॥ सा विद्या या विमुक्तये ॥

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड

'ज्ञानतीर्थ', विष्णुपुरी, नांदेड – ४३१ ६०६ (महाराष्ट्र राज्य) भारत

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

'Dnyanteerth', Vishnupuri, Nanded - 431 606 (Maharashtra State) INDIA

Established on 17th September, 1994, Recognized By the UGC U/s 2(f) and 12(B), NAAC Re-accredited with'B++' grade

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विद्यापीठ अनुदान आयोगाने शैक्षणिक वर्ष २०२०–२१ पासून मान्यता दिलेल्या बी.व्होक कोर्सेसच्या II year चे अभ्यासक्रम शैक्षणिक वर्ष २०२१–२२ पासून लागू करणे बाबत.

प रि प त्र क

या परिपत्रकान्वये सर्व संबंधितांना कळविण्यात येते की, विद्यापीठ अनुदान आयोगाने मान्यता दिलेल्या बी. व्होक. पदवी अभ्यासक्रमास अभ्यासमंडळानी केलेल्या शिफारशीनुसार द्वितीय वर्षाचे अभ्यासक्रम शैक्षणिक वर्ष २०२१–२२ पासून लागू करण्याबाबत मा. कुलगुरू महोदयानी मा. विद्यापरिषदेच्या मान्यतेच्या अधीन राहून मान्यता दिली आहे. त्यानुसार खालील अभ्यासक्रम लागू करण्यात येत आहेत.

1. B. Voc. Horticulture and Post-Harvest Technology. II year
5. B. Voc. Herbal Medicine II year
6. B. Voc. Agriculture/Commercial Aquaculture. II year
7. B. Voc. Food Processing/Food Processing Technology./Food Processing and Technology II year

सदरील परिपत्रक व अभ्यासक्रम प्रस्तुत विद्यापीठाच्या **www.srtmun.ac.in** या संकेतस्थळावर उपलब्ध आहेत. तरी सदरील बाब ही सर्व संबंधितांच्या निदर्शनास आणून द्यावी. ही विनंती.

स्वाक्षरित

सहा.कुलसचिव

शैक्षणिक (१–अभ्यासमंडळ) विभाग

जा.क्र.:शैक्षणिक–१/परिपत्रक/व्होकेशनल अभ्यासक्रम/N-२०२१–२२/३६२

दिनांक : १९.०४.२०२२

प्रत माहिती व पुढील कार्यवाहीस्तव :

१) मा. अधिष्ठाता, विज्ञान व तंत्रज्ञान विद्याशाखा, प्रस्तुत विद्यापीठ.
२) मा. संचालक, परीक्षा व मूल्यमापन मंडळ यांचे कार्यालय, प्रस्तुत विद्यापीठ.
३) प्राचार्य, सर्व संबंधित संलग्नित महाविद्यालये, प्रस्तुत विद्यापीठ.
४) अधिक्षक, परीक्षा विभाग विज्ञान विद्याशाखा, प्रस्तुत विद्यापीठ.
६) सिस्टम एक्सपर्ट, शैक्षणिक विभाग, प्रस्तुत विद्यापीठ. यांना देवून कळविण्यात येते की, सदरील परिपत्रक विद्यापीठ संकेतस्थळावर प्रसिध्द करण्यात यावे.

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

स्वामी रामानंद तीर्थ मराठवाडा विद्यापीठ, नांदेड.

UGC Sanctioned Vocational Course

Syllabus for

Certificate, Diploma, Advanced Diploma and B.Voc Degree

in

Commercial Aquaculture

(CBCS Pattern)

Second Year - Semester III & IV

(w.e.f. 2021-22)

Faculty: Science and Technology

Table: Indicating Eligibility, Duration, Total Credits.

Exit Points /Awards	Eligibility	Normal Duration	Skill Component Credits	General Education Credits	Total Credits for Award	NSQF Level	Medium of instruction
Certificate	12th pass or Diploma in relevant field after 10th	One semester	18	12	30	4	English
Diploma		Two semester	36	24	60	5	
Advanced Diploma		Four semester	72	48	120	6	
B. Voc Degree		Six semester	108	72	180	7	

About the Course:

Government of India, taking note of the requirement for skill development among students launched National Vocational Education Qualification Framework (NVEQF) which was later on assimilated into National Skills Qualifications Framework (NSQF). Various Sector Skill Councils (SSCs) are developing Qualification Packs (QPs), National Occupational Standards (NOSs) and assessment mechanisms in their respective domains, in alignment with the needs of the industry.

In view of this, the UGC implemented the scheme of Community Colleges from 2013-14 in pilot mode on the initiative of the MHRD. Thereafter, realizing the importance and the necessity for developing skills among students, and creating work ready manpower on large scale, the Commission decided to implement the scheme of Community Colleges as one of its independent schemes from the year 2014-15. The Commission also launched another scheme of B.Voc. Degree programme to expand the scope of vocational education and also to provide vertical mobility to the students admitted into Community Colleges for Diploma programmes to a degree programme in the Universities and Colleges. While these two schemes were being implemented, it was also realized that there is a need to give further push to vocational education on a even larger scale. Accordingly, 'Deen Dayal Upadhyay Centres for Knowledge Acquisition and Upgradation of Skilled Human Abilities and Livelihood (KAUSHAL)' was also incorporated. Since all these three provisions serve a common purpose, all these schemes are merged into a single scheme for providing skill based education under National Qualification Framework.

