ST. ALOYSIUS' COLLEGE

AUTONOMOUS

JABALPUR- 482001

MADHYA PRADESH, INDIA

CRITERION-7

INSTITUTIONAL VALUES AND BEST PRACTICES

Key Indicator – 7.1

Institutional Values and Social Responsibilities

Metric No.: 7.1.4

Environment Consciousness and Sustainability

Document Name

Courses on Water Conservation

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Date:5/16/2024 18:04:53 +05:30

Environmental Consciousness and Sustainability

7.1.4 Water conservation facilities available in the institution

Courses on Water Conservation

No. of Courses: 12

SNO.	COURSE	CLASS	PAPER NAME
1.	MSC. Zoology	III Semester	Aquaculture
2.	BSc. (DSE)Group A Zoology	III Year	Aquaculture
3.	BSc. Chemistry	IV Semester	Metal complex preparation thermodynamics and phase equilibrium experiment
4.	MSc Zoology	III Semester	Ecotoxicology
5.	BSc Biotechnology discipline elective 1	III year	Industrial biotechnology practical
6.	BSc. biotechnology Discipline Specific elective -2	III year	Agriculture biotechnology
7.	BSc. biotechnology Discipline Specific elective Group B	III year	environmental biotechnology
8.	UG	II semester	environmental education
9.	MSc zoology	III semester	Liminology
10.	MSc chemistry	IV semester	environmental chemistry
11.	M.sc biotechnology	Elective	environment and elementary ecology
12.	Chemistry	Certificate Course	Water quality monitoring

M.Sc. Zoology III Semester
Session 2023-24
CORE COURSE
Paper IV – Aquaculture

Max M: 40

Unit-1	1. Aquaculture: history, definition, scope & importance. 2. Inland Fisheries resources of MP- wsr Narmada 3. Riverine fisheries- Ecology and Fishes of Major River Systems wsr Ganga, Brahmaputra, East coast river system, Godavari and Cauvery river system. 4. Cold water fisheries in India. 5. Coastal fisheries in India. 6. General ecological characteristics of reservoirs of India.
Unit-2	1. Fish culture wsr Mono and Poly/ Mixed/ Composite Fish culture. 2. Fresh Water Prawn Culture and its prospects in India. 3. Culture of Oysters 4. Pearl culture and Pearl industry. 4. Frog culture.
Unit-3	1. Overview of Integrated fish culture 2. Paddy cum fish culture 3. Sewage fed fish culture. 4. Brackish water culture. 5 Cage Culture
Unit-4	1. Fresh water fish farm Engineering: Selection of site, soil chemistry of fish farm, designing of fish farm, Layout & construction of fish farm. 2. Types of fish ponds. 3. Setting and management of fresh water aquarium wsr feeding and Nitrogen cycle 4. Aquarium fishes –Types and characteristics, Breeding of aquarium fishes. 5. Different types of crafts and gears in fisheries
Unit-5	1. Water pollution, its effects on fisheries and methods of its abatement. 2. Common fish diseases & their control. 3. Biochemical composition and nutritional value of fishes. 4. Nutrigenomics and immune function in fishes.

14/7/23

14/7/23

Suggested Readings:

1. C.B.L.Shrivastava	:	Fishes of India
2. Jhingaran	:	Fish and fisheries of India
3. S.S.Khanna	:	An Introduction to fishes
4. R.S.Rath	:	Fresh waterAquaculture
5. Gopalji Shrivastava	:	Fishes of U.P.& Bihar
6. H.D.Kumar	:	Sustanibility & Management of Aquaculture
Fisheries		
7. A.J.K.Mainan	:	Identification of fishes
8. R.Sanatam	:	A Manual of freshwater Aquaculture
9. S.K.Gupta	:	Fish & Fisheries
10.P.D.Pandey	:	Fish & Fisheries
11.K.P.Vishwas	:	Fish & Fisheries

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St. Aloysius College (Autonomous), Jabalpur
Department of Higher Education, Govt. of M.P.

Under Graduate Syllabus for B.Sc. (Bio)

As recommended by Central board of Studies in Zoology

Class - B.Sc. III Year

(Session 2023-24)

Theory Paper

Part A Introduction			
Program: Degree	Class : B.Sc	Year :III	Session :2023-24
Subject : Zoology			
1	Course Code	S3-ZOOLID	
2	Course Title	Aquaculture (Paper -I) Group-A	
3	Course Type (Core Course /Elective/Generic Elective/ Vocational/...)	Discipline Specific Elective (DSE)	
4	Pre-requisite (if any)	To study this course ,a student must have had the subject Zoology in Diploma.	
5	Course Learning Outcome (CLO)	On Completion of this course, learners with be able to: 1. Identify Aquaculture and its scope in India. 2. Recognize the different economically important fishes and other culturable fauna. 3. Identify the details of different steps involved in Aquaculture. 4. Identify the profitability of the culture and identify the fields of Aquaculture which generate self-employment.	
6	Credit Value	4	
7	Total Marks	Max. Marks : 30+70	Min. Passing Marks – 35

Part B- Content of the Course

Total No. of Lectures – Tutorials – Practical (2 hour per week): L-T-P: 60

Unit	Topic	No. of Lectures
I	1. Aquaculture 1.1. Definition, History and Indian Traditional knowledge of Aquaculture. 1.2. Planning for higher Aquaculture productivity. 1.3. Present strategies and future policies. 1.4. Problems of Aquaculture. 1.5. Significance of Aquaculture- as food and as non-food products. 1.6. Aquaculture resources in India. 2. Common Aquatic Weeds and its control. Keywords: Aquaculture, Aquatic Weeds.	10

II	1. Prawn Culture 1.1. History of Prawn Culture. 1.2. Prawns of commercial value. 1.3. Biology of fastest growing species of freshwater Prawn. 1.4. Different stages of lifecycle. 1.5. Culture technology. 1.6. Methods of Prawn Fishing. 1.7. Preservation and processing of Prawns. 1.8. Parasite and diseases of Prawns and its control. 2. Aquatic Insects. 2.1. Introduction of Aquatic Insects. 2.2. Control of Predatory Insects. Keywords: Prawn Culture, Aquatic Insects.	12
III	1. Edible Oyster Culture 1.1. Culturable species of Oysters and their distribution. 1.2. Biology of Oyster. 1.3. Oyster culture technique. 1.4. Rearing and harvesting of Oyster. 1.5. Preservation of Oyster. 1.6. Use of Oysters and its shell. 2. Pearl Culture 2.1. History of Pearl culture and pearl producing sites. 2.2. Pearl producing animals. 2.3. Biology of pearl oyster. 2.4. Process of Pearl formation. 2.5. Pearl culture techniques. 2.6. Composition, types of pearls and its enemies. 2.7. Economic value and Pearl industry in India. Keywords: Oyster culture and pearl culture.	12
IV	1. Fresh water edible fishes of India. 1.1. Biology of major carp fishes, minor carp fishes, cat fishes, live fishes and miscellaneous fishes. 2. Marine water edible fishes of India. 2.1. Hilsa, Eel, Sardines, Pomfrets, Mackerel, Bombay duck, 3. Carp culture 3.1. Introduction and History of carp culture. 3.2. Qualities of cultures fishes. 3.3. Reason and achievements of carps culture in India. 3.4. Resources of crap culture in India. 3.5. Carp culture techniques-Indian, Chinese and European system. 3.6. Types of ponds and its management. 3.7. Procedure of carp culture. 3.8. Methods of catching of carps. 3.9. Transport of fishes open type and close type. 3.10. Diseases, control and carp fishes' health management. 3.11. Fish preservation processing and marketing. Keywords: Carp culture, Marine Fishes, Freshwater Fishes.	14

14/7/23

14/7/23

V	1. Aquarium 1.1. Introduction and History of Aquarium. 1.2. Types of Aquarium tree and fixed. 1.3. Requisites for fabrication of aquarium. 1.4. Types of significance of aquatic plants. 1.5. Types of aquarium fishes. 1.6. Maintenance of aquarium. 2. Plankton 2.1. Definition and History of Plankton. 2.2. Classification of plankton – based on their origin, size, lifecycle and their habitat. 2.3. Groups of phytoplankton and zooplankton. 2.4. Role of plankton and fisheries. 3. Polyculture 3.1 Identification and history in fisheries. 3.2 General idea and history of Polyculture. Keywords: aquarium, Plankton, Polyculture	12

Part C – Leaning Resources

Text Book , Reference Books , Other resources

Suggested Readings:

1. Pillay, T.V.R.," Aquaculture- Principle & Practice", Wiley Int.
2. Santhanam, E., Sukumaran, N, Natarajan, P, "A Md1danual of Fresh Water Aquaculture", Oxford IBH
3. Rath. RK 'Freshwater Aquaculture", Scientific publishers, Jodhpur, 1993
4. Shukla. G S. Upadhyay. V B, "economic Zoology", Rastogi Publication, Meerut, 2014
5. Sarkar. S. Kundus. G. Chaki. K, "Introduction to Economic Zoology", NCBS
6. Vishwapremi, K K C," Economic Zoology" , Anmol publication pvt. Ltd. New Delhi, 1995
7. Pillai, NGK, "Marine fishery and mariculture in India", Narendra publishing house, Delhi
8. Books Published by MP Hindi Granth Academy, Bhopal

Suggestive digital platforms web Links

1. Aquaculture- https://igor.crew.c-base.org/aquaculture.pdf
2. Applied Zoology- https://books.google.co.in/books?id=BjINII*UjbEC&printsec=frontcover&source=gbs ge summary r&cad=0#v=onepage&q&f=false

Suggestive equivalent on line courses

1. https://www.fao.org>gfem>news>details
2. https://www.openlearning.com>course
3. https://www.udemy.com>topic>aquaculture
4. https://www.Swayam online courses
5. UNIMAS MOOC : Aquaculture
6. https://www.mphindigranthacademy.org/

Part D-Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks : 100
Continuous Comprehensive Evaluation (CCE) :30 marks University Exam (UE) 70 marks

Internal assessment: Continuous Comprehensive Evaluation (cce):	**Class Test Assignment/Presentation**	**30**
External Assessment: University Exam Section: Time : 03:00 Hours	**Section(A): Very Short Questions Section(B): Short Questions Section(C): Long Questions**	**70**
Any remarks/suggestions:		

Practical Paper

Part A Introduction

Program: Degree	**Class: B.Sc.**	**Year: III**	**Session :2023-24**

Subject: Zoology

1	Course Code	**S3-ZOOLIQ**
2	Course Title	**Applied Aquaculture (Paper -I) Group-A**
3	Course Type (Core Course /Elective/Generic Elective/ Vocational/…)	**Discipline Specific Elective (DSE)**
4	**Pre-requisite (if any)**	**To study this course, a student must have had the subject Zoology in Diploma.**
5	**Course Learning Outcome (CLO)**	**On Completion of this course, learners with be able to:** 1. Identity and study the fresh and marine water economically important fauna. 2. Identify the water quality parameters by different experiments. 3. Learn the required things in the set-up of an aquarium and its maintenance. 4. Identify and learn the Rearing Method of aquarium fishes. 5. Know the method of preparation of slide of Zoo Plankton and Preservation method of Phyto Plankton. 6. Identify harmful aquatic insects for Aquaculture. 7. Enhance Collaborative Learning and Communication Skills through Practical Work, Team Work, Group Discussion, Assignment and Project.
6	**Credit Value**	**2**
7	**Total Marks**	**Max. Marks : 100** / **Min. Passing Marks – 35**

Part B- Content of the Course

Total No. of Lectures – Tutorials – Practical (2 hour per week):

Unit	Topic	No. of Lectures
I	Identification & Study of fresh water/marine water culturable, economically important fauna- Prawns, Pearl oyster, Edible oyster, Carp fishes, Crab, Lobsters and Squilla.	04

