be taken in fish drying; denaturation of fish protein. Recent trends in drying

### Module II

Cured fish, types of salt curing, use of salt, factors affecting salt uptake by fish, lean and fatty fish, whole, gutted or split open, type and size of salt crystals, source of salts and impurities salts, effect of impurities on salt penetration, temperature of salting.

### Module III

Smoke curing, chemistry of smoke, composition and properties, smoking methods: cold and hot method, use of smoke liquids, production of smoke, type of wood used, methods of smoke generation, carcinogens in smoke, smokekilns.

### Module IV

Fermented products: different methods of fermentation, indigenous products and their principles of preservation. Marinades: Principles; processing of cold, cooked and fried marinades, shelf life and spoilage. Fish and shellfish pickles: production, shelf life Packaging requirements for dry, cured and fermented products.



# SYLLABUS

## References:

1. Gopakumar K., Text Book of Fish Processing Technology
2. Hall, G.M., Fish Processing Technology.
3. Hui, Y.H., Merle D.P., & J R., Gorham Food borne Disease Handbook.
4. Oefjen, G.W., Haseky & Peter, Freezedrying.
5. Sen D.P., Advances in Fish Processing Technology.
6. Wheaton & Lawson, Processing Aquatic Food Products.

## SDC4FI19(P) Fishery microbiology

- CO1 Identify the microorganisms associated with fish and fishery products
- CO2 Summarize the sources of microorganisms in fish
- CO3 Identify the product characteristics that entice the microbial growth
- CO4 Identify the preventive measures to be adopted to reduce the microbial load in fish
- CO5 Summarize the culture techniques for microorganisms associated with fishery products
- CO6 Isolation and identification of microorganisms associated with fishery products

## Experiments

1. Basic microbiological techniques
2. Sterilisation- dry heat, moist heat, filtration, flaming, UV-irradiation
3. Preparation and sterilisation of media
4. Bacterial Handling Techniques, aseptic transfer of microbes
5. Estimation of bacterial population in water and fish- TPC
6. MPN
7. Isolation and maintenance of pure culture
8. Study of morphological characters, colony morphology, microscopic examination of micro organisms
9. Staining of bacteria, gram stain, spore stain, capsule stain



# SYLLABUS

10. Enrichment culture using selective media- Salmonella, vibrio.
11. Identification of E. coli, Staphylococcus, faecal streptococci
12. Growth of Fungi and yeast
13. Determination of mobility of bacteria

## **SDC4FI20(P) Biostatistics and Computer Applications**

- C01 Apply statistical techniques in fish population analysis, fish growth and fishery data
- C02 Use computer aided packages in handling of fisheries and aquaculture data.
- C03 Identify important computer hardware/storage devices/peripherals
- C04 Extract information from fishery databases

### **Experiments**

1. Study of computer components and external storage devices.
2. Formatting a document using word, use of mail merge
3. Use of internet to collect fisheries data - FAO, NACA, ICLARM etc.
4. Descriptive statistical analysis using excel; calculation of mean, median, mode, standard deviation, standard error using computer programmes/packages
5. t- test, Chi –square, F- test, one way ANOVA, Data analysis using computer analysis (excel, free softwares) Analysis of fisheries/ biological data using computer programmes/packages
6. Demonstration of FISHBASE

### **Projects**

1. Length weight analysis of a given fish using computer
2. Analysis of biological data using statistical tools and its representation using appropriate computer too



## SDC5FI23 Storage and Transportation of Fishery Products

- C01 To understand, analyse and apply Fish as raw material for processing
- C02 To understand, analyse and apply Changes in Fish muscle during freezing and in the cold storage
- C03 To understand, analyse and apply Layout and factors to be considered during storage
- C04 To understand, analyse and apply Types of cold storage in seafood industry
- C05 To understand, analyse and apply Various types of fish transport systems

### Module I

Quality of fish and Fishery products – Factors affecting quality of fresh fish, Chilled, Frozen and stored fish. Changes in Quality of fish and fishery products during cold storage

### Module II

Chill Storage - Methods used in chilling of fish, Factors affecting rate of chilling, Storage methods, Types of Ice, iced storage shelf life, physical, chemical, microbiological and sensory changes during chill storage, factors affecting spoilage in chill storage, cold shock, physical, chemical and sensory methods of analysis, advantages and disadvantages of chill storage of fish.