Type of Courses and Awards:

There will be full time credit-based modular programmes, wherein banking of credits for skill and general education components shall be permitted so as to enable multiple exit and entry. The multiple entry and exit enables the learner to seek employment after any level of Award and join back as and when feasible to upgrade qualifications / skill competencies either to move higher in the job profile or in the higher educational system. This will also provide the learner an opportunity for vertical mobility to second year of B.Voc degree programme after one year diploma and to third year of B.Voc degree programme after a two year advanced diploma. The students may further move to Masters and Research degree programmes mapped at NSQF Level 8 – 10.

Aims and Objectives:

The aims and objectives of the Vocational programme under NSQF are;

(i) To provide judicious mix of skills relating to a profession and appropriate content of general education.

(ii) To ensure that the students have adequate knowledge and skills, so that they are work ready at each exit point of the programme.

(iii) To provide flexibility to students by means of pre-defined entry and multiple exit points.

(iv) To integrate NSQF within the undergraduate level of higher education in order to enhance employability of the graduates and meet industry requirements.

(v) Such graduates apart from meeting the needs of local and national industry are also expected to be equipped to become part of the global workforce.

(vi) To provide vertical mobility to students coming out of 10+2 with vocational subjects and Community Colleges.

The Objectives of the B.Voc. in Commercial Aquaculture:

(i) To provide an updated education to the students in order to know the importance and scope of the discipline and to provide mobility to students from one university or state to other.

(ii) To develop a scientific attitude to make students open minded, critical and curious.

(iii) To develop an ability to work on their own and to make them fit for the society.

(iv) To develop skill in field work, experiments, equipment and laboratory use along with collection and interpretation of materials and data.

(v) To make aware of natural resources and environment and the importance of conserving the same.

(vi) To develop ability for the application of the acquired knowledge in the relevant fields so as to make our country self-reliant and self-sufficient.

Outcome of the course:

(i) This Program in commercial aquaculture will produce manpower with good expertize, knowledge and skills in the field of aquaculture and allied activities.

(ii) The program will impart education and skills with respect to aquaculture at different levels diploma, advance diploma, degree.

(iii) The certificate level of B. Voc. in commercial aquaculture will impart expertise and

knowledge with respect to general fisheries information, identification of different fish species, principle activities of aquaculture and aquatic ecology and its conservation.

(iv) The diploma level of B. Voc. in commercial aquaculture will impart expertise and knowledge of fish biology, freshwater aquaculture and aquaculture engineering in addition to the certification level.

(v) The advance diploma level of B. Voc. in commercial aquaculture will impart expertise and knowledge with respect to fish seed production, anatomy & physiology of fishes, soil & water quality management, fish nutrition & feed technology and fish preservation in addition to diploma level.

(vi) The degree level of B. Voc. in commercial aquaculture will impart expertise and knowledge with respect to fish disease management, ornamental fisheries, value added fish products and fish genetics & biotechnology in addition to advance diploma level.

(vii) This program allows the students for different techniques, recent trends, innovation in aquaculture and hands on laboratory as well as on farm skills in order to serve as human resource for fisheries and allied sectors at different entry and exit level.

(viii) This skill oriented programs will provide career opportunities and self-employment through entrepreneurship development of their own enterprises in aquaculture and its allied sectors.

Swami Ramanand Teerth Marathwada University, Nanded

Syllabus structure for,

Certificate, Diploma, Advanced Diploma and B.Voc Degree in Commercial Aquaculture

	Paper No.	Course Number	Course Title	Hr/ Week	Type of Course	Credits	Marks		Total
							ESA	CIA	
Sem. III		**General Education Component**							
	Paper-XIX	BAAGE-237	ICT-Skill	4	GE	4	75	25	100
	Paper-XX	BAAGE-238	Entrepreneurship Development	4	GE	4	75	25	100
	Paper-XXI	BAAGE-239	*Activity based on Paper-XIX & XX	1	GE	1	-	25	25
		Skill Courses							
	Paper-XXII	COMAQ-2310	Fish Breeding and Hatchery Management	4	CC	4	75	25	100
	Paper-XXIII	COMAQ-2311	Anatomy and Physiology of fishes	4	CC	4	75	25	100
	Paper-XXIV	COMAQ-2312	Soil and Water Quality Management in Aquaculture	4	CC	4	75	25	100
		Practical Skill Courses							
	Paper-XXV	Practical Based on COMAQ-2310		2	PR	2	50	-	50
	Paper-XXVI	Practical Based on COMAQ-2311		2	PR	2	50	-	50
	Paper-XXVII	Practical Based on COMAQ-2312		2	PR	2	50	-	50
	Paper-XXVIII	Report on Summer Activity		-	PR	3	75	-	75
	Paper No.	**Course Number**	**Course Title**	**Hr/ Week**	**Type of Course**	**Credits**	**Marks**		**Total**
							ESA	**CIA**	
Sem. IV		**General Education Component**							
	Paper-XXIX	BAAGE-2413	Agriculture Extension	4	GE	4	75	25	100
	Paper-XXX	BAAGE-2414	Agriculture Business Management	4	GE	4	75	25	100
	Paper-XXXI	BAAGE-2415	*Activity based on Paper-XXIX & XXX	1	GE	1	-	25	25
		Skill Courses							
	Paper-XXXII	COMAQ-2416	Fish Nutrition and Feed Technology	4	CC	4	75	25	100