II	Identification & Study of fresh water edible fishes- Labeo, Catla, Mystus, Wallego, Channa, Anabas and Cirrhinus.	03
III	Identification & Study of marine water edible fishes- Hilsa, Pomfret, Mackerel, Eel and Bombay duck.	03
IV	Collection Identification, Study and Preservation/slide preparation of phytoplankton and zooplankton from a pond.	03
V	Study of Water analysis. a. Estimation of dissolved oxygen in water **b. Estimation of Biological oxygen Demand in water** **c. Estimation of Chemical oxygen demand in water** d. Detection of chloride in water. e. Determination of pH/Recording of temperature of water. f. Hardness of water. g. Transparency of water.	06
VI	Study/Establishment and maintenance of aquarium in laboratory.	03
VII	Identification and Study of Aquarium fishes- Gold fish, Tiger fish, Kissing Gourami, Guppy, Black molly, X-ray fish, Zebra fish.	02
VIII	Identification and Study of Aquatic insects - Ranatra, Balostoma, Nepa, Water boat men, Back swimmier. **Identification and Study of Aquatic weeds Azolla,Pistia,Vallisneria Hydrilla , Chara**	02
IX	Visit/Virtual tour and Study of an aquatic site/any culture site and submit a report to supervisor.	04

Text Book , Reference Books , Other resources

Text Book , Reference Books , Other resources Suggested Readings:

1. Saxena, O.P., "Modern Approach to Non-Chordate Practical Zoology", Rajhans Publication, Meerut, 1992
2. Swarup, N, Arora, S and Pathak, S.C, "Laboratory Techniques in Modern Biology", Kalyani Publishers, New Delhi, 1992
3. Shukla, GS, Upadhyay, V B, "Economic Zoology", Rastogi Publication, Meerat,2014
4. Sarkar, S, Kundus, G, Chaki, K, "Introduction to Economic Zoology", NCBS
5. Lal, S.S., "A Textbook of Practical Zoology - Invertebrates", Rastogi Publication, 2016
6. Lal, S.S., "A Textbook of Practical Zoology - Vertebrates", Rastogi Publication, 2016
7. Verma, P.S., "A Manual of Practical Zoology - Invertebrates", S. Chand & Co., 2013
8. Verma, P.S., "A Manual of Practical Zoology - Vertebrates", S. Chand & Co., 2013
9. Besty, Judith, C., Felix, S., "Principles of Aquaculture: Practical Manual", Narendra Publishing House, Delhi, 2019
10. Books Published by MP Hindi Granth Academy, Bhopal

Suggestive digital platforms web links

1. https://www.fao.org>
2. https://asean.org>storage
3. https://www.researchgate.net
4. https://www.mphindigranthacademy.org/

Class	*Course Type*	*Course Code*	*Course Title (Theory/Practical)*	*Marks*	
B.Sc. IV Semester	Major/Minor/Elective	S2CHEM2P	Metal complex preparation, Thermochemistry & phase equilibrium experiments (Practical)	Max: 100	Min: 35

Course Objectives:

- To enable the students to create an understanding about the laboratory practices, variouslaboratory and analytical techniques.
- To enrich the students with the concepts of physical chemistry viz. thermodynamic andphase equilibrium

EXTERNAL ASSESSMENT: 60 marks

Inorganic Chemistry

- To obtain pure water from NaCl solution by distillation.
- To obtain pure potash alum by the process of crystallization.

Volumetric Analysis

- To determine the percentage of acetic acid in commercial vinegar.
- Estimation of calcium content in chalk as calcium oxalate by permagnatometry.
- To prepare M/20 solution of Mohr's salt and, using this solution find out the molarity and strength of the given potassium permanganate ($KMnO_4$) solution.

Gravimetry -Estimation of Copper

Physical Chemistry

A. Phase equilbrium

- To determine the critical solution temperature of two partially miscible liquid by determining their solubility in each other.
- To study the effect of solute (e.g. NaCl, succinic acid) on the critical solution temperature of two partially miscible liquid (e.g., phenol water system).

B. Thermochemistry

To determine the enthalpy of neutralization of weak acid/weak base versus strong acid/strong base and determine the enthalpy of ionization of the weak acid/base.

INTERNAL ASSESSMENT: **40 marks**

Internal assessment	**Marks**	**External assessment**	**Marks**
Class Interaction/Quiz	**15**	**Viva- Voce on Practical**	**15**
Attendance	**10**	**Practical Record File**	**10**
Assignment (Charts/ model seminar/ Rural services/ Technology dissemination/ Report of Excursion/ Lab visits/ Survey/ Industrial visit)	**15**	**Table work/ Experiments**	**35**
TOTAL	**40**		**60**

Course Outcome: By the end of this course students will be able to:

- Develop an understanding of preparation of inorganic complexes.
- Explain the use of calorimeter for thermochemistry experiments.
- Determine the enthalpy of various systems and reactions

- Perform the experiments on phase equilibria with understanding of changes involved intransitions
- Gain a thorough knowledge about construction of phase diagrams and study of reactionequilibrium

M.Sc. Zoology III Semester

Session 2023-24

CORE COURSE

Paper III - Ecotoxicology

Max M-40

Unit-1	1. General principles of Environmental Biology with emphasis on ecosystems. 2. Abiotic and biotic factors of ecosystems. 3. Communities of the environment, their structure &significance. 4. Energy flow in environment: Ecological energetics.
Unit-2	1. Productivity, Production and analysis. 2. Recycling and reuse technologies for solid and liquid wastes and their role in environmental conservation. 3. Remote Sensing–basic concepts and applications of remote sensing techniques in environmental conservation. 4. Environmental indicators and their role in environmental balance.
Unit-3	1. Air and Water pollution and their control methods. 2. Radioactive compounds and their impact on the environment. 3. Vehicular exhaust pollution, causes and remedies. 4. Noise pollution.
Unit-4	1. Toxicology-Basic concepts, toxicological methods. 2. Toxicity testing principles, hazards, risks and their control methods. 3. Food toxicants and their control methods. 4. Public Health Hazards due to environmental disasters.
Unit- 5	1.Pesticides, types, nature and their effects on environment. 2.Agrochemical use and misuse, alternatives. 3.Important heavy metals and their role in environment. 4..Occupational Health Hazards and their Control.

14/8/23

SUGGESTEDREADINGS:

1.Clark	:	Elements of ecology
2.Odum	:	Fundamentals of Ecology
3.SouthWoods	:	Ecological methods
4.Trivedi and Goel	:	Chemical and biological methods for water pollution studies
5 Ghoshe	:	Toxicology
6 Sood	:	Toxicology

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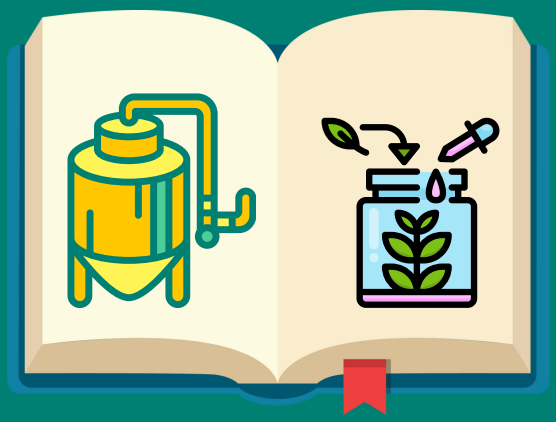
ST. ALOYSIUS' COLLEGE
(AUTONOMOUS), JABALPUR



SYLLABUS

B.SC. III YEAR

DEPARTMENT OF BIOTECHNOLOGY

Part A - Introduction				
Program: Degree		**Class: B.Sc.**	**Year: III Year**	**Session :2023-24**
Subject: Biotechnology				
1.	**Course Code**	**S3-BTEC1D**		
2.	**Course Title**	**Industrial Biotechnology**		
3.	**Course Type (Core Course/Discipline Specific Elective/ Elective/ Generic Elective/Vocational/....)**	**Discipline Specific Elective 1 (Theory) (Group A Paper I)**		
4.	**Pre-requisites**	To study this course, Student must have Diploma in Biotechnology		
5.	**Course Learning outcomes**	On successful completion of this course, the students will be able to: 1. Student will get concept of industrial and human beneficial living organism, their exploitation and application. 2. Student will get insight on industrially important organism, recent development in fermentation processes and various optimization strategies at fermenter level. 3. Create interest about design, types of fermenter and various critical components of bioreactors.		
6.	**Credit Value**	4		
7.	**Total Marks**	Max. Marks-30+70	Min. Passing Marks: 35	

Part B - Content of the Course		
Total No. of Lectures- Tutorials-Practical (in hours per week): L-T-P:		
Subject: Biotechnology		
Unit	**Topics**	**Number of Lectures (1 Hour Each) 12**
I.	Discovery, classifications and nomenclature of enzymes; Physico chemical characterization of enzymes; Enzyme kinetics: Enzyme catalysis in solution kinetics and thermodynamic analysis, effects of organic solvents on enzyme catalysis and structural consequences. Kinetics of enzyme inhibition.	**12**
II.	Immobilization of enzymes: principle and mechanism: Mechanism of enzyme function and reactions in process techniques; Enzymatic bioconversions e.g. starch and sugar conversion processes; High Fructose Corn Syrup; Interesterified fat; Hydrolyzed protein etc. and their downstream processing; baking by amylases, deoxygenation and desugaring by glucoses oxidase, beer mashing and chill proofing; cheese making by proteases and various other enzyme catalytic actions in food processing.	**12**
III.	Bioprocess technology: Basic principles in bioprocess technology; Media Formulation; Sterilization; Thermal death kinetics; Batch and continuous sterilization systems; Primary and secondary metabolites; Extracellular enzymes; Biotechnologically important intracellular products; exopolymers;	**12**
IV.	Bioreactor designs: Types of fermentation and fermenters; Concepts of basic modes of fermentation Batch, fed batch and continuous; Conventional fermentation v/s biotransformation; Solid substrate, surface and submerged fermentation; Fermentation economics; Fermentation media; Fermenter design mechanically agitated; Pneumatic and hydrodynamic fermenters; Large scale animal and plant cell cultivation and air sterilization; Upstream processing: Media formulation; Sterilization; Aeration and agitation in bioprocess; Measurement and control of bioprocess parameters; Scale up and scale down process.	**12**
V.	Techniques of enzyme isolation, purification and enzyme assay, techniques used for the immobilization of enzymes, Applications of immobilized enzyme in Biotechnology; Bioprocess control and monitoring variables such as temperature, agitation, pressure, pH Microbial processes production, optimization, screening, strain improvement, factors affecting downstream processing and recovery; Representative examples of ethanol, organic acids, antibiotics etc.	**12**

Part C - Learning Resources
Text Books, Reference Books, Other Resources
Suggested Readings: 1. Martin F. Chaplin and Christopher Bucke; Enzyme Technology, Cambridge, Univ Press 2. Anil Kumar and Sarika Garg; Enzymes and Enzyme Technology, Anshan Publishing; 1st edition 3. Jackson AT., Bioprocess in Biotechnology, Prentice Hall, Engelwood cliffs, 1991 4. Shufler ML and Kargi F., Bioprocess Engineering: Basic Concepts, 2nd Edition, Prentice Hall, Engelwood Cliffs, 2002. 5. Stanburry RF and Whitaker A., Principles of Fermentation Technology, Pergamon press, Oxford, 1977 6. Baily JE and Ollis DF., Biochemical Engineering fu8ndamentals, 2nd edition, McGraw-Hill Book Co., New York, 1986. 7. Aiba S, Humphrey AE and Millis NF, Biochemical Engineering, 2nd Edition, University of Tokyo Press, Tokyo 1973. 8. Young M.M., Comprehensive Biotechnology: The Principles, applications and regulations of Biotechnology in Industry, Agriculture and Medicine, Vol 1, 2, 3 and 4. Reed Elsevier India Private Ltd, India, 2004. 9. Mansi EMTEL, Bryle CFA, Fermentation Microbiology and Biotechnology, 2nd Edition, Taylor & Francis Ltd. UK 10. Books published by Madhya Pradesh Hindi Granth Acadmey, Bhopal.
Suggestive digital platforms/web links- www.biologyonline.com
Suggested equivalent online courses: Coursera, NPTEL, Career's 360