### Module III

Frozen storage – Storage conditions, factors to be considered during storage of frozen products, frozen storage shelf life, factors affecting the product quality in frozen storage, physical, chemical, microbiological and sensory changes during frozen storage, physical, chemical and sensory methods of analysis, advantages and disadvantages of frozen storage of fishery products



# SYLLABUS

## Module IV

Layout and factors to be considered during storage – processing unit Chill room facilities, functions of chill room, design and construction of cold storage, location, accessibility, spacing, structural support, temperature control, machinery, ventilation, measures for controlling flies and animals, lighting etc.,

## Module V

Various types of fish transport systems - Transportation: Live fish/shell fish, Transportation of raw fish to local markets and processing centres, Improvements needed in transportation, Refrigerated transport systems, Classification of transport vehicles, Cold chain.

## Module VI

Cold chain in Seafood Industry – importance, cold chain management of fishery products, temperature monitoring systems, cold chain in supply chain management.

## References:

1. Aitken, A., et al., Fish handling and processing.
2. Balachandran, K.K., Post harvest technology of fish and fish products.
3. Connell, J.J., Advances in fish sciences and technology. George, M.Hall., Fish processing technology

## SDC5FI24(E01) Instrumentation in Fish Processing Analysis

- C01 To understand Microscopy
- C02 To understand Probe meters for pH, temperature, chlorine check
- C03 To understand Chromatographic separation methods
- C04 To understand Blotting techniques
- C05 To understand PCR



# SYLLABUS

## **Module I**

Microscopy-Working principles of light microscopes (dark field and light field), fluorescent microscope, phase contrast microscope, and electronic microscope (TEM, SEM)

## **Module II**

pH meter, oxygen temperature probes, refractometer, Spectrophotometry- UV-visible, Flame Photometry and Atomic Absorption Spectrophotometry.

## **Module III**

High performance liquid chromatography and Chromatographic separation methods. Electrophoresis, isoelectric focusing. Immuno electrophoresis

## **Module IV**

Blotting techniques - Southern and northern blotting. ELISA- Indirect ELISA

## **Module V**

PCR-Principles and application in Fisheries for disease diagnosis. Microarrays- Principles

## **References:**

1. Macleod A.J., Instrumental methods of food analysis.
2. Anand C., Instrumental methods of chemical analysis.
3. Dtermann H., Gel Chromatography.
4. CRC series (vol I–III), Thin Layer Chromatography.
5. Connell J.J., Advances in Fishery Sciences and Technology.
6. Jones A, Read R and WeyersJ, Practical Skills in Biology.
7. Choudhary R., Biochemical Techniques.





# SYLLABUS

## SDC5FI24(E02) Fisheries Economics and Extension

- C01 Study basic economic principles
- C02 Understand the methods of business management
- C03 List the methods of Aquaculture extension and institutes/agencies concerned
- C04 Explain export procedures/policies

### Module I

Introduction and Basics of Business. Economics- definition, meaning and scope of economics with reference to fisheries. Basic concepts of economics- goods, services, wants, utility. Demand and supply, value price, individual demand and market demand, elasticity of demand, law of diminishing marginal utility.

### Module II

Business Management Nature and scope of business, meaning, definition, characteristics and functions of business. Requisites of a successful business, essential qualities of a good business man, Principles of management – characteristics, objective and levels of management. Functions of management – planning, organization, leading, staffing, direction, motivation, co-ordination and control. Types of management - marketing management, financial management, production management, administrative management, personal management and industrial relations. Different economic systems in operation- capitalism, communist economy and mixed economy. Classification of companies- sole, proprietorship, partnership, co-operative society, charter companies, public corporations and registered companies.

### Module III

Marketing and Economic Analysis. Marketing – Introduction, basic marketing functions, consumer behavior and demand concepts, different types of market, identifying and selecting markets, regulation of markets, advertising and sales promotion, organizing market surveys and test marketing of a new product. Fish marketing – prices and price determination of fishes. Marketing institutions – Primary institutions- producer fishermen, fishermen cooperatives and fisheries corporations. Secondary institutions – merchant middlemen, agent middlemen and speculative middlemen. Methods of economic analysis of business organizations – pay-back period, average rate of return, discounting method, net present value method, benefit cost ratio method and internal rate of return.



