


Ramakrishna Mission Vivekananda Centenary College
Rahara, Kolkata-700118

DEPARTMENT OF Botany

Programme Outcomes, Programme Specific Outcomes,
Course Objectives and Course Outcomes of the **B.Sc.**
(Hons.) Botany Syllabus
Session 2017-2018



Website : www.rkmvccrahara.org Email : rkmvccollege@rkmvccrahara.org
Phone : 033-25682049, ; Fax : 033-25682049


Principal
Ramakrishna Mission
Vivekananda Centenary College
Rahara, Kolkata-700 118

Programme Outcomes (POs)

After completion of the B.Sc. Degree program, the students will be able to

PO No.	Program Outcomes	Cognitive Level
PO-1	Recognize the scientific tempers and attitudes, which in turn can prove to be beneficial for the society since the scientific developments can make a nation or society to grow at a rapid pace.	R
PO-2	Understand scientific knowledge and exchange ideas with other stakeholders; make people aware about sustainable utilization of resources with ethical approach.	U
PO-3	Understand and apply the issues of environmental contexts and sustainable development as a basic interdisciplinary concern.	U, Ap
PO-4	Create the ability to perform experiments and to analyze & interpret the obtained accurate results and thus gain the ability to solve problems, to involve in critical, independent, and creative thinking.	An, E, C
PO-5	Possess expertise to apply and formulate ideas which will provide them competitive advantage in pursuing higher studies from India or abroad; and seek jobs in academia, research or industries.	Ap, E
PO-6	Assemble the acquired in-depth knowledge of applied subjects towards the inculcation of professional and employment skills so that students can make a career and become an entrepreneur in diverse fields.	C

R= remembering, U = understanding, Ap = applying, An = analysing, E = evaluating, and C = creating

Programme Specific Outcomes (PSOs)

After completion of the B.Sc. degree program in Botany, the students will be able to

PSO No.	Program Specific Outcomes	Cognitive Level
PSO1	Outline an all-round development, rolling out to be globally ready individuals competent enough in various analytical and technical skills.	R, U
PSO2	Understanding and development of basic concepts in various plant groups, their metabolism, components at the molecular level, biochemistry, taxonomy and ecology.	U, Ap
PSO3	Analyze and create awareness of natural resources and their conservation to develop responsibility as a citizen towards their community and environment.	U, An, E
PSO4	Design and formulate theoretical and lab-based experiments to generate technical advancement in priority areas such as genetics, cell and molecular biology, plant systematics and biotechnology.	E, C
PSO5	Invent, test, interpret and apply problems of biological interest, conduct self-evaluation to enrich themselves through lifelong learning.	C

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Semester – I	
Course name	Phycology and Microbiology
Course code	UGBOTCC01

Course Objectives: This course aims to

Course Objectives

- Increase the understanding of basic classification and evolution of the living world.
- Aware the students about the nature and role of microorganisms (bacteria and viruses).
- Explain the structure, organization, physiology, reproduction of simple autotrophic forms – Algae
- Explain the ecological and economical aspects of algae, bacteria and viruses.
- Apply the knowledge to learn use of beneficial and control of pathogenic microorganisms.

Course Outcome: After completion of this course the student will be able to

Sl. No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Develop knowledge on the diversity, phylogeny, classification of algae.	R, U	PO1, PO2	PSO1
CO2	Understand the structure, role and infectious cycle of bacteria and viruses.	U, An	PO2	PSO2
CO3	Understand life cycles of different algal species.	U, An	PO2	PSO2
CO4	Explore the economically important algae.	Ap, An	PO5, PO6	PSO3
CO5	Gain knowledge on the beneficial & harmful bacteria and viruses.	E	PO4, PO5, PO6	PSO3, PSO4

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Semester – I	
Course name	Biomolecules and Cell Biology
Course code	UGBOTCC02

Course Objectives: This course aims to

Course Objectives:

- Provide foundation to the structure and functions of nucleic acids, carbohydrates, proteins and lipids.
- Explain the structure of cell components and their functions, genome and its organization.
- Make the students acquainted with various biochemical processes occurring within the cell.
- Provide knowledge on cell division, cellular organization and cell functioning in plants.

Course Outcome: After completion of this course the student will be able to

CO No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Understand cell structures and function, along with molecules present in cells.	R, U	PO1, PO2	PSO1, PSO2
CO2	Understand the mechanism of cell cycle.	R, U	PO1, PO2	PSO1, PSO2
CO3	Focus on cellular components, nuclear & organellar genome, along with their regulatory role.	U, Ap, An	PO2, PO3	PSO3



CO4	Upgraded their analytical skills and instrumentation.	An, E, C	PO4, PO5	PSO4, PSO5
CO5	Acquire knowledge in designing experiment, statistical analysis, and interpretation of results.	C	PO5, PO6	PSO4, PSO5

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Semester – II	
Course name	Mycology and Phytopathology
Course code	UGBOTCC03

Course Objectives: This course aims to

Course Objectives:

- Provide basic knowledge about the fungi and lichens, their economical & ecological significance.
- Explain the structure, growth, food reserves, reproduction methods of fungi.
- Aware the students about parasitic and mutualistic interactions between fungi and plants.
- Enlighten the students about the phylogeny and evolutionary concepts in fungi.
- Identify the common plant diseases and devise control measures.