	Paper-XXXIII	COMAQ-2417	Coastal Aquaculture & Mariculture	4	CC	4	75	25	100
	Paper-XXXIV	COMAQ-2418	Fish Preservation and Refrigeration	4	CC	4	75	25	100
		Practical Skill Courses							
	Paper-XXXV	Practical Based on COMAQ-2416		3	PR	3	50	25	75
	Paper-XXXVI	Practical Based on COMAQ-2417		3	PR	3	50	25	75
	Paper-XXXVII	Practical Based on COMAQ-2418		3	PR	3	50	25	75
Summer		**Compulsory Activity: 2 Months Industrial Training during Summer Vacation**							

Note:

1. The ESA part of practical and Industrial Project should be completely assessed and evaluated by external examiner.
2. The external examiner should be appointed for practical and industrial training ESA part.
3. * Sign denotes that internal assessment should be based on seminar/Interview skill/expected component of the course.
4. Student should submit the Report based on summer industrial training.
5. For VI semester students can opt Elective-I or Elective-II pattern.
6. Student should submit the certificate of three months industrial training from respective industries.

ESA: End Semester Assessment,

CIA: Continues Internal Assessment,

GE: General Education Component,

CC: Core Skill Courses,

PR: Practical Skill Courses,

CIA of 25 Marks (Theory): 15 Marks for college level internal test & 10 Marks for Assignment,

CIA of 25 Marks (Practical): 15 Marks for college level internal practical test & 10 Marks for Record Book and Field Note Book submission.

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Certificate, Diploma, Advanced Diploma and B.Voc Degree (Agriculture and Allied Faculties)

Second Year (Semester III)

Paper-XIX: ICT-Skill (BAAGE-237)

Maximum Marks: 100 **Credits: 4** **Periods: 45**

Unit I:

IT and its importance. IT tools, IT-enabled services and their impact on society; computer fundamentals; hardware and software; input and output devices; Types of Memory, Units used for measurement of memory. Features of machine language, assembly language, high-level language and their advantages and disadvantages;

Unit II:

Principles of programming- algorithms and flowcharts; ER diagram. Operating Systems, definition and types; introduction to WINDOWS and LINUX Operating Systems;

Unit III:

Audio visual aids - definition, advantages, classification and choice of A.V aids; cone of experience and criteria for selection and evaluation of A.V aids; video conferencing. Communication process, feedback and barriers to communication.

Unit IV:

Database, concepts and types, uses of DBMS/RDBMS in Agriculture Database design. Smartphone Apps in Agriculture for farm advises, market price, postharvest management etc; Geospatial technology for generating valuable agri information Decision support systems, concepts, components and applications in Agriculture, Agriculture Expert System, Soil Information Systems etc. for supporting Farm decisions Communication process, feedback and barriers to communication.

Reference books:

1. Gurvinder Singh, Rachhpal Singh & Saluja KK. 2003. Fundamentals of Computer Programming and Information Technology. Kalyani Publishers.
2. Harshawardhan P. Bal. 2003. Perl Programming for Bioinformatics. Tata McGraw-Hill Education.
3. Kumar A 2015. Computer Basics with Office Automation. IK International Publishing House Pvt Ltd.
4. Rajaraman V & Adabala N. 2015. Fundamentals of Computers. PHI.
5. ***e-reading:*** http://ecourses.iasri.res.in/

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Certificate, Diploma, Advanced Diploma and B.Voc Degree (Agriculture and Allied Faculties)

Second Year (Semester III)

Paper-XX: Entrepreneurship Development (BAAGE-238)

Maximum Marks: 100 **Credits: 4** **Periods-45**

Unit-I: Concept of entrepreneurship:

Entrepreneurship, functions of entrepreneur. Entrepreneurial characteristics, Distinction between an entrepreneur and a manager, Agri-entrepreneurship- concept, need and scope. Assessing overall business environment in Indian economy. Globalization, and implications of social, political and economic systems on entrepreneurship. Entrepreneurship development programmes (EDPs) - objectives, phases, problems of EDPs, Criteria for assessment or evaluation of EDPs.

Unit-II: Role of entrepreneurship:

Generation, incubation and commercialization of business ideas. Role of entrepreneurship in economic development, Motivation and entrepreneurship development, managing an enterprise. Importance of planning, budgeting, monitoring, evaluation and follow up in running an enterprise. Researching / managing competition- ways to define possible competitors, competitive information, SWOT analysis-concept, meaning and advantages

Unit-III: Forms of Ventures:

Venture capital- concept, aims, features, financing steps sources, criteria to provide venture capital finance, Export & Import policies relevant to agriculture sector. Forms of business-contract farming, joint venture and public private partnership. An overview of agricultural input industry in India; fertilizer, pesticide, seed and farm machinery industry. Over view of Indian agricultural processing industry.

Unit-IV: Social responsibility and business ethics:

Project- meaning, importance, components & preparation. Government schemes and incentives for promotion of entrepreneurship and government policy on small and medium enterprises. Supply chain management- meaning, advantages, stages, process, drivers and scope of agri-supply chain management, Women entrepreneurship-concept, problems and development of women entrepreneurs.