# SYLLABUS

## Module IV

Fisheries Economics. Aquaculture economics. Production function - the laws of returns, returns to scale. Average, marginal and total revenues. Pricing-various factors influencing the price of a product. its assumptions in aquaculture analysis. Least cost combination of inputs, laws of variable proportions. Cost and earnings of aquaculture systems – carp culture, different shrimp farming systems and hatcheries. Cost and earnings of mechanized and non mechanized fishing units and freezing plants. Socio- economic conditions of fishermen in India and Kerala. Contributions of fisheries to the national economy.

## Module V

Export of Fishery Products/ Export of fishery products from India- major countries, important products, role of CIFT and MPEDA in regulating quality and export of fishery products. Export documents and procedures. Prospects and constraints in export including tariff and non- tariff barriers, marine insurance, export incentives, registered exporters. Legislation on export inspection in India. Quality standards in India and major importing countries like USA, Japan and EU.

## Module VI

Fisheries Extension. Extension education – its meaning, importance and scope in fisheries. Various methods of extension – individual, group and mass methods, farm and home visits, seminars, discussions, exhibition and personal contacts.

## References

1. Mithani,D.M. Principles of Economics.
2. Stonier,A.W and Hague,D.C. A Textbook of Economic Theory.
3. Anderson,L.G.The Economics of Fisheries Management.
4. Shang,Y.C. Aquaculture Economics.
5. Korakandy,R. Technological Change and the Development of Marine Fishing Industry in India..
6. Ibrahim,P. Fisheries Development in India



# SYLLABUS

## SDC5FI24(E03) Fisheries and Population Dynamics

- C01 To develop basic knowledge about marine and inland fishery resources
- C02 To create awareness about relevant fisheries stock assessment methods

### Module 1

Riverine and Coldwater Fisheries. Inland fish production in India- Riverine fisheries – major river systems in India– riverine ecology- capture fisheries, fishing methods, major species captured, recent statistics of catches. Cold water fisheries- major species – rivers supporting cold water fisheries.

### Module 2

Reservoir and Estuarine Fisheries. Reservoir fisheries- Major reservoirs in India- reservoir ecology, capture fisheries, fishing methods, major species captured. Measures for increasing production from reservoirs in India and abroad. Estuarine fisheries- definition and classification of estuaries- capture fisheries, fishing methods, major species captured.

### Module 3

Marine Fisheries- Pelagic Resources. Marine fishery resources in India- important fishing zones including wedge bank, maritime states. Major pelagic resource groups– sardines, mackerel, anchovies, ribbon fishes, tuna, seer fishes etc. Methods of fishing - Recent catch statistics of pelagic fisheries.

### Module 4

Marine Fisheries- Demersal and Deep Sea Resources. Major demersal resource groups- elasmobranchs, cephalopods, silver bellies, flat fishes, crabs, sciaenids, pomfrets, bombay duck, prawns, lobsters, molluscan resources etc. Methods of fishing, recent catch statistics. Fishery of mud banks. Major deep sea resources - fishes, shrimps, lobsters – status of deep sea fishing in India. Chartered fishing in India- policies and problems. Marine fish production in India. - Estimated fishery resources – inshore – offshore - deep sea resource



# SYLLABUS

## Module 5

Population Dynamics. Stratified random sampling for estimation of fish landing. Concept of stock, recruitment, growth rate and mortality rate. Over fishing - maximum sustainable yield and maximum net economic yield. Conservation and regulation of fishing pressure - closed season, mesh size regulations, sanctuaries. Important fishing regulations.

### References

1. Bal,D.V. and Rao,K.V. Marine Fisheries
2. Samuel,C.T. Marine Fisheries in India.
3. Kurien,C.V. and Sebastian,V.O. Prawns and Prawn Fisheries of India.
4. Talwar.P.K. and Kacker,R.K. Commercial Sea Fishes of India.
5. CMFRI Bulletin No.36 Tuna Fisheries of the Exclusive Economic Zone of India.
6. Jhingran,V.G. Fish and Fisheries of India.
7. Saigal,K.L. and Jhingran.V.G. Cold Water Fisheries of India.
8. CMFRI. Bulletin No.42 Shell Fish Resources and Farming.
9. CMFRI. Bulletin Cephalopod Resources of the EEZ of India.
10. Marine Fisheries Information Service (MFIS) CMFRI Publications, Monthly.
11. Devaraj,M. Fish Population Dynamics Course Manual.