Course Outcome: After completion of this course the student will be able to

CO No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Understand the classification, structure, role and infectious cycle of fungi.	R, U	PO1, PO2	PSO1, PSO2
CO2	Evaluate the impact of fungi in industrial processes.	U, Ap	PO2, PO3	PSO3
CO3	Know the procedures for mushroom cultivation.	Ap	PO2	PSO3
CO4	Identify plant diseases, their causes & importance in agriculture industry.	An, E	PO4, PO5	PSO3, PSO4
CO5	Apply acquired knowledge to control plant diseases.	C	PO5, PO6	PSO4, PSO5

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Semester – II	
Course name	Archegoniate
Course code	UGBOTCC04

Course Objectives: This course aims to

Course Objectives

- Provide knowledge about the diversity of bryophytes, pteridophytes and gymnosperms.
- Increase understanding on their classification, biology, adaptive mechanisms, and phylogeny.
- Highlight advances in developmental & reproductive habits and evolution of seeds.
- Aware the students about the economic values of these plant communities.

Course Outcome: After completion of this course the student will be able to

CO No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	To know about morphological, anatomical and developmental patterns in bryophytes to gymnosperms.	R, U	PO1, PO2	PSO1, PSO2
CO2	To know about the reproductive parts, mechanism of reproduction and life cycle patterns.	U	PO1, PO2	PSO1, PSO2



CO3	To understand stelar evolution and seed formation in pteridophytes.	U	PO1, PO2	PSO1, PSO2
CO4	Economic values of the lower plants.	Ap, E	PO3	PSO3
CO5	Observe and identify bryophytes, pteridophytes and gymnosperms & their internal structures.	C	PO4, PO5	PSO4

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Semester – III	
Course name	Anatomy of Angiosperms
Course code	UGBOTCC05

Course Objectives: This course aims to

Course Objectives

- Provide knowledge on the arrangement of tissue and cells in vascular plants.
- Impart knowledge on the characteristics of specialized cells and their components.
- Develop ideas on the adaptive & protective system of plants.

Course Outcome: After completion of this course the student will be able to

CO No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Understand structural & functional components of plants.	R, U	PO1, PO2	PSO1, PSO2
CO2	Compare, contrast and describe the various tissue systems in plants.	U, Ap, An	PO2, PO3	PSO2
CO3	Outline the process of secondary growth in plants.	U, An	PO4	PSO2
CO4	Outline the practical use of plant anatomy.	U, An	PO4, PO5	PSO4, PSO5
CO5	Design, carry out laboratory techniques in plant anatomy.	E, C	PO5, PO6	PSO4

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Semester – III	
Course name	Economic Botany
Course code	UGBOTCC06

Course Objectives: This course aims to

Course Objectives:

- Create an understanding about the use of plant resources to produce valuable products.
- Impart knowledge about the economic importance of various plants.
- Develop students' ability to think and create useful plant products.
- Enlighten the students about the opportunities for income and employment generation.

Course Outcome: After completion of this course the student will be able to

CO No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Understand economically important plants, their origin and morphology etc.	R, U	PO1, PO2	PSO1, PSO2
CO2	Gain knowledge about plant products and their biochemical nature and industrial applications.	U, Ap	PO2	PSO2
CO3	Get an idea about the industrial processing of economically important plant products.	Ap, An	PO3	PSO2



CO4	Understand scope and importance of indigenous medicinal science, medicinal plants & their therapeutic use.	U, An, E	PO4, PO5, PO6	PSO3
CO5	Enlighten the students about the opportunities for income and employment generation.	E, C	PO5, PO6	PSO4, PSO5

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Semester – III	
Course name	Genetics
Course code	UGBOTCC07

Course Objectives: This course aims to

Course Objectives:

- Summarize the history and scope of Genetics.
- Impart knowledge on the mendelian, post-mendelian genetic concepts and their deviations.
- Update the current knowledge of genetics and genomics.
- Provide statistical concepts in genetic analysis and plant breeding.
- Demonstrate practical skills on genetic analysis.

Course Outcome: After completion of this course the student will be able to

CO No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Understand the basics of genetic analysis at the gene, genome and population levels.	R, U	PO1, PO2	PSO1, PSO2
CO2	Understand the pattern of inheritance in plants.	U, Ap	PO3	PSO1, PSO2
CO3	Gain knowledge on molecular markers, linkage pattern and mapping techniques.	Ap, An	PO4, PO5	PSO2, PSO4
CO4	Gain knowledge on types of mutation, mutagenic agents and its application in plant breeding.	An, C	PO4, PO5	PSO3, PSO4
CO5	Develop a strong foundation for further molecular studies.	E, C	PO6	PSO5

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Semester – IV	
Course name	Molecular Biology
Course code	UGBOTCC08

Course Objectives: This course aims to

Course Objectives

- Give an idea about structure and function of genetic and hereditary materials.
- Develop understanding of chemical and molecular processes occurring within the cells.
- Give a concept on the central dogma of molecular biology.
- Impart knowledge on regulation of gene expression and gene silencing.



Course Outcome: After completion of this course the student will be able to

CO No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Relate the concepts of prokaryotic, and eukaryotic gene function.	R, U	PO1, PO2	PSO1, PSO2
CO2	Explain central dogma of molecular biology (replication, transcription, and translation).	U	PO1, PO4	PSO2
CO3	Distinguish between prokaryotic & eukaryotic gene regulation.	An	PO4, PO5	PSO2
CO4	Isolate E. coli & plant DNA and its quantification.	An, E	PO5, PO6	PSO4
CO5	Conversant with Laboratory Techniques viz. centrifugation, gel electrophoresis, spectrophotometry etc.	E, C	PO5, PO6	PSO4, PSO5

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Semester – IV	
Course name	Plant Ecology and Phytogeography
Course code	UGBOTCC09

Course Objectives: This course aims to

Course Objectives:

- Create an understanding of various aspects of environment and its components.
- Provide an idea about the status and role of biological organisms in the environment.
- Provide knowledge on the interactions of biological world with biotic & abiotic factors.
- Provide an idea on the phytogeographical distribution of plant communities and their ecological significance.