Part D-Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: 100 Continuous Comprehensive Evaluation (CCE): 30 marks University Exam (UE) 70 marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	30
External Assessment: University Exam Section Time: 03.00 Hours	**Section(A):** Very Short Questions **Section (B):** Short Questions **Section (C):** Long Questions	70
Any remarks/suggestions:		

Part A Introduction				
Program: Degree		**Class: B.Sc.**	**Year: III Year**	**Session: 2023-24**
Subject: Biotechnology				
1.	**Course Code**	**S3-BTEC1Q**		
2.	**Course Title**	**Industrial Biotechnology**		
3.	**Course Type (Core Course/ Discipline Specific Elective/Elective/ Generic Elective /Vocational/....)**	**Discipline Specific Elective 1 (Practical)**		
4.	**Pre-requisite (if any)**	To study this course, Student must have Diploma in Biotechnology		
5.	**Course Learning outcomes (CLO)**	**On successful completion of this course, the students will be able to:** 1. Student will get concept of industrial and human beneficial living organism, their exploitation and application. 2. Student will get insight on industrially important organism, recent development in fermentation processes and various optimization strategies at fermenter level. 3. Create interest about design, types of fermenter and various critical components of bioreactors.		
6.	**Credit Value**	2		
7.	**Total Marks**	**Max. Marks**-100	**Min. Passing Marks**: 35	

Part B-Content of the Course		
Total No. of Lectures- Tutorials-Practical (in hours per week): L-T-P:		
Unit	**Topics**	**Number of Lectures (2 Hours Each)**
	1. Determination of oxygen transfer rate and volumetric oxygen mass transfer coefficient (KLa) under variety of 30 operating conditions in shake flask and bioreactor. 2. Determination of mixing time and fluid flow behavior in bioreactor under variety of operating conditions. 3. Rheology of microbial cultures and biopolymers and determination of various rheological constants. 4. Production of microbial products in bioreactors. 5. Studying the kinetics of enzymatic reaction by microorganisms. 6. Production and purification of various enzymes from microbes. 7. Comparative studies of Ethanol production using different substrates. 8. Microbial production and downstream processing of an enzyme, e.g., amylase. 8. 9. Various immobilization techniques of cells/enzymes, use of alginate for cell immobilization	**30**
Keywords/Tags:		

Part C-Learning Resources
Text Books, Reference Books, Other resources
Suggested Readings: 1. Martin F. Chaplin and Christopher Bucke; Enzyme Technology, Cambridge, Univ Press 2. Anil Kumar and Sarika Garg; Enzymes and Enzyme Technology, Anshan Publishing; 1st edition 3. Jackson AT., Bioprocess in Biotechnology, Prentice Hall, Engelwood cliffs, 1991 4. Shufler ML and Kargi F., Bioprocess Engineering: Basic Concepts, 2nd Edition, Prentice Hall, Engelwood Cliffs, 2002. 5. Stanburry RF and Whitaker A., Principles of Fermentation Technology, Pergamon press, Oxford, 1977 6. Baily JE and Ollis DF., Biochemical Engineering fu8ndamentals, 2nd edition, McGraw-Hill Book Co., New York, 1986. 7. Aiba S, Humphrey AE and Millis NF, Biochemical Engineering, 2nd Edition, University of Tokyo Press, Tokyo 1973. 8. Young M.M., Comprehensive Biotechnology: The Principles, applications and regulations of Biotechnology in Industry, Agriculture and Medicine, Vol 1, 2, 3 and 4. Reed Elsevier India Private Ltd, India, 2004. 9. Mansi EMTEL, Bryle CFA, Fermentation Microbiology and Biotechnology, 2nd Edition, Taylor & Francis Ltd. UK. 10. Books published by Madhya Pradesh Hindi Granth Acadmey, Bhopal.
Suggestive Digital Platforms/Web Links- Nil
Suggested Equivalent Online Courses: Coursera, NPTEL, Career's 360

Part D-Assessment and Evaluation			
Suggested Continuous Evaluation Methods:			
Internal Assessment:	**Marks**	**External Assessment**	**Marks**
Class interaction/ quiz	**30**	Viva voce on practical	**70**
Attendance		Practical record file	
Assignment (Chart/Model Seminar/Rural Service/ Teachnology Dissertation/ Report of Excursion/ Lab Visits/ Survey/ Industrial Visit		Table work/ Experiments	
		Total Marks: 100	
Any remarks/ suggestions:			

Part A - Introduction				
Program: Degree		**Class: B.Sc.**	**Year: III Year**	**Session :2023-24**
Subject: Biotechnology				
1.	**Course Code**	**S3-BTEC2D**		
2.	**Course Title**	**Agriculture Biotechnology**		
3.	**Course Type (Core Course/Discipline Specific Elective/ Elective/ Generic Elective/Vocational/....)**	**Discipline Specific Elective 2 (Theory) (Group A Paper II)**		
4.	**Pre-requisites**	To study this course, Student must have Diploma in Biotechnology		
5.	**Course Learning outcomes**	**On successful completion of this course, the students will be able to:** 1. The student will empower with the fundamental of the agriculture biotechnology such as organic farming agrobiology and techniques. 2. The learner will get the deep understanding of soil microbiology, microbial diversity of soil and importance of organic farming. 3. Student will empower through the hand on training on compositing, vermiculture and methane production. 4. Learned molecular tetchiness will provide knowledge of further application. 5. Basic principle biofertilizer and biopecticide development will impart field knowledge.		
6.	**Credit Value**	4		
7.	**Total Marks**	Max. Marks-30+70	Min. Passing Marks: 35	

Part B - Content of the Course		
Total No. of Lectures- Tutorials-Practical (in hours per week): L-T-P:		
Subject: Biotechnology		
Unit	**Topics**	**Number of Lectures (1 Hour Each) 12**
I.	**Organic farming: Biofertilizers and Biopesticides** Biological N2 fixation, H2 production, biofertilizers and biopesticides; solid wastes; sources and management (composting, vermiculture and methane production). Single cell protein (Spirulina, yeast, mushroom).	**12**
II.	**National and international status of organic farming** Agencies and institutions related to organic agriculture. Organic and Indian National Standards for organic products. Organic Food Quality and Human Health.	**12**
III.	**Agrobiology** Agrobacterium plant interaction; Virulence; Ti and Ri plasmids; Opines and their significance; TDNA transfer; Disarming the Ti plasmid. Genetic Transformation Agrobacterium mediated gene delivery; Co integrate and binary vectors and their utility; Direct gene transfer PEG mediated, electroporation, particle bombardment and alternative methods; Screen able and selectable markers; Characterization of transgenics; Chloroplast transformation; Marker free methodologies; Gene targeting, Genetically modified crops.	**12**
IV.	**Gene Editing-** Gene transfer technique-physical chemical, Biological method; Gen isolation and gene silencing, mutagenesis-random & site directed, RNA structure of Ribozymes, Regulation of gene editing, Gene editing tools- CRISPR-Cass & TALEN, R Applications in crop improvement, seed industry and nutritional security.	**12**
V.	**Techniques and Applications:** enzyme detection, hybridization, PCR, Gene probe technology etc.; Strategies for controlling pathogen transfer; Biopesticides in integrated pest management..	**12**

Part C - Learning Resources
Text Books, Reference Books, Other Resources
Suggested Readings: 1. Rao Subba, Soil microbiology. 2. Waksman and Starkey, Soil and microbes. 3. Mehrotra, Plant pathology. 4. Alexander, M. Introduction to Soil Microbiology, 3rd Edition. Wiley Eastern Ltd., New Delhi 5. Purohit S.S., Microbiology. 6. Metcalf and Eddy Wastewater Engineering- Treatment, disposal and Reuse, Inc,.Tata McGraw Hill, New Delhi. 7. M. Moo-young (Ed-in-chief) Comprehensive Biotechnology. Vol. 4,, Pergamon Press, Oxford. 8. De., A.K., Environmental Chemistry, Wiley Eastern Ltd. New Delhi. 9. Allsopp D. and K.J. Seal Introduction to Biodeterioration, ELBS/Edward Arnold 10. Kristensen, P., Taji, A. and Reganold, J. (2006). Organic Agriculture: A Global Perspective. CSIRO Press, Victoria, Australia 11. Altieri, M. (1990). Agroecology: The Science of Sustainable Agriculture. Westview Press, Boulder, CO 12. Bavec, F. and Bavec, M. (2007). Organic Production and Use of Alternative Crops.CRC Press, Boca Raton, FL 13. Joshi, M., Setty, T.K.P. and Prabhakarasetty (2006). Sustainability through Organic farming. 1st Edition.Kalyani Publishers, Ludhiana, India. 14. Atwal, A. S. 1991. Agricultural Pests of India and South East Asia.Kalyani Publishers, New Delhi. 15. Books published by Madhya Pradesh Hindi Granth Academy, Bhopal.
Suggestive digital platforms/web links- www.biologyonline.com
Suggested equivalent online courses: Coursera, NPTEL

Part D-Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: 100 Continuous Comprehensive Evaluation (CCE): 30 marks University Exam (UE) 70 marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	30
External Assessment: University Exam Section Time: 03.00 Hours	**Section(A):** Very Short Questions **Section (B):** Short Questions **Section (C):** Long Questions	70
Any remarks/suggestions:		

Part A Introduction				
Program: Degree		**Class: B.Sc.**	**Year: III Year**	**Session: 2023-24**
Subject: Biotechnology				
1.	**Course Code**	**S3-BTEC2Q**		
2.	**Course Title**	**Agriculture Biotechnology**		
3.	**Course Type (Core Course/ Discipline Specific Elective/Elective/ Generic Elective /Vocational/....)**	**Discipline Specific Elective 2 (Practical)** **Group A Paper II**		
4.	**Pre-requisite (if any)**	To study this course, Student must have Diploma in Biotechnology		
5.	**Course Learning outcomes (CLO)**	**On successful completion of this course, the students will be able to:** 1. The student will empower with the fundamental of the agriculture biotechnology such as organic farming agrobiology and techniques. 2. The learner will get the deep understanding of soil microbiology, microbial diversity of soil and importance of organic farming. 3. Student will empower through the hand on training on compositing, vermiculture and methane production. 4. Learned molecular tetchiness will provide knowledge of further application. 5. Basic principle biofertilizer and biopecticide development will impart field knowledge.		
9.	**Credit Value**	2		
10.	**Total Marks**	**Max. Marks**-100	**Min. Passing Marks**: 35	

Part B-Content of the Course		
Total No. of Lectures- Tutorials-Practical (in hours per week): L-T-P:		
Unit	**Topics**	**Number of Lectures (2 Hours Each)**
	1. To study pollution stress by chlorophyll and carotenoid ratio from algae sample. 2. To study of effect of heavy metal on growth of bacteria. 3. Isolation and Enumeration of the microorganism from soil by serial dilution agar plate method. 4. Isolation of fungi from soil by warcup's method. 5. Isolation of azotobacter species from soil. 6. Isolation of microorganism from rhizosphere. 7. Isolation of microorganism from phyllosphere (phyloplane) by serial dilution, agar plate method or leaf impression method. 8. Plant diseases - leaf curl of papaya, rust of wheat, citrus canker, red rot of sugarcane. Study of weeds- Parthenium, water hyacinth 9. Visit to Apiculture area 10. Visit to Mushroom industry 11. Visit to terrace farming area 12. Study of policies and incentives of organic production 13. Study of farm inspection and certification. 14. Determination of amount of bleaching powder required to disinfect a water sample by Horrock's test. 15. To determine pH, electrical conductivity, total solids, total suspended solids and total dissolved solids in given sample of water. 16. To determine the amount of oil and grease content present in the given water sample	**30**
Keywords/Tags:		