## SDC5FI25 Quality Control, Inspection and Certification in Seafood

- C01 To understand, analyse and apply Significance of quality control in food processing
- C02 To understand, analyse and apply Quality assessment of fish and fishery products
- C03 To understand, analyse and apply HACCP and Good manufacturing practices in seafood industry
- C04 To understand, analyse and apply Quality evaluation techniques for seafood
- C05 To understand, analyse and apply Seafood certification systems

## Module I

Introduction to quality control in food processing. Necessity of quality control. Food laws in India, integrated food law.



# SYLLABUS

## Module II

Quality management, total quality concept and application in fish trade. Quality assessment of fish and fishery products - physical, chemical, organoleptic and microbiological quality standards. - sensory evaluation of quality, general testing conditions, different sensory tests.

## Module III

HACCP and Good manufacturing practices. HACCP principles, practical aspects of planning and implementation, verification, validation and audit. HACCP based quality control systems in India.

## Module IV

Quality evaluation techniques for seafood: Physical, chemical, bacteriological and Instrumental methods of quality evaluation. Sensory evaluation. Quality standards: National and International – Codex, USFDA, EU norms, ISO, BIS etc. Standards for fish and fishery products

## Module V

Seafood certification systems, IDP and SAT formations in certification of export worthiness of fish processing units, regulations for fishing vessels, pre-processing and processing plants, EU regulations. ISO 22000:2006. Marine Stewardship Council, Green certification. Microbial quality standards for major importing countries like USA, Japan, EEC.

## References

1. Amerien M.A.*et.al*, .Principles of sensory evaluation of Food.
2. Anthony T.Tu., Handbook of Natural toxins. Marine Toxins and Venom.
3. Balachandran, K.K., Post- Harvest Technology of fish and fish products.
4. Brody J., Fishery Byproduct Technology.
5. Chicheste C.O. & Graham H.D., Microbial Safety of fish Products.
6. Connel J.J., Control of Fish Quality.
7. Desrosier N.W. & Treasler D.K, Fundamentals of Food Freezing.
8. Gopakumar K., Text Book of Fish Processing Technology.
9. Govindan T.K., Fish Processing Technology.
10. Hall, G.M., Fish Processing Technology.
11. Hui, Y.H .*et al.*, Food borne Disease.



# SYLLABUS

## SDC5FI26 Economics and Marketing in Seafood Trade

- C01 To understand and apply Definition, scope and role of fishery economics
- C02 To understand and apply Economic theories and growth models of fish resource development and exploitation
- C03 To understand and apply Functions of fish marketing, Markets and market structure
- C04 To understand and apply Supply Chain Management Concepts and Evolution
- C05 To understand and apply Developing marketing strategies
- C06 To understand and apply Price analysis determination of fish and fishery products

### Module I

Fishery economics: Definition, scope and role. Production economics catch and effort studies – methodological issues in the estimation of fish catch and fishing effort – dimensions of fishing effort – costs of and returns from fishing – cost components – employment and earnings of fishermen in relation to technological options – production function in marine capture fisheries

### Module II

Economic theories and growth models of fish resource development and exploitation; Fishery resource management; Maximum Sustainable Yield (MSY), Maximum and Net Economic Yield (M/NEY), Optimum Sustainable Yield (OSY), Static Maximum Economic Yield (SMEY), Dynamic Maximum Economic Yield (DMEY)

### Module III

Fisheries Marketing definition and scope, functions of fish marketing, Markets and market structure, Government and Co-operative in fisheries marketing, integration, marketing efficiency, marketing cost and price spread, marketing planning, marketing strategy, marketing research, Marketing infrastructure, Marketing regulations, constraints and approaches to fish marketing development.

### Module IV

Supply Chain Management Concepts and Evolution, value addition in fish marketing. Constraints and approaches to SCM in fisheries sector. Vertical integration and its effect on price determination. Domestic and external markets for fisheries products. Indian fisheries intervention.