Course Outcome: After completion of this course the student will be able to

CO No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Explain various ecosystems & relationships between organisms and environment.	R, U	PO1, PO2	PSO1, PSO2
CO2	Outline various ecosystems and plant distribution.	U, An	PO2, PO3	PSO1, PSO2
CO3	Discuss phytogeography, including major plant communities of the world alongwith climatic conditions of the area.	E, C	PO3	PSO1, PSO2
CO4	Identify phytogeographical regions of India, plant biodiversity and its importance.	Ap, An	PO3, PO4	PSO3
CO5	Analyze plant population and their community.	An, C	PO5	PSO3, PSO5

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Semester – IV	
Course name	Plant Systematics
Course code	UGBOTCC10

Course Objectives: This course aims to

Course Objectives:

- Aware the students about diversity, description, identification and nomenclature of plants.
- Make the students acquainted with the different classification systems.
- Increase the understanding of angiosperm phylogeny.



Course Outcome: After completion of this course the student will be able to

CO No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Know about the diversity and morphology of various angiosperm families.	R, U	PO1, PO2	PSO1, PSO2
CO2	Develop knowledge on plant nomenclature system.	U, Ap	PO1, PO2	PSO2
CO3	Learn and compare various systems of classification.	An	PO4	PSO4
CO4	Acquire knowledge on angiosperm phylogeny and evolution.	An, E	PO4	PSO4
CO5	Upgraded their analytical skills in plant herbarium techniques.	E, C	PO5, PO6	PSO4, PSO6

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Semester – V	
Course name	Reproductive Biology of Angiosperms
Course code	UGBOTCC11

Course Objectives: This course aims to

Course Objectives:

- Aware the students about the structure of plant reproductive organs.
- Make the students acquainted with fundamentals aspects of plant growth and development.
- Enhance the understanding of fertilization process and pollen-stigma interaction.
- Provide a foundation on the post-fertilization events in plants.

Course Outcome: After completion of this course the student will be able to

CO No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Understand the molecular and morphological aspects in plant reproductive development.	R, U	PO1, PO2	PSO1, PSO2
CO2	Understand the structure and organization of the male and female reproductive organs.	R, U	PO2	PSO2
CO3	Understand the process of fertilization and pollen-stigma interaction.	R, U	PO4	PSO2, PSO4
CO4	Compare embryo and endosperm development in monocots & dicots.	An, E	PO4, PO5	PSO4
CO5	Address the compatibility & incompatibility issues in angiosperms.	E	PO5	PSO4, PSO5

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Semester – V	
Course name	Plant Physiology
Course code	UGBOTCC12

Course Objectives: This course aims to

Course Objectives

- Gain knowledge on different physiological events in plants.
- Develop understanding of the physiological parameters essential in growth and development.
- Acquire knowledge on the physiology of plants in altered environmental conditions.
- Enable students to design experiments related to basic plant physiology.



Course Outcome: After completion of this course the student will be able to

CO No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Relate physiological events in plants and their mechanism.	R, U	PO1, PO2	PSO1, PSO2
CO2	Interpret the effect of physiological parameters in plant growth and development.	E	PO2	PSO2, PSO3
CO3	Analyze the physiological adaptations of plants in stress conditions.	An, E	PO2, PO3	PSO3
CO4	Examine physiological mechanism of flowering & requirement of mineral nutrition.	An, E	PO3, PO4	PSO4
CO5	Estimate the effect of various parameters in physiological responses.	E	PO5, PO6	PSO4, PSO5

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Semester – VI	
Course name	Plant Metabolism
Course code	UGBOTCC13

Course Objectives: This course aims to

Course Objectives

- Impart basic knowledge on physiological and biochemical processes operative in plants.
- Analyze the various pathways involved in respiration and photosynthesis.
- Provide a concept of symbiotic N₂ fixation, and their applications in physiological activities.
- Quantify various plant metabolites and their biochemistry and biosynthesis.
- Develop knowledge on how plant system responds metabolically under stress conditions.

Course Outcome: After completion of this course the student will be able to

CO No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Relate the photosynthetic process of light and dark Reactions.	R, U	PO1, PO2	PSO1, PSO2
CO2	Outline the mechanism of biological N ₂ fixation.	U	PO3	PSO2, PSO3
CO3	Compare the pigment composition in plants.	U, An	PO4	PSO2
CO4	Understand the mechanism of carbohydrate & lipid metabolism.	U	PO4	PSO4
CO5	Explain the biochemical responses of stress in plants.	Ap, E	PO5, PO6	PSO5

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Semester – VI	
Course name	Plant Biotechnology
Course code	UGBOTCC14

Course Objectives: This course aims to

Course Objectives:

- Expose students to the techniques in genetic engineering.
- Focus on the concept, scope, and various types plant tissue cultures.
- Provide knowledge on the basic and applied aspects of plant tissue culture.
- Understand the importance of gene technology in plant improvement.