Part C-Learning Resources
Text Books, Reference Books, Other resources
Suggested Readings: 1. Rao, Subba, Soil microbiology. 2. Waksman and Starkey, Soil and microbes. 3. Mehrotra, Plant pathology. 4. Alexander, M. Introduction to Soil Microbiology, 3rd Edition. Wiley Eastern Ltd., New Delhi 5. Purohit, S.S., Microbiology. 6. Metcalf and Eddy, Wastewater Engineering- Treatment, disposal and Reuse., Inc,.Tata McGraw Hill, New Delhi. 7. De., A.K., Environmental Chemistry, Wiley Eastern Ltd. New Delhi. 8. Joshi, M., Setty, T.K.P. and Prabhakarasetty (2006). Sustainability through Organic farming. 1st Edition.Kalyani Publishers, Ludhiana, India. 9. Books published by Madhya Pradesh Hindi Granth Academy, Bhopal.
Suggestive Digital Platforms/Web Links- Nil
Suggested Equivalent Online Courses: Coursera, NPTEL

Part D-Assessment and Evaluation			
Suggested Continuous Evaluation Methods:			
Internal Assessment:	**Marks**	**External Assessment**	**Marks**
Class interaction/ quiz	**30**	Viva voce on practical	**70**
Attendance		Practical record file	
Assignment (Chart/Model Seminar/Rural Service/ Teachnology Dissertation/ Report of Excursion/ Lab Visits/ Survey/ Industrial Visit		Table work/ Experiments	
		Total Marks: 100	
Any remarks/ suggestions:			

Part A - Introduction				
Program: Degree		**Class: B.Sc.**	**Year: III Year**	**Session :2023-24**
Subject: Biotechnology				
1.	**Course Code**	**S3-BTEC3D**		
2.	**Course Title**	**Environmental Biotechnology**		
3.	**Course Type (Core Course/Discipline Specific Elective/ Elective/ Generic Elective/Vocational/....)**	**Discipline Specific Elective 3 (Theory) (Group B Paper I)**		
4.	**Pre-requisites**	To study this course, Student must have Diploma in Biotechnology		
5.	**Course Learning outcomes**	On successful completion of this course, the students will be able to: 1. Deep understanding of existing and emerging technologies that are important in the area of environment and the principles and techniques which underline the environmental issues including air and water pollution. 2. Empowers the students with the knowledge of Domestic waste water treatment, Classification of wastewater treatment (physical, chemical and biological) 3. Students learn about concepts of Biodegradation, Biodegradation of hydrocarbon, and Measurement of biodegradation. Bioremediation- Concept, Methods of Bioremediation (In-situ and Ex-situ Bioremediation), and Xenobiotic biodegradation. 4. Learners will understand the concept of biodiversity: conservation and management, rules and acts.		
6.	**Credit Value**	4		
7.	**Total Marks**	Max. Marks-30+70	Min. Passing Marks: 35	

Part B - Content of the Course		
Total No. of Lectures- Tutorials-Practical (in hours per week): L-T-P:		
Subject: Biotechnology		
Unit	**Topics**	**Number of Lectures (1 Hour Each) 12**
I.	**Environmental Pollution:** Definition, principles and scope of ecology types of pollution, Oil pollution, Methods for the measurement of pollution; Methodology of environmental management - the problem-solving approach, its limitations.	**12**
II.	**Solid and Water wastes:** sources and management (composting, vermiculture and methane production). Treatment of waste water, primary, secondary & Assessment of water quality.	**12**
III.	**Global Environmental Problems:** Ozone depletion, UV-B, green -house effect and acid rain. Biogas H2 Production	**12**
IV.	**Degradation of Xenobiotics in Environment.** Ecological considerations, decay behaviour & degradative plasmids; Hydrocarbons, substituted hydrocarbons, surfactants, pesticides, microbial leaching. Bioremediation of contaminated soils and waste land.	**12**
V.	**Techniques and Applications:** Methods of monitoring Pollution; Biological methods; Detection methods for DO, BOD, Pathogen monitoring by heterotrophic plate count; Multiple tube method; Membrane filtration methods; Strategies for controlling pathogen transfer; Chemical methods- Detection methods for COD, pH, alkalinity, TSS, TDS, Total organic carbon, oil, grease etc.; Biosensors for pollution	**12**

Part C - Learning Resources
Text Books, Reference Books, Other Resources
Suggested Readings: 1. Sodhi G. S., Environmental Chemistry, Narosa Publishing House. 2. Das Satya N., Essential of Biotech for student, PeePee Publication & Distributor Ltd. 3. Verma Dhananjay, Environmental Awareness, M. P. Hindi Granth Academy. 4. Purohit S. S., Shammi Q.T. and Agrawal A. K,A Test book of Environmental Sciences,, Student edition Jodhpur. 5. Agrawala, Environmental Studies Narosa Publishing House. 6. Mohapatra Pradipta Kumar,Text Book of Environmental Biotechnology,Willy Publication 7. Mohapatra Pradipta Kumar,Text Book of Environmental Biotechnology, I K International Publication 8. Kumar Pramod, Textbook of Environmental Biotechnology Woodhead Publishing India 9. Nachiketa Neeraj, Environment & Ecology a Dynamic Approach, G K Publication. 10. Sharma Vinay,Text Book of Environmental Biotechnology, Aavishkar Publication 11. Thakur Indu Shekhar, Environmental Biotechnology, Dream Tech Publication. 12. Books Published by Madhya Pradesh Hindi Granth Academy, Bhopal.
Suggestive digital platforms/web links- www.biologyonline.com
Suggested equivalent online courses: Coursera, NPTEL

Part D-Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: 100 Continuous Comprehensive Evaluation (CCE): 30 marks University Exam (UE) 70 marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	30
External Assessment: University Exam Section Time: 03.00 Hours	**Section(A):** Very Short Questions **Section (B):** Short Questions **Section (C):** Long Questions	70
Any remarks/suggestions:		

Part A Introduction				
Program: Degree		**Class: B.Sc.**	**Year: III Year**	**Session: 2023-24**
Subject: Biotechnology				
1.	**Course Code**	**S3-BTEC3Q**		
2.	**Course Title**	**Environmental Biotechnology**		
3.	**Course Type (Core Course/ Discipline Specific Elective/Elective/ Generic Elective /Vocational/....)**	**Discipline Specific Elective 3 (Practical) (Group B Paper I)**		
4.	**Pre-requisite (if any)**	To study this course, Student must have Diploma in Biotechnology		
5.	**Course Learning outcomes (CLO)**	**On successful completion of this course, the students will be able to:** 1. Deep understanding of existing and emerging technologies that are important in the area of environment and the principles and techniques which underline the environmental issues including air and water pollution. 2. Empowers the students with the knowledge of Domestic waste water treatment, Classification of wastewater treatment (physical, chemical and biological) 3. Students learn about concepts of Biodegradation, Biodegradation of hydrocarbon, Measurement of biodegradation. Bioremediation-Concept, Methods of Bioremediation (In-situ and Ex-situ Bioremediation), and Xenobiotic biodegradation. 4. Learners will understand the concept of biodiversity: conservation and management, rules and acts.		
6.	**Credit Value**	2		
7.	**Total Marks**	**Max. Marks**-100	**Min. Passing Marks**: 35	

Part B-Content of the Course		
Total No. of Lectures- Tutorials-Practical (in hours per week): L-T-P:		
Unit	**Topics**	**Number of Lectures (2 Hours Each)**
	1. Isolation of Cyanobacteria (blue green algae). 2. Estimation of nitrate. 3. Estimation of nitrite. 4. Estimation of ammonia. 5. Determination of biological oxygen demand (BOD) of water sample. 6. Determination of chemical oxygen demand (COD) of water sample. 7. To study air born microbes by agar plate technique. 8. To study pollution stress by chlorophyll and carotenoid ratio from algae sample. 9. To study of effect of heavy metal on growth of bacteria.	**30**
Keywords/Tags:		

Part C-Learning Resources
Text Books, Reference Books, Other resources
Suggested Readings: 1. Sodhi G. S., Environmental Chemistry, Narosa Publishing House. 2. Das Satya N., Essential of Biotech for student, PeePee Publication & Distributor Ltd. 3. Verma Dhananjay, Environmental Awareness, M. P. Hindi Granth Academy. 4. Purohit S. S., Shammi Q.T. and Agrawal A. K,A Test book of Environmental Sciences,, Student edition Jodhpur. 5. Agrawala, Environmental Studies Narosa Publishing House. 6. Mohapatra Pradipta Kumar,Text Book of Environmental Biotechnology, Willy Publication 7. Mohapatra Pradipta Kumar,Text Book of Environmental Biotechnology, I K International Publication 8. Kumar Pramod, Textbook of Environmental Biotechnology Woodhead Publishing India 9. Nachiketa Neeraj, Environment & Ecology a Dynamic Approach, G K Publication. 10. Sharma Vinay, Text Book of Environmental Biotechnology, Aavishkar Publication 11. Thakur Indu Shekhar, Environmental Biotechnology, Dream Tech Publication. 12. Books Published by Madhya Pradesh Hindi Granth Academy, Bhopal.
Suggestive Digital Platforms/Web Links- Nil
Suggested Equivalent Online Courses: Coursera, NPTEL

Part D-Assessment and Evaluation			
Suggested Continuous Evaluation Methods:			
Internal Assessment:	**Marks**	**External Assessment**	**Marks**
Class interaction/ quiz	**30**	Viva voce on practical	**70**
Attendance		Practical record file	
Assignment (Chart/Model Seminar/Rural Service/ Teachnology Dissertation/ Report of Excursion/ Lab Visits/ Survey/ Industrial Visit		Table work/ Experiments	
		Total Marks: 100	
Any remarks/ suggestions:			

Part A - Introduction				
Program: Degree		**Class: B.Sc.**	**Year: III Year**	**Session :2023-24**
Subject: Biotechnology				
1.	**Course Code**	**S3-BTEC4D**		
2.	**Course Title**	**Bioinformatics**		
3.	**Course Type (Core Course/Discipline Specific Elective/ Elective/ Generic Elective/Vocational/....)**	Discipline Specific Elective 4 (Theory) (Group B Paper II)		
4.	**Pre-requisites**	To study this course, Student must have Diploma in Biotechnology		
5.	**Course Learning outcomes**	On successful completion of this course, the students will be able to: 1. Will know the use of Bioinformatics tools and their applications. 2. Develop an understanding of basic theory of these computational tools. 3. Gain working knowledge of these computational tools and methods. 4. Appreciate their relevance for investigating specific contemporary biological questions. 5. Critically analyse and interpret results of their study.		
6.	**Credit Value**	4		
7.	**Total Marks**	Max. Marks-30+70	Min. Passing Marks: 35	