Swami Ramanand Teerth Marathwada University, Nanded

Certificate, Diploma, Advanced Diploma and B.Voc Degree (Agriculture and Allied Faculties)

Second Year (Semester III) Semester Pattern

Paper-XXII: Fish Breeding and Hatchery Management (COMAQ-2310)

Maximum Marks: **100** **Credits: 4** **Periods: 45**

Unit I: (12 Periods)

1. Introduction to fish breeding and hatchery management
2. Fish seed resources
   i. Spawn resources investigation technique, Selection of spawn collection site, Gears used for collection of spawn, Methods of collection of spawn
   ii. Spawn quality and quantity indices, advantages and disadvantages of riverine seed collection.

Unit II: (12 Periods)

1. Bundh breeding:
   i. Introduction, Types of bundhs, operation of bundhs
2. Artificial fertilization by stripping: Introduction, types, operation
3. Induced breeding: Introduction, Hormones responsible for induced breeding
   i. Hypophysation: Introduction, collection of Pituitary gland (PG), preservation and storage of PG, preparation of PG suspension for injection, dosage
   ii. Induced breeding by synthetic hormones: Introduction, different synthetic hormones used in fish breeding, dosage
   iii. Other methods used in induced breeding of fishes

Unit III: (11 Periods)

Breeding, seed production, hatchery design and management

1. Carps: Indian Major Carp (IMC), exotic carps
2. Cat fishes
3. Tilapia
4. Milk fish
5. Shellfishes: Shrimp, prawn, crab (etc)
6. Advances in fish seed production

Unit IV: (10 Periods)

1. Fish seed: Introduction, units and methods of fish seed counting,
2. Different stages of finfish and shellfish seed
3. Quality of fish seed
4. Fish seed transportation:
5. Methods of fish seed release/stocking

Reference Books:

1. Thomas P. C. *et al*., 2003. Breeding and seed production of finfish and shellfish, Daya Publishing House, New Delhi.
2. Rath, P. K., 2000. Freshwater Aquaculture, Scientific Publishers, Jodhpur.

3. FAO, 1992. Manual of seed production of carps.
4. Pillay, T.V.R. and M. N. Kutty, 2005. Aquaculture Principles and Practices, Blackwaell Scientific Publishers, UK.
5. Jingran, V. G. and Pullin, R. S.V., 1985. Hatchery Manual for the common, Chinese and Indian Major Carps, ICLARM.
6. James, P. M., 1983. Handbook of Mariculture, CRC Press, Florida.

Swami Ramanand Teerth Marathwada University, Nanded

Certificate, Diploma, Advanced Diploma and B.Voc Degree (Agriculture and Allied Faculties)

Second Year (Semester III) Semester Pattern

Paper-XXIII: Anatomy and Physiology of finfishes (COMAQ-2311)

Maximum Marks: **100** **Credits: 4** **Periods: 45**

Unit I: (12 Periods)

1. Skin: structure, function
2. Scales: types, structure
3. Study of mouth and associated structures: Teeth, gill rackers.
4. Digestive system,: structure, Glands associated with digestive system, physiology of digestion
5. Food and feeding habits of fishes.
6. Qualitative and quantitative methods for analysis of gut contents.

Unit II: (12 Periods)

1. Skeletal systems
    i. Axial Skeletal system
    ii. Peripheral Skeletal system
2. Circulatory system
    i. Heart
    ii. Arterial system
    iii. Venous system
    iv. Physiology of circulation
    v. Blood
3. Respiratory system
    i. Gills
    ii. Physiology of respiration

Unit III: (11 Periods)

1. Nervous system
    i. Brain
    ii. Nerves
2. Urino-genital system
    i. Excretory system: Kidney, urinary bladder, physiology of excretion
    ii. Osmoregulation
    iii. Reproductive system: male reproductive system, female reproductive system
3. Sensory organs (lateral line, eyes, etc)
4. Endocrine Gland

Unit IV: (10 Periods)

1. General morphology of shrimps
2. Anatomy of shrimp: Digestive system, circulatory system, nervous system, circulatory system, respiratory system, reproductive system

Reference Books:

1. Jayaram, K. C. (2002). Fundamentals of fish taxonomy. Narendra Publishing House, Delhi, 172 p.

2. Khanna, S. S. and H. R. Singh (2003). Fish Biology and fisheries, Narenrdra Publishing House, New Delhi, India.
3. Khanna, S. S. and H. R. Singh (2014). A text book of Fish Biology and Fisheries, Narendra Publishing house
4. Kumar, A. (2005). Fish Biology, APH Publishing Corporation.
5. Pillai, TVR. and M. N. Kutty (2005). Aquaculture: Principles and Practices, Wiley-Blackwell.
6. Santanam, R. (1980). Fisheries Science, Daya Publishing House, New Delhi, India.
7. Srivastava C.B.L. (2008). Fish Biology, Narendra Publishing House, Delhi
8. Yadav, B.N. (1997). Fish and fisheries, Daya Publishing House, New Delhi, India.

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Certificate, Diploma, Advanced Diploma and B.Voc Degree (Agriculture and Allied Faculties)

Second Year (Semester III) Semester Pattern

Paper-XXIV: Soil and Water Quality Management in Aquaculture (COMAQ-2312)

Maximum Marks: **100** **Credits: 4** **Periods: 45**

Unit I: (12 Periods)

1. Soil and water resources for aquaculture
2. Chemistry of water: The water molecule, properties of pure water, fresh water and sea water.
3. Composition of waters: surface water, ground water and sea water.
4. Properties of water: Physical, Chemical and Biological
5. Water analysis: collection and preservation of water samples.

