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S. P. Mandali's

Ramnarain Ruia Autonomous College

(Affiliated to University of Mumbai)

Syllabus for

Program: S.Y.B.Sc. (Microbiology)

Program Code: RUSVSCMICPO201

(As per the guidelines of National Education Policy 2020-
Academic year 2024-25)

(Choice based Credit System)

GRADUATE ATTRIBUTES

S. P. Mandali's Ramnarain Ruia Autonomous College has adopted the Outcome Based Education model to make its science graduates globally competent and capable of advancing in their careers. The Bachelors Program in Science also encourages students to reflect on the broader purpose of their education.

GA	GA Description **A student completing Bachelor's Degree in Science program will be able to:**
GA1	Recall and explain acquired scientific knowledge in a comprehensive manner and apply the skills acquired in their chosen discipline. Interpret scientific ideas and relate its interconnectedness to various fields in science.
GA2	Evaluate scientific ideas critically, analyse problems, explore options for practical demonstrations, illustrate work plans and execute them, organise data and draw inferences.
GA3	Explore and evaluate digital information and use it for knowledge upgradation. Apply relevant information so gathered for analysis and communication using appropriate digital tools.
GA4	Ask relevant questions, understand scientific relevance, hypothesize a scientific problem, construct and execute a project plan and analyse results.
GA5	Take complex challenges, work responsibly and independently, as well as in cohesion with a team for completion of a task. Communicate effectively, convincingly and in an articulate manner.
GA6	Apply scientific information with sensitivity to values of different cultural groups. Disseminate scientific knowledge effectively for upliftment of the society.
GA7	Follow ethical practices at workplace and be unbiased and critical in interpretation of scientific data. Understand the environmental issues and explore sustainable solutions for it.
GA8	Keep abreast with current scientific developments in the specific discipline and adapt to technological advancements for better application of scientific knowledge as a lifelong learner

PROGRAM OUTCOMES

PO	Description

	A student completing Bachelor's Degree in Science program in the subject of Statistics will be able to:
PO1	Recall, explain and summarize basic concepts related to cytology, biochemistry, physiology, genetics and reproduction of prokaryotes and compare it with eukaryotes.
PO 2	Appreciate and exemplify the diversity in the microbial world and evaluate their ecological role as well as state their significance to humankind.
PO 3	Understand the basic concepts associated with growth and control of microorganisms and apply it in pure culture and preservation techniques.
PO 4	Differentiate, classify and characterize microorganisms based on their morphological, cultural, biochemical, and molecular properties.
PO 5	Explore, compare and evaluate the role of microorganisms in different natural environments as well as plants, animals and humans, and evaluate and exemplify their interrelationships.
PO 6	Apply the understanding of microbial processes to diverse science areas such as medical, industrial, agricultural and food and evaluate their potential for human well-being, for tackling environmental issues and exploring sustainable solutions
PO 7	Recall and explain the nature of biomolecules and metabolic processes; the role and kinetics of enzymes as well as the thermodynamic laws that drive these reactions.
PO 8	Recall the basic working principles of various bioanalytical techniques and tools and apply them to detect, estimate and structurally evaluate biomolecules present in the microbial cells.
PO 9	Understand and explain the nature of genetic material and elaborate the molecular mechanisms underlying various genetic processes like replication, transcription, translation, gene transfer and recombination in bacteria; and explain basic concepts in virology.
PO 10	Apply the basics of genetics and molecular biology to understand and evaluate techniques in genetic engineering and also for the use of bioinformatic tools for presentation and processing of data.
PO 11	Recognize and explain the role of microorganisms in different diseases, attribute pathogenesis mechanisms to their properties and extrapolate it to disease diagnosis, treatment and prevention. Outline and recall concepts in epidemiology of diseases. Classify and evaluate different chemotherapeutic agents.
PO 12	Recall, classify and summarize mechanisms of defense in humans, detail out the functioning of our immune system, correlate it to disease and its prevention and outline its association to health. Apply immunological principles for diagnosis of diseases.
PO 13	Understand and outline different biochemical mechanisms and their regulation; retrieve and construct biochemical pathways in microbial metabolism of major macromolecules and, recall and integrate the bioenergetics of metabolic reactions.