Course Outcome: After completion of this course the student will be able to

CO No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Recall the basic concepts of biotechnology and explain its fundamental applications.	R, U	PO1, PO2	PSO1, PSO2
CO2	Become familiar with the tools and techniques of genetic engineering.	U, Ap	PO2	PSO1, PSO2
CO3	Acquire knowledge on the application of gene cloning in agriculture.	Ap	PO2, PO3, PO4	PSO3
CO4	Translate the concepts in future studies and debate on issues related to GMOs.	An, E	PO3, PO5	PSO3, PSO4
CO5	Design plant tissue culture and RDT experiments to address a research problem.	E, C	PO5, PO6	PSO4, PSO5

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Semester – V	
Course name	Industrial and Environmental Microbiology
Course code	UGBOTDSE01

Course Objectives: This course aims to

Course Objectives:

- Develop knowledge on the microbes involved in fermentation & basics of fermentation technology.
- Provide an idea about design of fermenter, media composition and process of fermentation.
- Provide knowledge on the use of microbes in environmental cleanup.
- Provide an idea about the use of microbes for production of important industrial products.

Course Outcome: After completion of this course the student will be able to

CO No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Outline the basic aspects of microbial science in industrial application.	R, U	PO1	PSO1, PSO2
CO2	Explain various aspects of fermentation technology.	U, Ap	PO1, PO2	PSO1, PSO2
CO3	Develop knowledge on the current updates in agriculture & environmental microbiology.	Ap, An	PO3	PSO3
CO4	Develop ideas on the routine and specialized microbiological laboratory skills.	Ap, An	PO3, PO4	PSO4
CO5	Design and formulate research activities in applied microbiology.	E, C	PO5, PO6	PSO5

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Semester – V	
Course name	Plant Breeding
Course code	UGBOTDSE02

Course Objectives: This course aims to

Course Objectives:

- To develop knowledge on the components to formulate a plant breeding programme.
- Describe various methods which are used in plant breeding.
- Provide an idea about the biotic and abiotic stress tolerant crop varieties.



Course Outcome: After completion of this course the student will be able to

CO No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Gather knowledge to design, execute, analyze results of genetic experiments in plant breeding systems.	R, U	PO1, PO2	PSO1, PSO2
CO2	Demonstrate practical emasculation and pollination methods in crop plants.	U, Ap	PO4	PSO2
CO3	Understand the patterns of inheritance in plants.	Ap, An	PO3, PO4	PSO4
CO4	Examine the methods of crop improvement.	An, E	PO5	PSO4
CO5	Formulate and justify the application of plant breeding methods to achieve a specific objective.	E, C	PO5, PO6	PSO5

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Semester – VI	
Course name	Biostatistics
Course code	UGBOTDSE03

Course Objectives: This course aims to

Course Objectives:

- Recognize the concept of statistics and its relation with biology.
- Conceptualize, Summarize, organize and display of quantitative data.
- Provide knowledge on different types of data and sampling techniques.
- Calculate and interpret results of biostatistical analyses.

Course Outcome: After completion of this course the student will be able to

CO No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Organize biological data and calculate descriptive statistics from these data.	R, U, Ap	PO1, PO2	PSO1
CO2	Compute and interpret biological variability.	Ap, An	PO2, PO3	PSO2
CO3	Compare different biological population using statistical algorithms.	Ap, An	PO4	PSO3, PSO4
CO4	Evaluate tests to perform hypothesis testing and experimental design for biological experiments.	An, E	PO5, PO6	PSO4, PSO5
CO5	Discuss the use of statistical software and packages in biostatistics.	E, C	PO6	PSO4

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Semester – VI	
Course name	Applied Phycology
Course code	UGBOTDSE04

Course Objectives: This course aims to

Course Objectives:

- Recognize the economic and applied aspects of algae.
- Summarize the basic concepts in algal culture.
- Provide knowledge on the industrial products obtained from algae.



Course Outcome: After completion of this course the student will be able to

CO No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Outline the various aspects of applied phycology.	R, U	PO1, PO2	PSO1, PSO2
CO2	Develop knowledge on harmful algae and their remedy.	U, Ap	PO3	PSO3
CO3	Identify algal sources of food, phycocolloids, fuel.	Ap, An	PO4, PO5	PSO3, PSO4
CO4	Plan and formulate culture of economically important species.	An, E	PO5, PO6	PSO4
CO5	Formulate the application of algal species to solve a human demand.	E, C	PO6	PSO4, PSO5

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Semester – VI	
Course name	Research Methodology
Course code	UGBOTDSE05

Course Objectives: This course aims to

Course Objectives:

- Understand the basic concepts of biological research.
- Select and define appropriate research problem and parameters.
- Organize and conduct research in a more appropriate manner.
- Provide knowledge on research proposal and report writing.

Course Outcome: After completion of this course the student will be able to

CO No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Discuss and demonstrate methodologies and techniques used in biological research.	R, U	PO1, PO2	PSO1
CO2	Explain and execute basic computer skills necessary for the conduct of research.	Ap, An	PO1, PO2	PSO1, PSO2
CO3	Assess the basic function and working of analytical instruments used in research.	An, E	PO4	PSO2
CO4	Identify the overall process of designing a research study from its inception to its report.	E, C	PO4, PO5	PSO4
CO5	Explain the rationale for research ethics and demonstrate its contribution in research career.	E, C	PO5, PO6	PSO4, PSO5

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Semester – I	
Course name	Cryptogamic Botany
Course code	UGBOTGE01

Course Objectives: This course aims to

Course Objectives:

- Understand the basic features of cryptogams and their diversity.
- Explain the structure, function and classification of lower plant groups.
- Elaborate the ecological and economic importance of the cryptogams.