Unit II: (12 Periods)

1. Water quality criteria/ requirements for Aquaculture.
2. Aerators and Aeration system:
    a) Types of aerators (Diffused type, Air lift type, U-tube type, Splasher etc.)
    b) Role of aerators in the water quality management,
3. Filters and Filtration system:
    a) Types of filter (Mechanical filter, Biological and Air lift filter),
    b) Role of filters in the water quality management
4. Water quality maintenance in farming

Unit III: (11 Periods)

1. Soil Chemistry: origin and nature of soils.
2. Properties of soil: Physical, Chemical and Biological(soil colour, texture, structure, pore size, bulk density, water holding capacity, Cation Exchange Capacity, pH, Organic carbon, Carbon - Nitrogen ratio, soil fertility, Microbes etc.)
3. Soil types and their distribution
4. Soil analysis: collection and preparation of soil samples.

Unit IV: (10 Periods)

1. Soil quality criteria/ requirements for aquaculture.
2. Soil and water amendments: lime, manures, fertilizers, micronutrients, zeolites, alum, gypsum.
3. Environmental ameliorative: chlorination, deodorizers, bacterial formulation.

Reference Books:

1. Claude E. Boyd (1990). Water Quality in Ponds for Aquaculture, Auburn University, Alabama Agricultural Experiment Station.
2. Claude E. Boyd, C.S. Tucker (2012). Pond Aquaculture Water Quality Management, Springer Science & Business Media.
3. Jhingran, V. G. (1975). Fish & Fisheries of India. Hindustan Publishing Corporation (India). 954p.
4. Kodarkar, M. S. (1992). Methodology for water analysis, physico-chemical, Biological and Microbiological Indian Association of Aquatic Biologists Hyderabad.

5. Pillai, TVR. and M. N. Kutty., 2005. Aquaculture: Principles and Practices, Wiley-Blackwell
6. Ratan Kumar Saha, Dibyendu Kamilya, Himadri Saha (January, 2015). Handbook on Soil and Water Quality Management Techniques in Aquaculture, Edition: 1st, Publisher: Dean, College of Fisheries, CAU, Lembucherra

Swami Ramanand Teerth Marathwada University, Nanded

Certificate, Diploma, Advanced Diploma and B.Voc Degree (Agriculture and Allied Faculties)

Second Year (Semester III) Semester Pattern

Paper-XXV: Practical paper based on Fish Breeding and Hatchery Management (COMAQ-2310)

Maximum Marks: **50** **Credits: 2** **Periods: 45**

List of practical's	Number of Hours
1. Study of commercially important aquaculture species Indian Major Carp (IMC), Exotic carps, Tilapia, Cat fishes, Milk fish, Shrimp, prawn, Crab	9
2. Study of life and developmental stages of finfish (Any one) 3. Study of life and developmental stages of shrimp 4. Study of life and developmental stages of prawn 5. Study of life and developmental stages of crab	9
6. Study of stripping methods for Artificial fertilization 7. Collection, preservation and storage of pituitary gland 8. Preparation of suspension/extract of pituitary gland	6
9. Study of eye-stalk ablation in shrimp for induced breeding 10. Visit to fish seed production centre/hatchery	6

Swami Ramanand Teerth Marathwada University, Nanded

Certificate, Diploma, Advanced Diploma and B.Voc Degree (Agriculture and Allied Faculties)

Second Year (Semester III) Semester Pattern

Paper-XXVI: Practical paper based on Anatomy and Physiology of finfishes (COMAQ-2311)

Maximum Marks: **50** **Credits: 2** **Periods: 45**

List of practical's	Number of Hours
1. Study of teeth in fishes 2. Study of fish scales 3. Study of digestive system of fishes 4. Analysis of gut content	9
5. Study of Gills of fishes 6. Study of circulatory system of fishes 7. Study of reproductive system of fishes	9
8. Study of maturity stages in ovary of fishes 9. Study of maturity stages in testis of fishes 10. Estimation of fecundity	6
11. Study of morphology of shrimp 12. Study of Digestive system of shrimp 13. Study of Reproductive system of shrimp	6

Swami Ramanand Teerth Marathwada University, Nanded

Certificate, Diploma, Advanced Diploma and B.Voc Degree (Agriculture and Allied Faculties)

Second Year (Semester III) Semester Pattern

Paper-XXVII: Practical paper based on Soil and Water Quality Management in Aquaculture (COMAQ-2312)

Maximum Marks: **50** **Credits: 2** **Periods: 45**

List of practical's	Number of Hours
1. Equipment used in soil and water analysis (pH Meter, Thermometer, Salinity refractometer, Secchi disc, Nansen water sampler, Plankton net, Petersen Grab etc.) 2. Collection and storage of water and soil samples **Water analysis** 3. Estimation of dissolved oxygen. 4. Estimation of free carbon dioxide	9
5. Estimation of pH, 6. Estimation of turbidity 7. Estimation of total alkalinity 8. Estimation of hardness, 9. Estimation of transparency (Light penetration)	9
Soil analysis 10. Estimation of water retention capacity 11. Estimation of soil texture, 12. Estimation of temperature	6
13. Estimation of pH, 14. Estimation of conductivity 15. Estimation of pond lime requirement (pond liming). 16. Study of aerators and biological filters	6

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Second Year (Semester III) Semester Pattern

Paper-XXVIII: Practical paper based on Summer Activity

Maximum Marks: **75** **Credits: 3** **Periods:**

List of practical's
1. Report on Summer Activity

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Second Year (**Semester IV**)

Paper-XXIX: Agriculture Extension (BAAGE-2410)

Maximum Marks: **100** **Credits: 4** **Periods: 45**

Unit-I: Introduction to Extension Education:

Extension Education-Meaning, definition, need, scope and process; history, objectives, philosophy, principles and approaches. Extension Programme Planning- Meaning, process, principles and steps in programme development. Present extension System: Department of Agriculture: Structure, Function.