# SYLLABUS

## References:

1. Phillip Kotler, Marketing Management.
2. Robert E Branson & Norvel,, Introduction to Agricultural Marketing
3. Ian Chaston,, Marketing.
4. Dennis Adeock, *et al.*, Marketing Principles and Practice.
5. Jolson,M.A., Marketing Management,
6. Amarchand & Varadharajan, B., An introduction to marketing,
7. Phillip Kotler& Gary Armstrong, Principles of Marketing.
8. G.E. Shephard., Agricultural Price Analysis.

## SDC5FI27 Packing and Labelling of Fish and Fishery Products

- C01 To understand, apply and analyse technological aspects of packaging fishery products
- C02 To understand, apply and analyse development of protective packaging for fishery products
- C03 To understand, apply and analyse Methods of testing for packaging materials for their physical properties
- C04 To understand, apply and analyse Types of packaging in seafood industry
- C05 To understand, apply and analyse national and international, legislation on labelling
- C06 To understand, apply and analyse Nutritional labelling and education act

### Module I

Food packaging, its purposes and procedures; technological aspects of packaging fishery products; packing of fresh and frozen fish for consumers; packaging for transport, shipping and institutional supplies; packaging standards for domestic and international trade.

### Module II

Packaging materials; basic films and laminates, their manufacture and identification; resistance of packaging materials; development of protective packaging for fishery products.





# SYLLABUS

## **Module III**

Methods of testing for packaging materials for their physical properties; containers and their testing and evaluation; package designs; resistance of packages to hazards in handling; transport and storage.

## **Module IV**

Modified atmosphere packaging, controlled packaging and aseptic packaging. Flexible packing, retort pouch processing of fish and fishery products principles and techniques. Combination and synergistic effects.

## **Module V**

Labelling and printing of packaging materials. Labeling requirements - national and international, legislation on labeling. Labeling for product traceability. Type of labeling for organic foods, specific foods like organic foods, GM foods, irradiated foods, vegetarian and non- vegetarian foods. Label design specification – size, colour.

## **Module VI**

Nutritional labelling and education act. The US/ International labelling requirements (Codex/ Indian standards for labelling). Food grade packaging materials. Major nutrients Minor nutrients, Essential nutrients. Antinutritional factors.

## **References:**

1. Balachandran K.K., Post Harvest Technology of Fish and Fishery Products.
2. Desrosier N.W. and Treasler D.K, Fundamentals of Food Freezing.
3. Govindan T.K., Fish Processing Technology.
4. Moorjani M.N., Fish Processing in India.
5. Brody J., Fishery Byproduct Technology.
6. Chicheste C.O. and Graham H.D., Microbial Safety of fishery Products.
7. Amerien M.A. et.al., Principles of sensory evaluation of Food.
8. Connel J.J., Control of Fish Quality.



## SDC5FI28(P) Fish processing

- C01 To study present day technologies involved in fish processing

### Experiments

1. Filleting of fish
2. Processing of Prawns, Lobster, Squid, Cuttle Fish, Crab etc. in different styles,
3. Packaging and Freezing,
4. Freezing curve
5. Determination of freezing point.
6. Studies on physical, chemical and sensory changes.
7. Evaluation of pasteurisation and sterilisation
8. Determination of TDT and F value
9. Examination of canned foods, can seams, testing sterility
10. Canning operations for different fish/shellfish products
11. Double seam profile, Heat Penetration Curve, FO Value, Z value, Process time,
12. Canning of table fishes, Bivalves, Crustaceans in different containers,
13. Examination of canned fishery products.
14. Preparation of dried, cured and fermented fish products
15. Examination of salt, protein, moisture in dried / cured products
16. Examination of spoilage of dried / cured fish products.

### Field visit:

Visit to fish processing plants

### Institutional visit:

Visit to CIFT, NIFPNATT, etc.