Part B - Content of the Course		
Total No. of Lectures- Tutorials-Practical (in hours per week): L-T-P:		
Subject: Biotechnology		
Unit	**Topics**	**Number of Lectures (1 Hour Each) 12**
I.	Introduction to computers and Bioinformatics: History of Bioinformatics, Computer Organization: components, Memory devices; Comparison of different operating systems DOS, Windows, Linux. Comparison of different operating systems DOS, Windows, Linux. Computers in biology and medicine; Internet Technologies: Web Services - WWW; URL; Servers: Client/ Server essentials - Domain Name Server; FTP server; E-mail server; WEB servers; Web publishing-Browsers-IP Addressing. Sequence file formats: GenBank, FASTA, PIR, ALN/Clustal W2, GCG/MSF, and PDB.	**12**
II.	Proteomics and genomics: Aims, strategies and challenges in proteomics; proteomics technologies: Brief overview of prokaryotic and eukaryotic genome organization; extra-chromosomal DNA: bacterial plasmids, mitochondria and chloroplast. Genetic and physical maps; markers for genetic mapping; methods and techniques used for gene mapping, physical mapping, linkage analysis, cytogenetic techniques, FISH technique in gene mapping, somatic cell hybridization, radiation hybrid maps, in situ hybridization, comparative gene mapping.	**12**
III.	Overview of biological databases, nucleic acid & protein databases, primary, secondary, functional, composite, structural classification database, Sequence formats & storage, Access databases, Extract and create sub databases, limitations of existing databases. databases and search tools: biological background for sequence analysis; Identification of protein sequence from DNA sequence; searching of databases similar sequence; NCBI; publicly available tools; resources at EBI; resources on web; database mining tools.	**12**
IV.	Database: Database concept; Database management system; Data generating techniques, Database browsing and Data retrieval; Data structures and Databases. Sequence and Genome Databases: Databases such as GenBank; EMBL; DDBJ; Swissprot etc	**12**
V.	Applications and techniques: clinical and biomedical applications of proteomics; Identification and classification of organisms using molecular markers-16S rRNA typing/sequencing, SNPS; use of genomes to understand evolution of eukaryotes, track emerging diseases and design new drugs; determining gene location in genome sequence.	**12**

Part C - Learning Resources

Text Books, Reference Books, Other Resources
Suggested Readings: 1. Sinha P K & Sinha Priti, Computer Fundamentals, Fourth Edition. 2. Greg Perry, SAMS teach your self open office.org. 3. Alexis & Mathews Leon, Fundamentals of information technology 4. Sharma Vinay, Munjal Ashok, Shankar Asheesh, A text book of Bioinformatics, Rastogi publications. 5. Rastogi SC, Mandirreta Namita, Rastogi Parag, Bioinformatics Concepts, Skill and applications, Rastogi Publications 6. Books published by Madhya Pradesh Hindi Granth Academy, Bhopal Suggestive digital platforms/web links https://www.ncbi.nlm.nih.gov/ https://www.rcsb.org/ http://www.mbio.ncsu.edu/BioEdit/bioedit.html https://www.expasy.org/ https://swissmodel.expasy.org/ http://molprobity.biochem.duke.edu/ https://web.expasy.org/protparam/ https://blast.ncbi.nlm.nih.gov/Blast.cgi?PAGE=Proteins
Suggested equivalent online courses:

Part D-Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks: 100 Continuous Comprehensive Evaluation (CCE): 30 marks University Exam (UE) 70 marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	30
External Assessment: University Exam Section Time: 03.00 Hours	**Section(A):** Very Short Questions **Section (B):** Short Questions **Section (C):** Long Questions	70
Any remarks/suggestions:		

Part A Introduction				
Program: Degree		**Class: B.Sc.**	**Year: III Year**	**Session: 2023-24**
Subject: Biotechnology				
1.	**Course Code**	S3-BTEC4Q		
2.	**Course Title**	Bioinformatics		
3.	**Course Type (Core Course/ Discipline Specific Elective/Elective/ Generic Elective /Vocational/....)**	Discipline Specific Elective 4 (Practical) (Group B Paper II)		
4.	**Pre-requisite (if any)**	To study this course, Student must have Diploma in Biotechnology		
5.	**Course Learning outcomes (CLO)**	**On successful completion of this course, the students will be able to:** 1. Will know the use of Bioinformatic tools and their applications. 2. Develop an understanding of basic theory of these computational tools. 3. Gain working knowledge of these computational tools and methods. 4. Appreciate their relevance for investigating specific contemporary biological questions. 5. Critically analyse and interpret results of their study.		
6.	**Credit Value**	2		
7.	**Total Marks**	**Max. Marks**-100	**Min. Passing Marks**: 35	

Part B-Content of the Course		
Total No. of Lectures- Tutorials-Practical (in hours per week): L-T-P:		
Unit	**Topics**	**Number of Lectures (2 Hours Each)**
	Practicals: Topics 1. Searching PubMed, Introduction to NCBI, NCBI data bases, 2. Multiple sequence alignment, Primer designing, Phylogenetic Analysis. 3. Sequence information resource: . Understanding and use of various web resources: EMBL, Genbank, Entrez, Unigene, Protein information resource (PIR) 4. Understanding and using: PDB, Swissprot, TREMBL 5. Using various BLAST and interpretation of results.	**30**
Keywords/Tags:		

Part C-Learning Resources
Text Books, Reference Books, Other resources
Suggested Readings: 1. Sinha P K & Sinha Priti, Computer Fundamentals, Fourth Edition. 2. Greg Perry, SAMS teach your self open office.org. 3. Alexis & Mathews Leon, Fundamentals of information technology 4. Sharma Vinay, Munjal Ashok, Shankar Asheesh, A text book of Bioinformatics, Rastogi publications. 5. by Rastogi SC, Mandirreta Namita, Rastogi Parag, Bioinformatics Concepts, Skill and applications, Rastogi Publications 6. Books published by Madhya Pradesh Hindi Granth Academy, Bhopal
Suggestive digital platforms/web links https://www.ncbi.nlm.nih.gov/ https://www.rcsb.org/ http://www.mbio.ncsu.edu/BioEdit/bioedit.html https://www.expasy.org/ https://swissmodel.expasy.org/ http://molprobity.biochem.duke.edu/ https://web.expasy.org/protparam/ https://blast.ncbi.nlm.nih.gov/Blast.cgi?PAGE=Proteins
Suggested equivalent online courses:

<table>
<tr><th colspan="4">Part D-Assessment and Evaluation</th></tr>
<tr><td colspan="4">Suggested Continuous Evaluation Methods:</td></tr>
<tr><td>Internal Assessment:</td><td>Marks</td><td>External Assessment</td><td>Marks</td></tr>
<tr><td>Class interaction/ quiz</td><td rowspan="3">30</td><td>Viva voce on practical</td><td rowspan="3">70</td></tr>
<tr><td>Attendance</td><td>Practical record file</td></tr>
<tr><td>Assignment (Chart/Model Seminar/Rural Service/ Teachnology Dissertation/ Report of Excursion/ Lab Visits/ Survey/ Industrial Visit</td><td>Table work/ Experiments</td></tr>
<tr><td colspan="2"></td><td colspan="2">Total Marks: 100</td></tr>
<tr><td colspan="4">Any remarks/ suggestions:</td></tr>
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St. Aloysius' College (Autonomous), Jabalpur, M.P.
Department of Microbiology
II Semester
Foundation Course/ बुनियादी पाठ्यक्रम।
ENVIRONMENTAL EDUCATION/ पर्यावरण शिक्षा

PART A: Introduction			
Program: UG Level Certificate	**Class: UG**	**Year: II Semester**	**Session 2023-24 onwards**
Subject: Environmental Education			
1.	Course Code	XI-FCACIT	
2.	Course Title.	Environmental Education	
3.	Course Type (Core Course/ Elective/ Generic/ Elective/ Vocational	Foundation Course.	
4.	Pre-Requisite (if any).	A course intended to create awareness about the life of human beings which is an integral part of environment, and to inculcate the skills required to protect the environment from all sides	
5.	Course Learning Outcomes	1. To understand various aspects of life forms, ecological processes, and the impacts on them by the human during Anthropocene era. 2. To build capabilities to identify relevant environmental issues, analyze the various underlying causes, evaluate the practices and policies and develop framework to make inform decisions. 3. To develop empathy for all life forms, awareness, and responsibility towards environmental protection and nature preservation 4. To develop the critical thinking for shaping strategies such as ; social, economic, administrative & legal environmental protection, conservation of biodiversity, environmental equity an sustainable development 5. To prepare for the competitive exams (CLO)	
6.	Credit Value.	2 Credit	
7.	Total Marks	Max.Marks:50	

PART B: Content of the Course		
Total No. of Lectures-15 Hrs. (01 hours per week)		
Unit	**Topics.**	**No. of lectures**
I	**Environment and natural resources** • Multidisciplinary nature and scope and importance of environment. • Components of environment: atmosphere, hydrosphere, lithosphere and biosphere. • Brief account of natural resources and associated problems: land resources, water resources, energy resources. • Concept of sustainability a d sustainable development. ***Key words: Environment, forest, minerals, food, land, water, energy, sustainable development***.	5 Hrs
II	**Biome, ecosystem and biodiversity:** • Major Bin Tropical, Temperate, Forest, Grassland, Desert, Tundra, Wetland Estuarine and Marine • Ecosystem Structure function and types their Preservation & restoration • Biodiversity and its conservation practices ***Keywords : Biome, Ecosystem, Biodiversity***	4 Hrs
III	**Environmental Pollution, Management and Social Issues:** • Pollution Types, Control measures, Management and associated problems. • Environmental Law and Legislation: Protection and conservation Act International Agreement & Programme • Environmental Movements, communication and public awareness programme • National and international organizations related to environment conservation and monitoring • Role of information technology in environment and human health. ***Keywords: Pollution, Environmental Legislation, Environmental movement, Environmental programme and organization.***	6 Hrs
	Suggested activities: (at least one) 1. Visit to an area to document environmental assets rivers/Sarest/flora/ fauna 2. Visit to a local polluted site Urban/Rural/Industrial 3. Study of simple ecosystem	

PART C: Learning Resources

Textbooks, Reference Books, Other Resources

●Singh S.P. and Gupta, S... Eology invite Science and Conservation S Chand publication New Delhi (2015)

●Divan, S. and Rosencranz, A.. "Environmental Law and Policy in India Cases, Material & Status" Oxford University Prems India 2002) 200 Edition:

●Odum EP. Fundamentals of Ecology Philadelphia Studies (1971)

●Bharucha, Erach, "Environmental studies" Universities Press India Pvt. Ltd. Hyderabad (2014) (Hindi Edition also available)

●Kaushik, Anubha, Kaushik, C.P. "Perspectives in Environmental Studies "New Environmental Studies" New age International Publishers (2018), 6th Edition.