PO 14	Evaluate, exemplify and outline the role of microorganisms in different industrial fermentations, summarize technological aspects of bioprocesses, recall knowledge about patents, copyright and regulatory practices and QA.
PO 15	Demonstrate key practical skills/competencies in working with microbes for their study and use in the laboratory as well as outside, including the use of good microbiological practices. Analyze problems involving microbes, articulate them and devise innovative and creative solutions.
PO 16	Hypothesize, design experiments, construct experimental plans, execute them and analyze data with a basic understanding of statistics. Demonstrate an ability to be unbiased and critical in interpretation of scientific data
PO 17	Communicate effectively to express scientific ideas and/or their experimental data in an effective, precise and concise manner.

Credit Structure for SYBA/BSc/BVoc/BACM

Semester	Subject 1 (Major)		Subject 2 (Minor)	GE/ OE course	Vocational and Skill Enhancement Course (VSC) & SEC	Ability Enhancement Course/ VEC/IKS	OJT/FP/CEPCC, RP	Total Credits
	DSC	DSE						
3	Major 8		Minor 4	2	VSC-2-Major	AEC-2 MIL (Marathi/Hindi)	FP -2, CC-2	22
4	Major 8		Minor 4	2	SEC-2	AEC-2 MIL (Marathi/ Hindi)	CEP-2, CC-2	22
Total	16		8	4	4	4	8	44
Exit option: award of UG Diploma in Major with 88 credits and an additional 4 credit Core NSQF course/ Internship or Continue with Major and Minor								

Course Code-Vocational Skill Based Course: RUSVSCMICPO201

Course Title: Microbiological analysis of environmental samples- Air, Water and sewage

Academic year 2024-25

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION A student completing this course will be able to:
CO 1	Explain significance of microbiological analysis of air, water and sewage
CO 2	Execute microbiological techniques for studying microbiota of air and evaluate efficiency of fumigation techniques.
CO 3	Implement routine bacteriological analysis techniques for assessing water quality and attribute the results to sources of contamination and efficiency of treatment
CO 4	Recall steps in sewage treatment and check effectivity of treatment processes

DETAILED SYLLABUS

Course Code	Practical Course	Credits / Hours
RUSVSC MIC.O201	**Microbiological analysis of environmental samples- Air, Water and Sewage**	**2/60**
1	Introduction, Study of types of microbes present in air, Methods to study microbial load, Effect of fumigants on air quality, Effect of air filters, germicidal lamps.	
2	Introduction , Aquatic environments, sampling protocols, Heterotrophic plate counts of natural water bodies, Potable water and its microbiological analysis: Routine bacteriological analysis of water, Testing of water for *Clostridium perfringens*, Detection of fecal enterococci, Use of membrane filter technique, Rapid detection of *E.coli* by MUG technique	
3	Introduction, Types of Sewage, physical and chemical characteristics, Methods for studying organic loads in sewage- Determination of BOD of untreated and treated sewage, Visit to a Sewage treatment plant	

References:

a) Raina M. Maier, Ian L. Pepper, Charles P. Gerba, Environmental Microbiology, 2nd Edition,2010, Academic Press
b) A.J. Salle, Fundamental Principles of Bacteriology, 7th Editon,1974, Tata McGraw Hill Publishing Company
c) Air Quality Standards - NAAQS Manual, Volume I, 2011
d) Frobisher, Hinsdill, Crabtree, Goodheart, Fundamentals of Microbiology, 9th Edition, 1974, Saunders College Publishing
e) Michael T. Madigan & J.M. Martin, Brock's Biology of Microorganisms 13th Ed. International edition 2012, Pearson Prentice Hall.
f) Bureau of Indian Standards https://dn790008.ca.archive.org/0/items/gov.in.is.1622.1981/is.1622.1981.html
g) Baird R.B., Eaton A.D., and Rice E.W., (Eds.), 2015, Standard Methods for the Examination of Water and Wastewater, 23rd ed., APHA, Washington, D.C.
h) Manual of Methods of Analysis of Foods- Water, Food Safety and Standards authority of India (fssai), Ministry of Health and Family Welfare, Government of India, New Delhi, 2016
i) Uniform Drinking Water Quality Monitoring Protocol, Government of India Ministry of Drinking Water and Sanitation, New Delhi, February 2013

Modality of Assessment: Skill Enhancement Course

2 Credits- Total Marks 50

Sr No	Evaluation type	Marks
1	**Laboratory work**	30
2	**Spots/Quiz/Viva**	10
3	**Journal/ Project book**	10
	TOTAL	50