Course Outcome: After completion of this course the student will be able to

CO No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Understand the diversity of lower plant groups.	U, R	PO1, PO2	PSO1
CO2	Know the systematic, morphology and structure, of Bacteria, Viruses and Algae.	U, R	PO2, PO3	PSO1, PSO2
CO3	Understand the life cycle patterns of Cryptogams.	U, R	PO4	PSO3
CO4	Understand the useful and harmful features of Bacteria, Viruses and Algae.	Ap, An, E	PO5	PSO4, PSO5
CO5	Understand the economic importance of Bryophytes and Pteridophytes.	An, E	PO5, PO6	PSO4, PSO5

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Semester – II	
Course name	Biology of Vascular Plants
Course code	UGBOTGE02

Course Objectives: This course aims to

Course Objectives:

- Study the diversity of Gymnosperms and its role in evolution.
- Study the diversity of Angiosperms.
- Complement the students with the basic knowledge of plant taxonomy.

Course Outcome: After completion of this course the student will be able to

CO No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Outline ecological and evolutionary importance of the angiosperm and gymnosperm.	R, U	PO1, PO2	PSO1, PSO2
CO2	Explain the economic importance of the angiosperm and gymnosperm.	U, Ap	PO2, PO3	PSO2, PSO3
CO3	Analyze and evaluate a comparative account of angiospermic families.	Ap, An	PO4	PSO3
CO4	Discuss the systematic position and classification of angiosperm and gymnosperm.	E, C	PO4	PSO3
CO5	Analyze and examine various angiosperm families and their economically important members.	C	PO5, PO6	PSO4, PSO5

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Semester – III	
Course name	Plant Ecology, Anatomy and Embryology
Course code	UGBOTGE03

Course Objectives: This course aims to

Course Objectives:

- Study plant communities and ecological adaptation in plants.
- Acquaint students with basic concepts of plant anatomy.
- Study various plant tissue system.
- Study the physiology of plant reproduction.



Course Outcome: After completion of this course the student will be able to

CO No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Illustrate the basic concept of ecology and its biotic and abiotic components.	R, U	PO1, PO2	PSO1, PSO2
CO2	Explain and interpret the relationship between organisms and its ecosystem.	U, Ap	PO3	PSO3
CO3	Distinguish the normal and anomalous secondary growth in plants.	Ap, An	PO4	PSO2
CO4	Analyze biodiversity at various levels and prioritize its conservation.	An, E	PO5	PSO4
CO5	Discuss plant reproduction and post reproductive events.	E, C	PO5, PO6	PSO5

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Semester – IV	
Course name	Plant Physiology and Biotechnology
Course code	UGBOTGE04

Course Objectives: This course aims to

Course Objectives:

- Know the importance and scope of plant physiology.
- Study plant and plant cell in relation to water.
- Understand the growth of plants at various level.
- Know the importance and procedures of tissue culture.

Course Outcome: After completion of this course the student will be able to

CO No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Explain and summarize the process of photosynthesis with emphasis on light and dark reactions, C3 and C4 pathways.	R, U	PO1, PO2	PSO1, PSO2
CO2	Outline respiration with emphasis on energy yield.	R, U	PO2	PSO3
CO3	Analyze the various physiological activities within plant body.	Ap, An	PO3	PSO4
CO4	Evaluate various types of tissue culture methods.	An, E	PO4, PO5	PSO4, PSO5
CO5	Discuss the importance and application of tissue culture.	An, E	PO5, PO6	PSO5

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Semester – I	
Course name	English Communication
Course code	UGAECC01

Course Outcome: At the end of the program, the students will be able to:

CO	Course Outcome	Cognitive level	POs Addressed	PSOs Addressed
CO1	Engage in self-directed English language learning.	R,	PO, PO2, PO3	PSO1
CO2	Be responsible and ethical English users.	R, U	PO1, PO2, PO3	PSO1



CO3	Enhance their English language proficiency in the aspects of reading, writing, listening and speaking.	R, U	PO1, PO2, PO3	PSO1
CO4	Develop academic literacy required for undergraduate learning, further studies and research.	Ap	PO3, PO5	PSO2
CO5	Apply the requisite communicative skills and strategies to future careers.	Ap,	PO3, PO5	PSO2
CO6	Gain an insight into cultural literacy and cross-cultural awareness.	Ap	PO3, PO5	PSO2

Semester – II	
Course name	Environmental Science (ENVS)
Course code	UGAECC02

Course Objectives: This course aims to

Course Objectives:

- Remember and understand the concept, components and function of natural resources and ecosystems.
- Understand and evaluate the Cause, effects and control measures of various environmental pollutants.
- Understand the basic idea about the disasters and its management.
- Understand and apply the knowledge about the social, environmental issues and environmental legislation.

Course Outcomes:

After completion of this course the student will be able to

CO No.	Course Outcomes:	Cognitive Level	PO Addressed	PSOs Addressed
CO 1:	Define and demonstrate the concept, components and function of natural resources and ecosystems.	R, U	PO1	PSO1, PSO2
CO 2:	Define, illustrate and analyze cause, effects and control measures of various environmental pollutants.	R, U, An	PO 3	PSO2, PSO3
CO 3:	Demonstrate the basic idea about the disasters and its management.	U	PO 3	PSO3
CO 4:	Illustrate and apply the knowledge about the social, environmental issues and environmental legislation.	U, Ap	PO 4	PSO4
CO 5:	Define, demonstrate and evaluate the impact of human population on the Environment	R, U, E	PO 6	PSO5

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Semester – III	
Course name	Value Education and Indian Culture
Course code	UGBOTSEC01

Course Objectives: This course aims to

Course Objectives:

- Attain awareness about daily routine, self-evaluation & integral personality development.
- Understand the educational needs, the power of thoughts and the science of peace.
- Understand the relation: Values and enlightened citizenship.
- Demonstrate the importance of four yogas.
- Acquire idea about modern India: her hopes, challenges and Swami Vivekananda.