# SYLLABUS

## SDC5FI29(P) Quality control in seafood processing

- C01 To study evaluation of freshness of fish
- C02 To study evaluation spoilage in fish

### Experiments

1. Organoleptic analysis of fish and shell fish
2. Determination of total bacterial count in fishery products
3. Estimation of indicator bacteria and pathogens in fishery products
4. Isolation and identification of E. Coli, Staphylococcus, Vibrio, Salmonella, Listeria monocytogenes, Faecal streptococci, and Clostridium
5. Reactions in Triple Sugar Iron, Lysine Iron Agar, Indole. Methyl Red, VogusProskauer and Citrate (IMVIC) test. Urease test, Agglutination using polyvalent sera, Analysis of indole, total nitrogen, trimethyl amine (TMA)
6. Analysis of filth and other extraneous materials from sea food
7. Analysis of ice, water and fish contact surfaces
8. Estimation of percentage chlorine in hypochlorate solution, Peroxide value of fish oil, acid value or free fatty acids of fish oil and refractive index of fish oil.
9. Paper chromatography
10. Thin layer chromatography
11. Colorimetry
12. Refractometry
13. Centrifugation

### Field visit:

Visit to fishing harbour

### Institutional visit:

Visit to CIFT, NIFINATT, etc.



# SYLLABUS

## **SDC6FI30(TP) Term paper**

A research paper in fish processing technology which is eligible to publishing in UGC CARE listed journals.

### **Components in the manuscript**

1. Introduction
2. Review of literature
3. Materials and methods
4. Results and discussion
5. Conclusion
6. References

## **SDC6FI31 Six months internship and Project (900 hrs)**

Six months internship preferably in two phases i.e. (1) in-plant training in established seafood processing firms and (2) advanced training in seafood product development, quality evaluation etc. in reputed research institutes of central/state governments.

Since Internship and Project is considered as a single course having a common course code and course name, external examination is also conducted as single. But the evaluation (internal as well as external) should be done separately for internship and project. In the mark

sheet and Grade Card, the split up mark is to be shown. Distribution of marks will be in the following pattern: Internal Marks- 20 and External mark- 80 for both internship and project. If any student fails to do the Internship will be withheld until the internship requirement is met within 12 months from the completion of the course.



# GENERAL ADMISSION RULE



## GENERAL ADMISSION RULES

Admission to various UG and PG programs are conducted as per the university of Calicut rules in force. University conducts centralized allotment process (CAP) for both UG and PG programs and the candidates should register through the online portal provided by University of Calicut.

The seats for each aided program of this college will be distributed as open quota (40%), SC (15%), ST (5%), Community Quota (Only for Muslim Community) (20%) and Management quota (20%), For Self-financing programs, it is distributed as merit quota (50%) and Management quota (50%).

Students seeking admission under management quota should submit management quota form along with their application which are available from the college office. The students eligible for admission should accompany their parent/guardian during the interview.

- The candidates should produce the following documents in original before the principal of the college at the time of admission
- Admit Card
- The print outs of the application
- Receipt/Chalan of the Mandatory fee remitted for acceptance of allotment.
- Qualifying Certificate.
- Mark List(s) of the qualifying examination.
- Transfer Certificate received from the institution last studied.
- Conduct Certificate.
- S.S.L.C
- Those candidates who have passed examinations others than HSE/VHSE except CBSE/CISCE should produce Equivalency/Recognitions Certificate from University of Calicut.