●Aathana, D. K Asthana Moma. "A Testbook of Environmental Studies", S. Chand. Publishing. Now Delhi (2007)

●National Digital Library (http://ndl.iitkgp.ac.in/home/download)

●Epg-pathshala . (http://infiboet.ac.in/Home/Download)

●NPTEL (http:// nptel.ac.in/course.html)

●Cousera (https://www.coursera.org/search?query=environmental+science and page=1)

Suggested equivalent online course

1. The Health Effects of Climate Change (edx)
2. Climate Change: Financial Risks and Opportunities (edx)
3. Introduction to Environmental Law and Policy (coursera)
4. Women in environmental biology (coursera)
5. Our Earth 's Climate, History, and Processes (coursera)
6. Ecology, physiology, environmental science (National digital library)

St. Aloysius College (Autonomous), Jabalpur, M.P.
Department of Botany & Microbiology
II Semester

Foundation Course/ बुनियादी पाठ्यक्रम।

ENVIRONMENTAL EDUCATION/ पर्यावरण शिक्षा

भाग ए: परिचय			
कार्यक्रम: यूजी स्तर	**कक्षा: यूजी**	**सेमेस्टर: 2**	**सत्र 2023-2024**
विषय: पर्यावरण शिक्षा			

1 कोर्स कोड।	XI-FCACIT
2. पाठ्यक्रम शीर्षक।	पर्यावरण शिक्षा
3.कोर्स टाइप (कोर कोर्स। ऐच्छिक जेनेरिक ऐच्छिक, व्यवसायिक	फाउंडेशन कोर्स।
4. प्रो-अपेक्षित (यदि कोई हो)।	जागरूकता पैदा करने के इरादे से बनाया गया एक कोर्स ,मनुष्य का जीवन जो एक अभिन्न है पर्यावरण का हिस्सा, और सु कौशल विकसित करना। हर तरफ से पर्यावरण की रक्षा के लिए आवश्यक।
5.पाठ्यक्रम सीखने के परिणाम	1. जीवन रूपों के विभिन्न पहलुओं को समझने के लिए, पारिस्थितिक प्रक्रियाओं, और मानव द्वारा उन पर प्रभाव के दौरान एंथ्रोपोसीन युग। 2. प्रासंगिक विडंबनाओं की पहचान करने के लिए क्षमताओं का निर्माण करने के लिए , विभिन्न अंतर्निहित कारणों का विश्लेषण करें, प्रथाओं का मूल्यांकन करें और नीतियों, और सूचित निर्णय लेने के लिए रूपरेखा विकसित करना। 3. सभी जीवन रूपों, जागरूकता और जिम्मेदारी के लिए सहानुभूति विकसित करना पर्यावरण संरक्षण और प्रकृति संरक्षण की दिशा में। 4. रणनीतियों को आकार देने के लिए महत्वपूर्ण सोच विकसित करना जैसे; , सामाजिक, आर्थिक, प्रशासनिक और कानूनी पर्यावरण संरक्षण, जैव विविधता का संरक्षण, पर्यावरण समानता सतत विकास 5. प्रतियोगी परीक्षाओं की तैयारी (CLO)
6. क्रेडिट मूल्य।	2 क्रेडिट
7. कुल अंक।	अधिकतम अंक: 50

भाग बी: पाठ्यक्रम की सामग्री		
लेक्चर की कुल संख्या-15 घंटे। (01 घंटे प्रति सप्ताह)		
व्याख्यानों की कुल संख्या 15		
इकाई	**विषय**	**व्याख्यानों की संख्या**
1	पर्यावरण और प्राकृतिक संसाधन: 1. बहुविषयक प्रकृति, कार्यक्षेत्र और पर्यावरण का महत्व। 2. पर्यावरण के घटक: हाइड्रोस्फीयर, लिथोस्फीयर और बायोस्फीयर 3. प्राकृतिक संसाधनों और संबंधित समस्या का संक्षिप्त विवरण: भूमि संसाधन, जल संसाधन, ऊर्जा संसाधन 4. स्थिरता और सतत विकास की अवधारणा कीवर्ड: पर्यावरण, वन, खनिज, भोजन, भूमि, जल, ऊर्जा, सतत विकास	5 घंटे
2	बायोम, पारिस्थितिकी तंत्र और जैव विविधता: 1. मेजर बिन ट्रॉपिकल, समशीतोष्ण, वन, घास के मैदान, रेगिस्तान, टुंड्रा, वेटलैंड एस्टुरीन और समुद्री 2. पारिस्थितिकी तंत्र संरचना कार्य और उनके संरक्षण और बहाली के प्रकार 3. जैव विविधता और इसके संरक्षण के तरीके कीवर्ड: बायोम, पारिस्थितिकी तंत्र, जैव विविधता	4 घंटे
3	पर्यावरण प्रदूषण, प्रबंधन और सामाजिक मुद्दे: 1. प्रदूषण के प्रकार, नियंत्रण के उपाय, प्रबंधन और संबंधित समस्याएं। 2. पर्यावरण कानून और कानून: संरक्षण और संरक्षण अधिनियम अंतर्राष्ट्रीय समझौता और कार्यक्रम 3. पर्यावरण आंदोलन, संचार और जन जागरूकता कार्यक्रम 6 बजे 4. पर्यावरण संरक्षण और निगरानी से संबंधित राष्ट्रीय और अंतर्राष्ट्रीय संगठन 5. पर्यावरण और मानव स्वास्थ्य में सूचना प्रौद्योगिकी की भूमिका। कीवर्ड प्रदूषण, पर्यावरण कानून, पर्यावरण आंदोलन पर्यावरण कार्यक्रम और संगठन	6 घंटे
	सुझाई गई गतिविधियां: (कम से कम एक) 1. पर्यावरणीय संपत्ति नदियों/सरेस्ट/वनस्पति/जीवों का दस्तावेजीकरण करने के लिए किसी क्षेत्र का दौरा 2. स्थानीय प्रदूषित स्थल का दौरा शहरी/ग्रामीण/औद्योगिक 3. सरल पारिस्थितिकी तंत्र का अध्ययन	

भाग सी: सीखने के संसाधन

पाठ्यपुस्तकें, संदर्भ पुस्तकें, अन्य संसाधन

1. सिंह ... सिंह एसपी और गुप्ता, एस ... ईओलॉजी विज्ञान और संरक्षण को आमंत्रित करते हैं एस चंद प्रकाशन नई दिल्ली (2015)
2. दीवान, एस. और रोसेनक्रांज़, ए.. "पर्यावरण कानून और नीति भारत में मामले, सामग्री और स्थिति" ऑक्सफोर्ड यूनिवर्सिटी प्रेम्स इंडिया 2002) 200 संस्करण:
3. ओडुम ईपी। पारिस्थितिकी के बुनियादी सिद्धांत फिलाडेल्फिया अध्ययन (1971)
4. भरूचा, एराच, "पर्यावरण अध्ययन" विश्वविद्यालय प्रेस इंडिया प्रा। लिमिटेड हैदराबाद (2014) (हिंदी संस्करण भी उपलब्ध है)
5. कौशिक, अनुभा, कौशिक, सीपी "पर्सपेक्टिव्स इन एनवायर्नमेंटल स्टडीज" न्यू एनवायर्नमेंटल स्टडीज "न्यू एज इंटरनेशनल पब्लिशर्स (2018), 6 वां संस्करण।
6. . अथाना, डी. के. अस्थाना मोमा। "ए टेस्टबुक ऑफ एनवायर्नमेंटल स्टडीज", एस. चंद। प्रकाशन। अब दिल्ली (2007)
7. राष्ट्रीय डिजिटल पुस्तकालय (http://ndl.iitkgp.ac.in/home/download)
8. एपीजी-पाठशाला। (http://infiboet.ac.in/Home/Download)
9. एनपीटीईएल (http://nptel.ac.in/course.html)
10. कूसेरा (https://www.coursera.org/search?query=environmental+science और पेज = 1)

सुझाए गए समकक्ष ऑनलाइन पाठ्यक्रम

1. जलवायु परिवर्तन के स्वास्थ्य प्रभाव (edx)
2. जलवायु परिवर्तन: वित्तीय जोखिम और अवसर (edx)
3. पर्यावरण कानून और नीति का परिचय (कोर्सेरा)
4. पर्यावरण जीव विज्ञान में महिलाएं (कोर्सेरा)
5. हमारी पृथ्वी की जलवायु, इतिहास और प्रक्रियाएं (कोर्सेरा)
6. पारिस्थितिकी, शरीर विज्ञान, पर्यावरण विज्ञान (यूशनल डिजिटल लाइब्रेरी)

M.Sc. Zoology III Semester

Session Session 2023-24

CORE COURSE

Paper II-Limnology

Max.M-40

Unit-1	1. Limnology–Definition, historical development and scope of Limnology. 2. Types of fresh water habitats and their Ecosystem- (a) Ponds, Streams and rivers. (b)Lakes–Origin and classification. 3. Morphometry–Use of various morphometric parameters and Zonation.
Unit-2	Physico–Chemical Characteristics- 1. Light and Temperature- (a) Light as an ecological parameter in freshwater. (b) Temperature-Radiation, Stratification and Heat Budget. 2. (a) Dissolved Solids–Carbonate, Bicarbonates, Phosphate and Nitrate. (b) Physico–Chemical characteristics of fresh water with special reference to different parameters-Turbidity, dissolved gases (Oxygen, Carbondioxide, Hydrogen Sulphide), seasonal changes in dissolved gases and pH.
Unit-3	1. Study of Biota- (a) Phytoplankton, Zooplankton and their inter-relationship. (b) Aquatic insects, birds and their environmental significance. 2. Ecological classification of aquatic fauna. 3. Higher aquatic plants and their significance.
Unit-4	1. Methods of water quality testing BOD and COD. 2. Sewage– Definition, composition and its treatment. 3. Bioindicators - Aquatic flora and fauna in relation to water quality in an aquatic environment.

14/7/23

14/7/23

Suggested Readings:

Anathakrishnan	:	Bioresources Ecology
Goldman	:	Limnology
Odum	:	Ecology
Pawlosuske	:	Physico-chemical methods for water
Wetzal	:	Limnology
Trivedi&Goyal	:	Chemical and biological methods for water pollution studies
Welch	:	Limnology Vols.I-II
Perkins	:	Ecology
Arora	:	Fundamentals of environmental biology
Ghoshe	:	Toxicology
Sood	:	Toxicology

14/7/23

14/7/23

14/7/23

St. Aloysius (Autonomous) College, Jabalpur

Department of Chemistry

Class	*Course Type*	*Course Code*	*Course Title (Theory/Practical)*	*Marks*	
M.Sc. IV SEM	**Departmental Elective**	Course **MCH 403 A**	**Environmental Chemistry**	Max: 40	Min: 14

COURSE OBJECTIVE:

To provide an overview of water, air, soil, radioactive and noise pollution including methods for prevention of pollution and its control measures.

Unit I

Environment Introduction. Composition of atmosphere, vertical temperature, temperature inversion, heat budget of the earth, atmospheric system, vertical stability atmosphere, Biochemical cycles of C,N, P, S and O. Biodistribution of elements.

Hydrosphere Chemical composition of water bodies-lakes, streams, rivers and wet lands etc. Hydrological cycle Aquatic pollution – Inorganic, organic, pesticide, agriculture, industrial and sewage, detergents, oil spills and oil pollutants. Water quality parameters – dissolved oxygen,biochemical oxygen demand, solids, metals, content of chloride, sulphate, phosphate, nitrate and microorganisms. Water quality standards.Analytical methods of measuring BOD, DO, COD, F, Oils, metals (As, Cd, Cr, Hg, Pb, Se etc.),residual chloride and chlorine demand. Purification and treatment of water.

UnitII

Soils-Composition, micro and macro nutrients, pollution – fertilizers, pesticides, plastics and metals.Waste treatment.

Atmosphere Chemical composition of atmosphere – particles, ions and radicals and their formation. Chemical and photochemical reactions in atmosphere, smog formation, oxides of N,

C, S, O and their effect, pollution by chemicals, petroleum, minerals, chlorofluorohydrocarbons. Green house effect, acid rain, air pollution controls and their chemistry. Analytical methods for measuring air pollutants. Continuous monitoring instruments.

Unit III

Industrial Pollution

Cement, sugar, distillery, drug, paper and pulp, thermal power plants, nuclear power plants, metallurgy. Polymers, drugs etc. Environmental disasters – Cherbonyl, Three mile island, Seveso and Minamata disasters, Japan tsunami.

Unit IV

Environmental Toxicology Toxic heavy metals **:**Mercury, lead, arsenic and cadmium. Causes of toxicity. Bioaccumulation, sources of heavy metals. Chemical speciation of Hg, Pb, As, and Cd. Biochemical and damaging effects.

Toxic Organic Compound **:** Pesticides, classification, properties and uses of organochlorine and ionospheres pesticides detection and damaging effects.