Course Outcomes:

After completion of this course the student will be able to

CO No.	Course Outcomes:	Cognitive Level	POs Addressed	PSOs Addressed
CO 1:	Define, demonstrate and apply the daily routine, self-evaluation & Integral Personality Development	R, U, Ap	PO1	PSO1, PSO2
CO 2:	Demonstrate, and apply the Power of thoughts & the Science of Peace	U, Ap	PO3	PSO2
CO 3:	Demonstrate the relation between Values and enlightened citizenship	U	PO3	PSO3
CO 4:	Discuss awareness about Indian Practice and Culture	C	PO4	PSO3
CO 5:	Demonstrate and practice the Four Yogas	U, Ap	PO6	PSO4
CO 6:	Explain and analyse the idea about Modern India: her hopes, challenges and Swami Vivekananda	U, An	PO4, PO6	PSO4

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DEPARTMENT OF BOTANY

Programme Outcomes, Programme Specific Outcomes,
Course Objectives and Course Outcomes of the **B.Sc.**
(Hons.) Botany Syllabus
Session 2020-2021



Website : www.rkmvccrahara.org Email : rkmvccollege@rkmvccrahara.org

Phone : 033-25682049, ; Fax : 033-25682049



Principal
Ramakrishna Mission
Vivekananda Centenary College
Rahara, Kolkata-700 118

Ramakrishna Mission Vivekananda Centenary College
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DEPARTMENT OF BOTANY

Programme Outcomes, Programme Specific
Outcomes, Course Objectives and Course Outcomes
of the *MSc Botany* Syllabus

Session 2018-2019



Website : www.rkmvccrahara.org Email : rkmvccollege@rkmvccrahara.org

Phone : 033-25682049, ; Fax : 033-25682049



S. K. Ghosh
Principal
Ramakrishna Mission
Vivekananda Centenary College
Rahara, Kolkata-700 118

PROGRAMME OUTCOMES (PO)

After completion of the M.Sc. Degree programme, the students will be able to

PO No.	Programme Outcome	Cognitive Level
PO1	Outline and demonstrate the basic concepts by acquiring a comprehensive knowledge in the newer emerging field of knowledge.	R, U
PO2	Perform experiments, analyse & interpret the obtained accurate results and thus gain the ability to solve problems.	Ap, An, E
PO3	Apply and evaluate the basic ideas to their thoughts, actions, and interventions for the societal benefits through the development of entrepreneurship.	Ap, E
PO4	Develop the ability to involve in critical, independent, and inventive thinking for the engagement in research and development on the emerging topics.	C

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PROGRAMME SPECIFIC OUTCOMES (PSO)

After completion of M.Sc. Degree programme the student will be able to

PSO No.	Programme Specific Outcome	Cognitive Level
PSO1	Understand the diversity & classification of plants from cryptogams to spermatophyte. Identification of flora in field. Study of biodiversity, physiology, biochemistry, molecular cytogenetics and application of statistics etc. Application of Botany in agriculture and industry.	R, U
PSO2	Learn about practical techniques in detail of plant cell structure, reproduction, anatomy, systematics. Maintain a high level of scientific excellence in botanical research with specific emphasis on the role of plants.	Ap, An, E
PSO3	Identify, formulate and analyze the critical problems ultimately providing a conclusion. Logical thinking with application of biological, physical and chemical sciences. Learning that develops analytical and integrative problem-solving approaches.	U, Ap, E
PSO4	Develop problem-solving skills that would encourage them to carry out innovative research projects thereby making them to use knowledge creation in depth.	Ap, An, C
PSO5	Attain good values, ethics, and kind heart and should be aware of ethical issues and regulatory considerations while addressing society needs for growth with honesty that provide a foundation for future career.	E, C

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Semester – I	
Course name	Phycology and Microbiology (Theory)
Course code	PGBOTCC1.1

Course Objectives: This course aims to

Course Objectives

- Explain the physiology of bacteria & algae, their growth, metabolism, development and phylogeny.
- Aware the students about antibiotics and control of harmful microbes
- Increase the understanding of microbial impact on the environment.
- Assess the utilization of beneficial microbes in industrial microbiology.

Course Outcome: After completion of this course the student will be able to

Sl. No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Outline diversity of bacteria & algae.	R, U	PO1	PSO1, PSO2
CO2	Summarize microbial physiology of & their growth, metabolism, development and phylogeny.	U, Ap, An	PO2	PSO1, PSO2
CO3	Design and execute experiments using microbes.	An, E	PO2, PO3	PSO3
CO4	Assess eutrophication, water quality & understand bacterial genetics and its application.	An, E	PO3, PO4	PSO3, PSO4
CO5	Develop concepts on antibiotics & chemotherapy, environmental and industrial microbiology.	E, C	PO4	PSO4, PSO5

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Semester – I	
Course name	Mycology and Plant Pathology (Theory)
Course code	PGBOTCC1.2

Course Objectives: This course aims to

Course Objectives

- Impart knowledge to students on fungus and plant pathogens
- Provide an understanding of pathogenesis in plant systems
- Provide information on disease incidences and immune responses of plant systems
- Enrich students about plant-pathogen interactions.