**എം.ഇ.എസ്. അസ്മാബി കോളേജ്**  
**ഡിഗ്രി / പി.ജി. വിദ്യാർത്ഥികളുടെയും**  
**അവരുടെ രക്ഷകർത്താക്കളുടെയും ശ്രദ്ധയ്ക്ക്**



1. ഹൈക്കോടതി വിധിക്കനുസൃതമായി കോളേജ് കമ്പസിനുള്ളിൽ രാഷ്ട്രീയ പ്രവർത്തനം നിരോധിച്ചിരിക്കുന്നു. വിദ്യാർത്ഥികൾ കമ്പസിനുള്ളിൽ ഔദ്യോഗികമല്ലാത്ത ധാരതാര മീറ്റിംഗുകളും സംഘടിപ്പിക്കുവാനോ അവയിൽ പങ്കെടുക്കുവാനോ പാടില്ല.
2. ജൂനിയർ കുട്ടികളെ റാഗ് ചെയ്യുക, വാക്കുകൾ കൊണ്ടും പ്രവൃത്തികൊണ്ടും വേദനിപ്പിക്കുക, അധിക്ഷേപിക്കുക, അപമാനമായി പെരുമാറുക ഇവയെല്ലാം കഠിനശിക്ഷ ലഭിക്കുന്ന ക്രിമിനൽ പ്രവർത്തികളാണ്. ഇങ്ങനെയുള്ള പെരുമാറ്റങ്ങൾ കോളേജിൽ വെച്ചോ പുറത്തുവെച്ചോ ജൂനിയർ വിദ്യാർത്ഥികൾക്ക് ഉണ്ടായാൽ ഉടൻ തന്നെ പ്രിൻസിപ്പാളിനെ അറിയിക്കേണ്ടതാണ്.
3. ബുധൻ ഒഴികെയുള്ള എല്ലാ പ്രവൃത്തിദിവസങ്ങളിലും കോളേജ് യൂണിഫോം നിർബന്ധമാണ്. ടി ഷർട്ട്, ലോവേസ്റ്റ് ജീൻസ് / ട്രൗസർ, ഇറുകിപ്പിടിച്ച വസ്ത്രങ്ങൾ എന്നിവ ധരിച്ച് കമ്പസിൽ വരാൻ പാടില്ല.
4. വിദ്യാർത്ഥികൾ കോളേജിനുള്ളിൽ നിർബന്ധമായും ഐഡന്റിറ്റി റ്റാഗ് വ്യക്തമായി കാണത്തക്കവിധം ധരിച്ചിരിക്കണം.
5. പുകവലി, മദ്യപാനം, പുകയില, മയക്കുമരുന്ന് എന്നിവ കമ്പസിൽ കർശനമായി നിരോധിച്ചിരിക്കുന്നു.
6. കമ്പസിനുള്ളിൽ മൊബൈൽ ഫോൺ നിരോധിച്ചിരിക്കുന്നു. ഉപയോഗിക്കുന്നത് ശ്രദ്ധയിൽപെട്ടാൽ ഫോൺ പിടിച്ചെടുക്കുന്നതാണ്. യാതൊരുകാരണവശാലും മടക്കി നൽകുന്നതല്ല.
7. ക്ലാസ് സമയത്തിന് ശേഷം കാരണമില്ലാതെ കമ്പസിനുള്ളിൽ നിൽക്കുവാൻ അനുവദിക്കുന്നതല്ല.
8. പ്രിൻസിപ്പാളോ നിയമാനുസരണം സംഘടിപ്പിക്കപ്പെട്ട മറ്റു കമ്മറ്റികളോ കോളേജിൽ അച്ചടക്ക സംബന്ധമായും ദരണപരമായും കാലാകാലങ്ങളിൽ പുറപ്പെടുവിക്കുന്ന എല്ലാ നിയമങ്ങളും, നിർദ്ദേശങ്ങളും പാലിക്കാൻ ഞാൻ തയ്യാറാണ്.
9. കമ്പസിന്റെ ദിത്തികളിലോ, മതിലുകളിലോ എഴുതുന്നതും, പോസ്റ്റർ, സ്റ്റിക്കർ എന്നിവ പതിക്കുന്നതും കർശനമായി നിരോധിച്ചിരിക്കുന്നു.
10. ക്ലാസ് മുറിയിലെ മതിൽ, ഡെസ്ക്, ബെഞ്ച് എന്നിവയിൽ എഴുതുകയോ കേടുപാടുകൾ വരുത്തുകയോ, ചെയ്യരുത്. നിയമങ്ങൾ പാലിക്കാതെ വന്നാൽ എന്നെ കോളേജിൽ നിന്നും ഒരു വിശദീകരണവും കൂടാതെ പുറത്താക്കാൻ സമ്മതമാണ്.
11. വിദ്യാർത്ഥികളുടെ വാഹനങ്ങൾ പാർക്കിംഗിന് അനുവദിച്ച സ്ഥലത്ത് മാത്രം സ്വന്തം ഉത്തരവാദിത്വത്തിൽ സൂക്ഷിക്കുക.

**വിദ്യാർത്ഥി**

**രക്ഷകർത്താവ്**

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 ഒപ്പ്.....  
 തിയ്യതി.....

പേര്.....  
 ഒപ്പ്.....

സൂപ്രണ്ട്  
 (എം.ഇ.എസ്. അസ്മാബി കോളേജ്)

പ്രിൻസിപ്പാൾ  
 (എം.ഇ.എസ്. അസ്മാബി കോളേജ്)



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