Unit-II: Extension Programme:

Various extension/ agriculture development programmes launched by ICAR/ Government of India: Introduction, Objectives and Salient Achievements Intensive Agricultural District Programme (IADP), Intensive Agricultural Area Programme (IAAP), High Yielding Varieties Programme (HYVP), Institution-Village Linkage Programme (IVLP) 151, Operational Research Project (ORP), National Agricultural Technology Project (NATP), Rashtriya Krishi Vikas Yojana (RKVY).

Unit-III: Cyber Extension Programme:

New trends in agricultural extension: Meaning, Objectives, Salient features, Privatization in extension, ICT in Extension education - Cyber extension/ e-extension, Market-led extension, Farmer-led extension.

Unit-IV: Rural Development Extension Programme:

Rural Development: Concept, meaning, definition, objectives. Various rural development programmes launched by Government of India : Introduction, Objectives and salient features Swarnajayanti Gram SwarojgarYojana (SGSY), Indira AwasYojana (IAY), Mahatma Gandhi National Rural Employment Guarantee Act, Prime Ministers' RozgarYojana (PMRY), District Rural Development Agency (DRDA), Integrated Watershed Development Programme (IWDP) Capacity building of extension personnel and farmers : Meaning, Training and Education, Types of training, Training institutes in India, Concept of Human Resource Development.

Suggested Readings:

1. Dahama, O.P. and Bhatnagar, O.P. 1980. Education and Communication for

Development. Oxford &lBH Publishing Co. Pvt. Ltd., New Delhi.

2. Dudhani, C.M.; Hirevenkatgoudar, L.V., Manjunath, L.; Hanchinal, S.N. and Patil, S.L. (2004). Extension Teaching Methods and Communication Technology, UAS, Dharwad.
3. Kamat, M.G. (1985). Writing for Farm Families. Allied Publishers, New Delhi.
4. Kelsey, L.D. and Hearne, G.C. (1963). Cooperative Extension Work, Comstar Publishing Associate, New York.
5. Mehta, D.S. (1981). Mass Communication and Journalism in India. Vikas Publication, New Delhi.

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Second Year (**Semester IV**)

Paper-XXX: Agriculture Business Management (BAAGE-2411)

Maximum Marks: 100 **Credits: 4** **Periods: 45**

Unit I: Introduction of agriculture Business Management:

Definition, history and scope of agri-business (Input, Farm Product Sectors). Importance of agri-business in the Indian economy. Agri-business Management-distinctive features, nature and components. Introduction to management-Management functions -Management levels-Managerial roles Management skills-Definitions of management-Role of management. Elements, Levels, Process & Functions of Management, Functions of Management:

Unit II: Planning of agribusiness management:

Planning: Definition importance, characteristics, Steps in planning. Types of planning; Forms of planning, Nature and importance, Purpose of planning, Steps in planning, Limitations of planning.

Unit III: Organization of agribusiness management:

Organization: Meaning, definition, importance, Characteristics, Nature of organization. Principles & Process of organization. Directing; definition, functions, techniques, qualities of good supervisor.

Unit IV: Controlling and Farm business analysis:

Controlling –Definition, Elements, Process of control, Techniques, Tools of control. Farm business analysis; Farm efficiency measures, farm financial & cash accounts, Net worth statement, systems of book keeping.

Reference Books:

1. K.Loknandhan, K.Mani, K.Mahendran Innovations in AB

2. D.K.Tripathi Principles& Practices of Management.

3. S.S.Johl, T.R.Kapoor Fundamentals of farm business management

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Second Year (Semester IV) Semester Pattern

Paper-XXXII: Fish Nutrition and Feed Technology (COMAQ-2416)

Maximum Marks: **100** **Credits: 4** **Periods: 45**

Unit I: (12 Periods)

1. Introduction and fundamentals of fish nutrition and growth in fish.
2. Principal nutrients and nutritional requirements of cultivable fishes
   a) Protein
   b) Fat/Lipid
   c) Carbohydrate
   d) Vitamin

Unit II: (12 Periods)

1. Feed ingredients: Animal and plant origin.
2. Feed Additives: Binder, Antioxidants, Antimicrobial agents, Chemoattractant, Feeding stimulus, pigments, Probiotics and miscellaneous additives

Feed manufacturing:

1. Types of feed : Wet feeds, moist feeds, dry feeds, mashes, pelleted feeds, floating and sinking pellets.
2. Forms of Feed: Spray dried diet, Micro-bound diet, micro encapsulated diet, flake diet

Unit III: (11 Periods)

1. Selection of Ingredients and Additives,
2. Formulation of Feed: Pearson's square method, linear programming method
3. Feed Processing:
   a) Grinding,
   b) Mixing
   c) Pelleting
   d) Floating pellets
   e) Cooling / Drying
   f) Crumbling
   g) Fat spraying.
   h) Bagging
   i) Feed Storage and Quality Control

Unit IV: (10 Periods)

1. Feeding Strategies
   a) Feeding rate
   b) Feeding Frequency Size of feed particles
   c) Feeding methods
2. Nutrition deficiency diseases: Avitaminosis, Mineral deficiency, Starvation.