Unit-V

Aquatic Chemistry and Water Pollution. Redox chemistry in natural waters. Dissolved oxygen, biological oxygen demand, chemical oxygen demand, determination of DO, BOD and COD. Aerobic and anaerobic reactions of organic sulphur and nitrogen compounds in water acid-base chemistry of fresh water and sea water. Aluminum, nitrate and fluoride in water. Petrification. Sources of water pollution. Treatment of waste and sewage. Purification of drinking water, techniques of purification and disinfection.

COURSE OUTCOME:

By the end of this course student will be able to-

- Understand Environmental Chemistry and its concepts.
- Build concepts of Hydrosphere, Atmosphere and Soil, their composition, and side effects pollution.
- Understand and apply the concepts industrial pollution and study of some famous environmental disasters.
- Understand and apply the concepts Water pollution, purification and treatment and study of some prime pollutants.
- Develop an understanding of environmental toxicology and some toxic Organic Compounds.

1. Environmental Chemistry, Colin Baird, W.H. Freeman Co. New York, 1998.
2. Chemistry of Atmospheres, R.P. Wayne, Oxford.
3. Environment Chemistry, A.K. De, Wiley Eastern, 2004.
4. Environmental Chemistry, S.E. Manahan, Lewis Publishers.
5. Introduction to atmospheric Chemistry, P.V. Hobbs, Cambridge.
6. Environmental Chemistry, S.E. Manahan, Lewis Publishers.
7. Environmental chemistry, Sharma and Kaur, Krishna Publishers.
8. Environmental Chemistry, Analysis, S.M. Khopkar, Wiley Eastern.
9. Standard Method of Chemical Analysis, F.J.WelcherVol.III, VanNostr and ReinholdCo.
10. Environmental Toxicology, Ed.J.Rose, Gordon and Breach Science Publication. 7. Environmental Chemistry, C. Baird, W.H.Freeman.

Elective Course - I
Environment and Elementary Ecology

Unit I

Major biomes of the world, tropical rain and seasonal forests, temperate rain and seasonal forests, boreal forests, grasslands, deserts, aquatic ecosystems wetlands, lakes and pond streams and rivers, marine and estuarine habitats.

Unit II

Resource utilization, status and utilization of biodiversity, sustainable development resources from forest, grassland and aquatic habitats. Food forage, fodder, timber and non-wood forest products. Threats to quality and quantity of resources due to overexploitation.

Unit III

Strategies for conservation of resources: classifications of resources. Principles of conservation, *In-situ* conservation sanctuaries , national parks, biosphere reserves for wildlife conservation, habitat conservation practices of conservation for forests range. Soil and water.

Unit IV

Introduction to Ecology: Definition & Scope; Environment: Physical environment, biotic environment, biotic and abiotic interaction.

Population Ecology: Characterstics of a population, population growth curves, population regulation, concept of meta-population.

Unit V

Ecological succession: types, mechanism, models of succession.

Community organization: Types of species interaction, food chain, food web, ecological pyramids, energy flow.

2019-20

Water Quality Monitoring

Brochure

&

Course Module

ST. ALOYSIUS' COLLEGE
(AUTONOMOUS), JABALPUR (M.P.)

Reaccredited 'A+' Grade by NAAC (CGPA 3.68/4.00)
College with Potential for Excellence (CPE) by UGC
DST-FIST Supported , STAR college scheme by DBT

SOCIETY

LAB

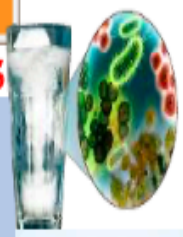
Department of Botany and Microbiology

(Excellence through perseverance)

Certificate course in

WATER QUALITY MONITORING

A STEP TOWARDS YOUR FUTURE CAREER.....



ABOUT THE COURSE

Duration of course: one month (inclusive of theory and practicals)

Commencement of Course: 6th dec 2021 onwards

Course fees: Aloysians (Rs. 150), Non-Aloysians (Rs. 200)

Eligibility criteria: 12th pass candidate with Science background.

OBJECTIVES OF THE COURSE

- To alert us about current, ongoing, and emerging problems of pollution.
- To determine compliance with drinking water standards.
- To protect other beneficial uses of water.
- To inculcate skills for water quality assessment.

LEARNING OUTCOMES

- Physical properties of water Chemical properties of water
- Biological properties of water
- Assessment methodologies
- Industrial application and job opportunities.

REGISTER HERE

ACCOUNT DETAILS

Name: St. Aloysius' College Account **Acc.No.**: 5201214000008
Branch: Gorakhpur Jabalpur **IFSC code**: CNRB0005201
MICR code: 482015006

Contact: **Mrs. Roshni Choubey,** Course coordinator, Dept. of Botany and Microbiology, SAC, JBP. (9713247488)

Department of Botany and Microbiology
St. Aloysius' College (Autonomous) Jabalpur

CERTIFICATE COURSE ON

WATER QUALITY MONITORING

2019-20

Module 1 **1 credits**

1. **Physical analysis of water**

   Introduction to general properties of water: odor, pH, color and turbidity, methods of assessment, water quality and surveillance programme, Water quality, Guidelines and standards.

2. **Chemical analysis of water**

   Total dissolved solids (TDS), Ionic Analysis: Sodium, Potassium, Magnesium, calcium, iron, Lithium; Alkalinity: Chloride, nitrite, nitrate, phosphate, sulphate, chlorine Inorganic non-metallic constituents

3. **Microbiological analysis of water**

   Aerobic Microbial Plate Count (AMPC), Total Coliforms, Faecal Coliforms: *Streptococcus, Vibrio cholera, Escherichia coli, Staphylococcus aureus, Salmonella, Shigella, Clostridium, yeasts and moulds.*

Module 2: Hands on water quality analysis **1 credits**

Visit to water industries

Report submission

Note: Total credits: 2

01 credit= 15 hrs.

6/7/19

6/7/19

6/7/19

(Dr. P K Khare)

Monica Saini

2020-21

Certificate Course in Water Quality Monitoring

Brochure

&

Course Module

ST. ALOYSIUS' COLLEGE

(AUTONOMOUS), JABALPUR (M.P.)

Reaccredited 'A+' Grade by NAAC (CGPA 3.68/4.00)
College with Potential for Excellence (CPE) by UGC
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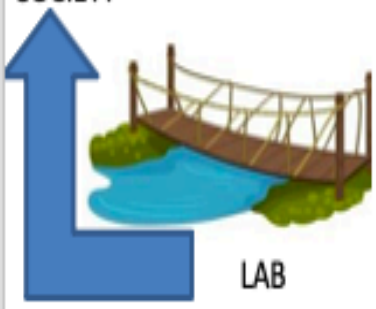

Department of Botany and Microbiology

(Excellence through perseverance)

Certificate course in

WATER QUALITY MONITORING

2020-21

ABOUT THE COURSE

Duration of course: One month (inclusive oftheory and practical) **Commencement of Course**: 4th Jan 2021 onwards

Course fees: Rs. 500

Eligibility criteria:

12th pass candidate with Science background.

Contact : **Mrs. Roshni Choubey,** Course coordinator, Dept. of Botany and Microbiology, SAC, JBP. (9713247488)

St. Aloysius' College (Autonomous), Jabalpur, M.P.
Reaccredited A+ by NAAC with CGPA (3.68/4.0),
College with Potential for Excellence by UGC
DST –FIST supported and STAR College scheme by DBT
Department of Botany and Microbiology

CERTIFICATE COURSE IN WATER QUALITY MONITORING

Syllabus

Session 2020-21 onwards

Course Outcome:

Upon completion of the course learners will

- acquire knowledge about Water resources and pollution.
- be able to summarize the major properties of water.
- be able to describe and apply different tools, criteria and assessment methods for successful monitoring of water.
- be able to analyze water samples for physicochemical pollution / microbial contamination.
- develop skills to serve water industries.

Module 1:	1 credit

1. Examination of Water's Physical Properties Introduction to fundamental water properties: scent, pH level, hue, and clarity, evaluation methods, water quality overview, surveillance programs, Water Quality: Standards and Guidelines.
2. Water's Chemical Assessment Measurement of Total Dissolved Solids (TDS), Ionic Analysis: Sodium, Potassium, Magnesium, Calcium, Iron, Lithium; Alkalinity: Chloride, Nitrite, Nitrate, Phosphate, Sulphate, Chlorine, Inorganic Non-Metallic Elements.
3. Microbial Examination of Water Aerobic Microbial Plate Count (AMPC), Total Coliforms, Faecal Coliforms: Streptococcus, Vibrio Cholera, Escherichia coli, Staphylococcus aureus, Salmonella, Shigella, Clostridium, Yeasts, and Molds

Module 2: Practical Water Quality Analysis: 1 credit Field Trip to Water Industries

Note: Total credits: 2(1 credit= 15 hrs)

St. Aloysius' College (Autonomous), Jabalpur, M.P.

Reaccredited A+ by NAAC with CGPA (3.68/4.0),
College with Potential for Excellence (CPE) by UGC
DST –FIST supported and STAR College scheme by DBT
Department of Botany and Microbiology

CERTIFICATE COURSE IN WATER QUALITY MONITORING

Syllabus

Session 2020-21 onwards

MARKING SCHEME **MM: 100 Marks**

1. **Theory examination:** **50 Marks**

   Multiple choice questions (5X1 = 05)

   Short answer type questions (3X5 = 15)

   Long answer type questions (10X3 = 30)

2. **Practical examination** **25 Marks**

   Major experiment (10)

   Minor experiment (05)

   Comment upon (05)

   Viva voce (05)

3. **Project** **25 Marks**

2021-22

Certificate Course in Water Quality Monitoring Practical

Brochure

&

Course Module

ST. ALOYSIUS' COLLEGE
(AUTONOMOUS), JABALPUR (M.P.)

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DST-FIST Supported; STAR college scheme by DBT

Every DROP counts

Department of Botany and Microbiology

(Excellence through perseverance)

Offers

Certificate course in

'Water Quality Monitoring 'Practical
2021-22
Duration 15 Days

Course Fee: In campus (Rs. 300), Off campus (Rs. 450)

Target Group: UG and PG Students

Grab the opportunity

Account details

Name: St. Aloysius' College Account
Acc.No.:5201214000008
Branch: Gorakhpur Jabalpur
IFSC code: CNRB0005201
MICR code: 482015006
Address: Canara Bank, Gorakhpur Branch, J R Sama Complex 78 Narbada road, Katanga Crossing, Jabalpur, M.P.

REGISTER HERE

Objectives of the course

- *To alert about current, ongoing, and emerging problems of water pollution.*
- *To describe beneficial uses of water.*
- *To determine compliance with drinking water standards.*
- *To discuss Government strategies for water management.*
- *To inculcate skills for water quality assessment.*

Learning outcomes

- *Physical properties of water*
- *Chemical properties of water*
- *Biological properties of water*
- *Assessment methodologies*
- *Industrial application and job opportunities.*

Contact details

Email:
bot.sac@gmail.com

St. Aloysius' College (Autonomous), Jabalpur, M.P.
Reaccredited A+ by NAAC with CGPA (3.68/4.0),
College with Potential for Excellence (CPE) by UGC
DST –FIST supported and STAR College scheme by DBT
Department of Botany and Microbiology

CERTIFICATE COURSE IN WATER QUALITY MONITORING
Syllabus
Session 2021-22 onwards

List of practical

1. To study the color / turbidity of given water sample.
2. To study the pH of given water sample.
3. Detection of chloride in given water sample.
4. To study the role of sedimentation in water purification.
5. To calculate TDS of given water sample.
6. Detection of ions in water through flame photometer.
7. Detection of dissolved oxygen in given water sample.
8. Detection of BOD and COD for given water sample.
9. Isolation of aquatic bacteria.
10. Isolation of aquatic fungi.
11. Isolation of *Vibrio / Salmonella / Shigella / Klebsiella / E. coli* on selective growth medium.
12. To perform coliform test.
13. Study of effect of UV radiations on microbial growth.
14. Treatment of waste water using Nature's strategy (**Innovation**).