Course Outcome: After completion of this course the student will be able to

Sl. No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Explain the life cycle patterns of pathogenic fungi and their host specificity	R, U, Ap	PO1	PSO1
CO2	Analyze how host immune systems respond to pathogenic infections.	Ap, An	PO1, PO2	PSO1, PSO2, PSO3
CO3	Explain the importance of plant defence systems in combating infections.	An, E	PO2, PO3	PSO3
CO4	Determine the importance of mycology and plant pathology as a discipline of plant science.	E	PO3, PO4	PSO3
CO5	Exploit the scope of database and bio-informatics in plant disease management.	C	PO4	PSO4, PSO5

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Semester – I	
Course name	Biostatistics & Bio-Maths; Biophysics (Theory)
Course code	PGBOTCC1.3

Course Objectives: This course aims to

Course Objectives

- Enable students to learn through real examples by application of statistical techniques.
- Analyze and interpret the data generated in biology using modern statistical methods.
- A thorough grasp of mathematical, biophysical and statistical methodology, before going on to apply these skills to solve real-life problems in various field.

Course Outcome: After completion of this course the student will be able to

Sl. No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Explain the various application of biostatistics.	R, U	PO1, PO2	PSO1, PSO2
CO2	Distinguish different types of data and sampling methods.	Ap, An	PO1, PO2	PSO2
CO3	Analyze and interpret quantitative data.	An	PO3	PSO3
CO4	Identify appropriate tests to perform hypothesis testing and experimental design and its interpretation.	Ap, An	PO3	PSO3, PSO4
CO5	Explain the use of statistical software packages in biostatistics.	E, C	PO4	PSO4, PSO5

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Semester – I	
Course name	Ecology; Evolution (Theory)
Course code	PGBOTCC1.4

Course Objectives: This course aims to

Course Objectives

- Provide hands-on training on fieldwork and assessment of biodiversity of habitats.
- Provide knowledge on ecological niche, selection, population and course of evolution.
- Helps students in developing an insight of competition, and other biotic interactions.
- Gather ideas on modes of evolution, speciation and genetic variation.

Course Outcome: After completion of this course the student will be able to

Sl. No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Analyze the biodiversity of a habitat by application of key concepts.	Ap, An	PO1	PSO1
CO2	Interpret and outline how biotic interactions affect biotic communities in natural ecosystems.	U, Ap	PO2, PO3	PSO2, PSO3
CO3	Relate the biogeography and biodiversity of plants in Indian perspective.	U, Ap	PO3	PSO3
CO4	Perceive knowledge on biomes and ecosystems and their evolution.	An, E	PO3	PSO3
CO5	Apply key concepts in conservation and estimate biodiversity of diverse habitats.	Ap, E, C	PO4	PSO5

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Semester – I	
Course name	Phycology & Microbiology (Practical)
Course code	PGBOTCC1.5

Course Objectives: This course aims to

Course Objectives

- Develop knowledge on preparation of different culture media for bacteria and algae.
- Identify bacteria and algae under microscope based on staining properties/ morphology.
- To develop skills of isolation of bacteria/algae from natural sources and formulation of pure culture.
- To analyse antibiotic resistance, metabolic and growth parameters of bacteria.

Course Outcome: After completion of this course the student will be able to

Sl. No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Develop media and culture different algae/ bacteria in laboratory condition.	Ap, An	PO2, PO3	PSO1, PSO2
CO2	Identify bacteria/ algae based on their staining properties/ morphology.	U, Ap	PO3	PSO1, PSO3
CO3	Examine metabolic, growth and developmental properties of bacteria.	U, Ap	PO3	PSO3
CO4	Isolate and culture microbes from different natural sources.	An, E	PO3, PO4	PSO4
CO5	Identify antibiotic resistance in bacteria from different environmental and clinical samples.	Ap, E, C	PO4	PSO4, PSO5

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Semester – I	
Course name	Mycology & Plant Pathology (Practical)
Course code	PGBOTCC1.6

Course Objectives: This course aims to

Course Objectives

- Acquaintance with laboratory techniques and instruments used in mycology and plant pathology.
- Develop knowledge on preparation of specific media for fungal culture.
- Analyze mycoflora from air, leaf surface and root surface.
- Develop skill on mushroom production.
- Survey plant diseases and its causal organisms.

Course Outcome: After completion of this course the student will be able to

Sl. No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Demonstrate culture media preparation and culture of fungi in laboratory.	R, U	PO1	PSO1
CO2	Develop idea on laboratory instruments, sterilization and safety in plant pathology laboratory.	U, An	PO1	PSO1, PSO2
CO3	Analyze & estimate biomolecules and essential compounds from fungal sources.	Ap, An	PO2	PSO2, PSO3
CO4	Survey local crop diseases and propose probable remedies.	An, E	PO2, PO3	PSO3
CO5	Design and formulate commercial mushroom cultivation.	E, C	PO4	PSO4, PSO5

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Semester – II	
Course name	Plant Anatomy; Developmental Biology (Theory)
Course code	PGBOTCC2.1

Course Objectives: This course aims to

Course Objectives

- Provide knowledge to the learners on the differentiation of plant tissues.
- Impart in-depth understanding of wood anatomy and reproductive anatomy.
- Help students to develop concepts on ecological anatomy and plant developmental biology.