Reference Books and suggested readings:

1) Cyrino E. P. and Bureau D & Kapoor BG. (2009). Feeding and Digestive Functions in Fishes. Science Publ.
2) D' Abramo L.R., Conklin D.E. and Akiyama D. M. (1977). Crustacean Nutrition: Advances in Aquaculture. Vol. VI. World Aquaculture Society, Baton Roughe.

3) De Silva S. S. and Anderson T. A. (1995). Fish Nutrition in Aquaculture. Chapman & Hall Aquaculture Series.
4) Halver J. and Hardy R.W. (2002). Fish Nutrition. Academic Press.
5) Halver J. E. and Tiews K.T. (1979). Finfish Nutrition and Fish feed Technology Vols. I, II, Heenemann, Berlin.
6) Lavens P. and Sorgeloos P. (1996). Manual on the Production and use of Live Food for Aquaculture.
7) Lovell R.T. (1998). Nutrition and Feeding of Fishes. Chapman & Hall.
8) Ojha J. S. (2005). Aquaculture Nutrition and Biochemistry. Daya Publ.
9) Paulraj, R (1997) Hand book on Aquafarming: Aquaculture Feed. Manual. MPEDA, Cochin.
10) Rath, R. K. (2000). Nutrition requirement of finfish. In: Fresh water Aquaculture. Published by Scientific Publishers (India), Jodhpur: 214-224.
11) Robert R. Stickney (2000). Encyclopedia of Aquaculture, Wiley-Inter science.

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Second Year (Semester IV) Semester Pattern

Paper-XXXIII: Costal Aquaculture and Mericulture (COMAQ-2417)

Maximum Marks: **100** **Credits: 4** **Periods: 45**

Unit I: (12 Periods)

1. Introduction: Over view, production and resources in India.
2. Commercial important cultivable species
   a) Finfishes
   b) Shellfishes
   c) Mussel and clams
   d) Edible oyster and pearl oyster
   e) Seaweeds
3. Traditional shore based aquaculture systems in India: Bheries, Gheries, Pokali fields, Gaznis and khazans

Unit II: (12 Periods)

1. Site selection for coastal aquaculture and mariculture
2. Methods of aquaculture - cages Rafts, racks, poles and ropes
3. Aquaculture practices of commercially important species
   a) Culture of Sea bass
   b) Culture of Mullet

Unit III: (11 Periods)

Aquaculture practices of commercially important species

1. Culture of Milk fish
2. Culture of shrimp
3. Culture of Mud crab
4. Culture of clam

Unit IV: (10 Periods)

Aquaculture practices of commercially important species

1. Culture of mussel
2. Culture of oyster
3. Culture of pearl oyster
4. Culture of sea weed

Reference Books:

1. Athithan, S. (2020). Coastal Aquaculture and Mariculture, Narendra Publishing House, CRC Press.
1. Ayyappan (2013). Handbook of Fisheries and Aquaculture, Indian Council of Agricultural Research New Delhi.
2. Khanna, S. S. and H. R. Singh (2014). A Text Book of Fish Biology & Fisheries, Narendra Publishing House.

3. Krishnaveni, G., N. Veerabhdr and K. Veeranjaneyulu (2016). Recent technologies in fish and fisheries, Rigi Publication.
4. Pillai, TVR. and M. N. Kutty., 2005. Aquaculture: Principles and Practices, Wiley-Blackwell
5. Robert, R. Stickney (2000). Encyclopedia of Aquaculture, Wiley-Inter science.

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Second Year (Semester IV) Semester Pattern

Paper- XXXIV: Fish Preservation and Refrigeration (COMAQ-2418)

Maximum Marks: **100** **Credits: 4** **Periods: 45**

Unit I: Fish spoilage (11 Periods)

1) Introduction
2) Biochemical composition of fish
3) Sources of contamination of fish.
4) Causes of fish spoilage: Chemical, Bacterial, Enzymatic
5) Post mortem changes in fish: Rigor Mortis

Unit II: Fish Preservation (12 Periods)

1) Introduction
2) Principles of preservation: - Washing, gutting, lowering the temperature, rising the temperature, dehydration, use of salt, use of preservatives.
3) Methods of Preservation: Drying, Salting, Chilling, Freezing, Smoking, Pickling, Canning, Store in cold storage.
4) Problems in fish preservation: Denaturation due to freezing, Food poisoning
5) Freshness of fish: organoleptic and chemical test

Unit III: Refrigeration (10 Periods)

1) Refrigeration: Introduction, definition, principle and classification
2) Different types of refrigeration systems.
3) Refrigeration components and refrigeration cycle: Compressors, Evaporator, Condenser, Expansion valve, Refrigerant etc.

Unit IV: Freezers and Cold storages (12 Periods)

1) Freezers: Introduction, definition and design of freezers: Plate freezer, Blast freezer, Tunnel freezer, spray or immersion freezers, IQF, fish rooms and fish hold.
2) Ice-plant and cold storage
3) Alternative refrigeration technique:
    a) Refrigerated sea water (RSW) and chilled sea water (CSW) for on board the fishing vessel
    b) Refrigerated transport.

Reference Books and suggested Readings:

1. Aitken, A. *et al.* (1982). Fish Handling and Processing. Second Edition, Edinburgh, Her Majesty's Stationery Office.
2. FAO (1975). Ice in Fisheries. FAO Fish Rep. 57p
3. Gopakumar, K. (2002). Textbook of fish processing technology, Indian Council of Agricultural Research, New Delhi (India).