18/12/20

18/12

Unit – 5	**Cultivation management:** Insect pests, fungal competitors and other important diseases, Pest management; Harvest and Post-harvest technology, Value added products and entrepreneurship.	**3 Hours**
Total theory hours		**15 Hour**

Module II: Practical — 1 Credits

1.	Preparation of mother culture	2 Hour
2.	Multiplication of spawn	3 Hour
3.	Sterilization of substrates	2 Hour
4.	Pasteurization of substrates	2 Hour
5.	Composting	2 Hour
6.	Cultivation of oyster mushroom	3 Hours
7.	Cultivation of button mushroom	3 Hours
8.	Visit to mushroom cultivation unit	5 Hours
9.	Project	8 Hours
Total practical hours		**30 Hour**

Marking Scheme

MM 100

Modules	**Max Marks**	**Minimum passing marks (50% marks)**
Module I	50 marks	25
Module II	50 marks	25
(a) Practical	25 marks	
(b) Project	25 marks	
Total marks		**100**

Reference Books

1. Handbook on Mushrooms by Bahl N.
2. Benjamin Hirst Mushrooms: A Beginners Guide to Home Cultivation Paperback (20150)
3. V. N. Pathak. Mushroom Production and Processing Technology IST Edition Hardcover – 2011
4. Eiri Staff Hand Book of Mushroom Cultivation, Processing and Packaging Paperback – Import, 2007
5. R. C. Dubey and D. K. Maheshwari. PracticalMicrobiology, 2009. S. Chand and Com. Ltd. ISBN 81219-2153-8. 8 (4)

2022-23

Water Quality Monitoring
Brochure
&
Course Module

ST. ALOYSIUS' COLLEGE
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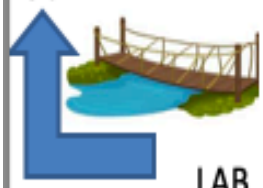
SAC

SOCIETY



LAB

Department of Botany and Microbiology

2022-23

Certificate course in

WATER QUALITY MONITORING

A STEP TOWARDS YOUR FUTURE CAREER.....

ABOUT THE COURSE

Duration of course:
One month (theory and practical)

Commencement of Course:
1st Dec 2022 onwards

Course fees
Rs. 500

Eligibility criteria:
12th pass candidate with Science background.

OBJECTIVES OF THE COURSE

- To alert us about current, ongoing, and emerging problems of pollution.
- To determine compliance with drinking water standards.
- To protect other beneficial uses of water.
- To inculcate skills for water quality assessment.

LEARNING OUTCOMES

- Physical properties of water Chemical properties of water
- Biological properties of water
- Assessment methodologies
- Industrial application and job opportunities.

REGISTER HERE

ACCOUNT DETAILS

Name: St. Aloysius' College Account
Acc.No.: 5201214000008
Branch: Gorakhpur Jabalpur
IFSC code: CNRB0005201
MICR code: 482015006

Contact: **Mrs. Roshni Choubey,** Course coordinator (9713247488)

St. Aloysius' College (Autonomous), Jabalpur, M.P.
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CERTIFICATE COURSE IN WATER QUALITY MONITORING

Syllabus

Session 2024-22onwards

Course Outcome:

Upon completion of the course learners will

- acquire knowledge about Water resources and pollution.
- be able to summarize the major properties of water.
- be able to describe and apply different tools, criteria and assessment methods for succesful monitoring of water.
- be able to analyze water samples for physicochemical pollution / microbial contamination.
- develop skills to serve water industries.

Module 1 **1 credits**

1. **Physical analysis of water**
   Introduction to general properties of water: odor, pH, color and turbidity, methods of assessment, water quality and surveillance programme, Water quality; Guidelines and standards.

2. **Chemical analysis of water**
   Total dissolved solids (TDS), Ionic Analysis: Sodium, Potassium, Magnesium, calcium, iron, Lithium; Alkalinity: Chloride, nitrite, nitrate, phosphate, sulphate, chlorine
   Inorganic non-metallic constituents

3. **Microbiological analysis of water**
   Aerobic Microbial Plate Count (AMPC), Total Coliforms, Faecal Coliforms: *Streptococcus, Vibrio cholera, Escherichia coli, Staphylococcus aureus, Salmonella, Shigella, Clostridium, yeasts and moulds.*

***Module 2: Hands on water quality analysis** **1 credits**

Visit to water industries

Report submission

Note: Total credits: 20 (1 credit= 15 hrs)

18/12/20

18/12

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Department of Botany and Microbiology

CERTIFICATE COURSE IN WATER QUALITY MONITORING

Syllabus

Session 202. -2. onwards

MARKING SCHEME — MM: 100 Marks

1. **Theory examination:** — 50 Marks
   - Multiple choice questions (5X1 = 05)
   - Short answer type questions (3X5 = 15)
   - Long answer type questions (10X3 = 30)
2. **Practical examination** — 25 Marks
   - Major experiment (10)
   - Minor experiment (05)
   - Comment upon (05)
   - Viva voce (05)
3. **Project** — 25 Marks

18/12/20

18/12

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CERTIFICATE COURSE IN WATER QUALITY MONITORING
Syllabus
Session 2021-22 onwards

List of practical

1. To study the color / turbidity of given water sample.
2. To study the pH of given water sample.
3. Detection of chloride in given water sample.
4. To study the role of sedimentation in water purification.
5. To calculate TDS of given water sample.
6. Detection of ions in water through flame photometer.
7. Detection of dissolved oxygen in given water sample.
8. Detection of BOD and COD for given water sample.
9. Isolation of aquatic bacteria.
10. Isolation of aquatic fungi.
11. Isolation of *Vibrio / Salmonella / Shigella / Klebsiella / E. coli* on selective growth medium.
12. To perform coliform test.
13. Study of effect of UV radiations on microbial growth.
14. Treatment of waste water using Nature's strategy (Innovation).

18/12/20

2023-24

Water Quality Monitoring
Brochure
&
Course Module

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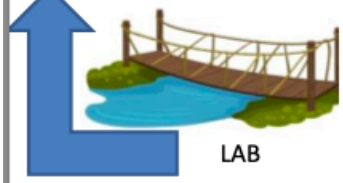
SOCIETY



LAB

2023-24

Department of Botany and Microbiology

(Excellence through perseverance)

Diploma course in

WATER QUALITY MONITORING

ABOUT THE CERTIFICATE COURSE

Duration of course: 30 hrs (inclusive of theory and practical)
Credit: 02
Commencement of Course: second week on November 2023
Course fees: Rs. 500
Eligibility criteria:
12th pass candidate with Science background.

ABOUT THE DIPLOMA COURSE

Duration of course: 30 hrs (inclusive of theory and practical)
Commencement of Course: 1st March 2024
Course fees: Rs. 500
Eligibility criteria:
Candidate with Certificate in water quality monitoring.

Contact

Mrs. Roshni Choubey, Course coordinator, Dept. of Botany and Microbiology, SAC, JBP. (Email: bot.sac@gmail.com)

St. Aloysius' College (Autonomous), Jabalpur, M.P.
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Department of Botany and Microbiology

DIPLOMA COURSE IN WATER QUALITY MONITORING

Session 2023-24

Syllabus

Course Outcome:

Upon completion of this course learners will

- Acquire knowledge about Water resources and pollution.
- Be able to summarize the major properties of water.
- Be able to describe and apply different tools, criteria and assessment methods for successful monitoring of water.
- Develop skills to serve water industries.

and will be awarded with a certificate in Water Quality Monitoring Certificate course.

MODULE I AND II

Module 1 **1 credits**

Unit 1- Hydrology **8hrs.**

1.1: Resources of water (Global and Indian), Fresh and marine water, Hydrological cycle, General properties of water: Physical: odor, taste, pH, color and turbidity; Chemical: acidity, alkalinity, hardness, TDS

1.2: Water pollution and management, Water quality and surveillance programme, Water quality: Guidelines and standards (as per BIS norms), Status of water quality in India

1.3: Water ecosystem, Aquatic flora and fauna, Biological methods of Zonation- Microbial load and Aquatic biota.

Unit 2- Assessment of water quality **7hrs.**

2. 1: Water Composition analysis: - Hardness testing, Chromatographic analysis, pH – Salinity testing, Ionic composition, Minerals, Pollutants, Nutrient Parameters, Potability of Water.

2. 2 Toxicology: Toxicity Testing, Dose and toxicity, *In-vitro* Toxicology, Toxicogenomics

2.3: Water and health hazards: Water borne illness, major pathogens.

Module 2: **1 credits**

- Hands on water quality analysis: 20 hrs.
- Visit to packaged water industry: 5 hrs.
- Project and Report submission: 5 hrs.
- *Note: Total credits: 2(1 credit= 15 hrs.; one practical of 2 hrs.)*

- *Techniques used as per BIS and APHA*

MARKING SCHEME **MM: 100 Marks**

1. **Theory examination:** **60 Marks**

   Multiple choice questions (6X2= 12)

   Short answer type questions (3X6 = 18)

   Long answer type questions (15X2 = 30)

2. **Practical examination** **20 Marks**

   Major experiment (10)

   Minor experiment (05)

   Viva voce (05)

3. **Project** **20 Marks**

List of practical

1. To study the color / turbidity of given water sample using spectrophotometer.
2. To study the pH of given water sample using pH meter.
3. Detection of chloride in given water sample by titration method.
4. To study the role of sedimentation in water purification.
5. To calculate TDS of given water sample.
6. Detection of ions in water through flame photometer.
7. Detection of dissolved oxygen in given water sample.
8. Detection of COD for given water sample.
9. Methods of water sampling.
10. Demonstration of portable water testing kit.

MODULE III AND IV

Course Outcome:

Upon completion of this course learners will

- Understand water quality criteria and standards, and their relation to public health and environmentL
- Learn how to run accurate water quality tests and to determine how the parameters relate to each other
- Be able to describe and apply different tools, criteria and assessment methods for successful monitoring of water.
- Develop skills to serve water industries and will be awarded with a Diploma in Water Quality Monitoring course.

Module 3

1 credits

Unit 1- Microbiology of water **8hrs.**

- Microbial community of water: bacteria, fungi, algae and protozoans, zooplanktons and phytoplanktons, indicator microorganisms, pathogenic bacteria: *Vibrio, Salmonella, Shigella, Clostridium*; Yeast and moulds, Biological oxygen demand, self- purification of water. waste water treatment: Activated sludge and trickling filters.

Unit 2- Microbial Assessment of water quality **7hrs.**

- Standard plate count, Most probable number test, total coliform count, faecal coliform count, microbial assessment of pathogens by culture methods.

Module 4:

1 credits

- Hands on water quality analysis: 20 hrs.
- Visit to water industry: 5 hrs.
- Project and Report submission: 5 hrs.

Note: Total credits: 2(1 credit= 15 hrs.; one practical of 2 hrs.)

List of practical

1. Isolation of aquatic bacteria in selective media.
2. Isolation of aquatic fungi.
3. To perform MPN test.
4. To perform total coliform count.
5. To perform faecal coliform count.
6. To estimate BOD for given water sample.
7. Field survey of local water bodies.
8. Effect of UV radiation on microbial growth.
9. Assessment of Chlorine as disinfectant.
10. Demonstration of membrane filtration for water analysis.

MARKING SCHEME **MM: 100 Marks**

4. **Theory examination:** **60 Marks**

   Multiple choice questions (6X2= 12)

   Short answer type questions (3X6 = 18)

   Long answer type questions (15X2 = 30)

5. **Practical examination** **20 Marks**

   Major experiment (10)

   Minor experiment (05)

   Viva voce (05)

6. **Project** **20 Marks**