4. Johnston, W.A; F.J. Nicholson, A. Roger and G.D. Stroud (1994). Freezing and refrigerated storage in fisheries, FAO FISHERIES TECHNICAL PAPER – 340
5. Khanna, S. S. and H. R. Singh (2003). Fish Biology and fisheries, Narenrdra Publishing House, New Delhi, India.
6. Louis J. RonsivallI and Daniel W. Baker II (1981). Low Temperature Preservation of Seafoods: A Review, Marine Fisheries Review, 43(4)
7. MPEDA Technology. https://mpeda.gov.in/?page_id=922
8. TNAU AGRITECH PORTAL: Fisheries: Post harvest practices. https://agritech.tnau.ac.in/fishery/fish_processing_fish.html

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Second Year (Semester IV) Semester Pattern

Paper-XXXV: Practical paper based on Fish Nutrition and Feed Technology (COMAQ-2416)

Maximum Marks: **100** **Credits: 4** **Periods: 45**

List of practical's	Number of Hours
1. Proximate composition: Analysis of feed ingredients and feeds. (Moisture Estimation) 2. Proximate composition: Analysis of feed ingredients and feeds. (Protein Estimation- Digestion) 3. Proximate composition: Analysis of feed ingredients and feeds (Protein Estimation- Extraction and estimation)	9
4. Proximate composition: Analysis of feed ingredients and feeds. (Fat Estimation) 5. Proximate composition: analysis of feed ingredients and feeds.(Ash Estimation) 6. Proximate composition: analysis of feed ingredients and feeds.(Carbohydrate Estimation)	9
7. Preparation of artificial feeds using locally available feed ingredients. a. Feed formulation exercise b. Feed preparation: Weighing, Grinding, mixing, pelleting/flake making and drying)	6
8. Calculation of feeding rate and feeding frequency Method of feeding 9. Determination of sinking rate and stability of feeds. 10. Field / Industrial visit	6

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Second Year (Semester IV) Semester Pattern

Paper-XXXVI: Practical paper based on Coastal Aquaculture & Mariculture (COMAQ-2417)

Maximum Marks: **100** **Credits: 4** **Periods: 45**

List of practical's	Number of Hours
1. Identification of important cultivable Fin fishes 2. Identification of important cultivable Crustaceans	9
3. Identification of important cultivable Mollucs 4. Identification of commercially important seed of fish. 5. Seed selection and quality of seed	9
6. Techniques of acclimatization of fish seed 7. Estimation of survival of seed 8. Study of fouling organism in cages and pens.	6
9. Study of material, apparatus and machinery for costal aquaculture and sea farming. 10. Visit to aquaculture/allied industries	6

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Second Year (Semester IV) Semester Pattern

Paper-XXXVII: Practical paper based on Fish Preservation and Refrigeration (COMAQ-2418)

Maximum Marks: **100** **Credits: 4** **Periods: 45**

List of practical's	Number of Hours
1. Identification of spoiled and fresh fishes by organoleptic test	9
2. Identification of spoiled and fresh fishes by chemical test (any one)	
3. Preparation fish for preservation: Fish processing-washing, gutting, cleaning of locally available fish	
4. Preservation of local available fish by icing	9
5. Preservation of locally available fish by sun drying / mechanical drying method	
6. Preservation of local available fish by salting / brining	
7. Lay out design of Refrigeration plants	
8. Study, handling and operation of a. Compressors, b. Condensers, c. Evaporators d. Expansion valves	6
9. Visit to processing plant / refrigeration plant / ice plant	6
10. Visit to refrigeration plant / ice plant	

SWAMI RAMANAND TEERTH MARATHWADA UNIVERSITY, NANDED

Choice Based Credit System (CBCS) (Semester Pattern)

Theory Examination

Question Paper Pattern (B.Voc.)

Maximum Marks: **75** **Time: 3.00 Hrs**

Q1. Long Answer Type Question …… (15 Marks).

OR

a) Short Answer Type Question …… (8 Marks).

b) Short Answer Type Question …… (7 Marks).

Q2. Long Answer Type Question …… (15 Marks).

OR

a) Short Answer Type Question …… (8 Marks).

b) Short Answer Type Question …… (7 Marks).

Q3. Long Answer Type Question ……. (15 Marks).

OR

a) Short Answer Type Question …… (8 Marks).

b) Short Answer Type Question …… (7 Marks).

Q4. Long Answer Type Question ……. (15 Marks).

OR

a) Short Answer Type Question …… (8 Marks).

b) Short Answer Type Question …… (7 Marks).

Q5. Write a short note on (**Any three** of following) …… (15 Marks).

a) ……..(5 Marks)

b) ……..(5 Marks)

c) …….(5 Marks)

d) ……....(5 Marks)

e) ……....(5 Marks)

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Choice Based Credit System (CBCS) (Semester Pattern)

Practical Examination

Question Paper Pattern (B.Voc.)

Maximum Marks: 50 **Time: 4.00 Hrs**

Q1. Perform the Major Experiment ……. (20 Marks).

Q2. **a)** Perform the Minor Experiment …… (10 Marks).

b) Describe procedure and working of the Minor Experiment …… (10 Marks).

Q3. **a)** Viva -voce ..…… (5 Marks).

b) Submission of Field Collection and Samplings during Field Visits and Excursions ..…… (5 Marks).

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