Course Outcome: After completion of this course the student will be able to

Sl. No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Extend state of the art knowledge on how plant tissues differentiate.	R, U	PO1, PO2	PSO1
CO2	Relate their existing know-how on genes involved in plant developmental processes.	Ap, An	PO2, PO3	PSO2
CO3	Develop their concepts on aerial, xeromorphic, hydromorphic and stressed root systems and their anatomical features.	Ap, An	PO3	PSO2, PSO3
CO4	Evaluate the role of PGRs in developmental biology.	An, E	PO3, PO4	PSO3, PSO4
CO5	Interpret the molecular details of plant developmental process.	An, E, C	PO4	PSO4, PSO5

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Semester – II	
Course name	Taxonomy and Biosystematics; Embryology of seed plants (Theory)
Course code	PGBOTCC2.2

Course Objectives: This course aims to

Course Objectives

- Provide knowledge on identification, nomenclature, classification of plants and their evolution.
- Recognize members of the major angiosperm families by identifying their diagnostic features and economic importance.
- Gain knowledge on plant reproductive organs and fertilization process.

Course Outcome: After completion of this course the student will be able to

Sl. No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Outline the range of variations in angiosperms.	R, U	PO1	PSO1
CO2	Relate the trends in angiosperm classification.	U, Ap	PO1	PSO2
CO3	Compare the various rules, principles and recommendations of plant nomenclature.	An	PO2, PO3	PSO2, PSO3
CO4	Discuss the methods of pollination fertilization and embryogeny.	E, C	PO3	PSO3, PSO4
CO5	Explain the use of molecular biology & computers in angiosperm taxonomy.	E, C	PO4	PSO4, PSO5

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Semester – II	
Course name	Biochemistry and Metabolism; Plant Physiology (Theory)
Course code	PGBOTCC2.3

Course Objectives: This course aims to

Course Objectives

- Impart knowledge to students on the general aspects of plant physiology and biochemistry
- Develop concepts in different aspects of plant metabolism.
- Familiarize students to different anabolic and catabolic pathways.

Course Outcome: After completion of this course the student will be able to

Sl. No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Outline the various biochemical pathways.	R, U	PO1	PSO1
CO2	Develop knowledge on the concepts of anabolism and catabolism.	U	PO1	PSO1, PSO2
CO3	Summarize enzymatic catalysis & apply the concepts of enzymology and bioenergetics.	U, Ap	PO2	PSO3
CO4	Inspect the substrate specificity of enzymes.	An, E	PO3	PSO3, PSO4
CO5	Develop concepts of plant growth regulators (PGRs) and stress physiology.	E, C	PO4	PSO4, PSO5

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Semester – II	
Course name	Environmental Science; System Biology (Theory)
Course code	PGBOTCC2.4

Course Objectives: This course aims to

Course Objectives

- Provide knowledge on basic concepts of pollution and pollutants with emphasis on their management.
- Provide idea about toxicology and heavy metal toxicity.
- Impart technical know-how of fossil fuel in light of the global environment and EIA.

Course Outcome: After completion of this course the student will be able to

Sl. No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Summarize how pollutants affect our immediate environment.	R, U	PO1	PSO1
CO2	Examine the toxicity levels of various heavy metals.	Ap, An	PO1, PO2	PSO2
CO3	Inspect how greenhouse gases are affecting the environment and depleting ozone layer.	An, E	PO2, PO3	PSO3, PSO4
CO4	Assess the rules and regulations of Environmental Impact Assessment (EIA).	An, E	PO3	PSO4
CO5	Formulate the use experimental, computational and mathematical methods in systems biology.	C	PO3, PO4	PSO4, PSO5

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Semester – II	
Course name	Taxonomy & Plant Anatomy (Practical)
Course code	PGBOTCC2.5

Course Objectives: This course aims to

Course Objectives

- Study of Plant families w.r.t systematic position, morphological characters, floral formula and floral diagram.
- Successful preparation of artificial key.
- Perform the techniques in plant anatomy.

Course Outcome: After completion of this course the student will be able to

Sl. No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Illustrate the internal tissue system and secondary growths in plant.	R, U	PO1, PO2	PSO1
CO2	Summarize normal & anomalous secondary growth in plants.	U, Ap	PO1, PO2	PSO1, PSO2
CO3	Demonstrate maceration of vascular tissue.	U, Ap	PO2	PSO2, PSO3
CO4	Identify plants based on morphological data and preparation of artificial key.	Ap, An	PO3	PSO3
CO5	Analyze local flora and flora of different phytogeographical zone	An	PO4	PSO4

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Semester – II	
Course name	Plant Physiology & Biochemistry (Practical)
Course code	PGBOTCC2.6

Course Objectives: This course aims to

Course Objectives

- Provide idea on enzyme isolation and activity assay.
- Deliver knowledge on isolation and characterization of different biomolecules from plant tissue.
- Offer skill for analyzing photosynthetic parameters in plant.
- Provide knowledge on assessment of various pigments, metabolites in plants.

Course Outcome: After completion of this course the student will be able to

Sl. No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Demonstrate isolation of enzymes from plant organs and their quantitative estimation.	U	PO1, PO2	PSO2, PSO3
CO2	Examination of photosynthetic parameters in plants.	Ap, An	PO2	PSO2, PSO3
CO3	Demonstrate isolation of biomolecules, hormones and design bioassay for the same.	U, Ap, An	PO2, PO3	PSO3, PSO4
CO4	Inspect redox state of plants and analyze scavenging enzymes.	An, E	PO3	PSO4
CO5	Design and formulate chromatographic techniques.	C	PO3, PO4	PSO4, PSO5

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Semester – III	
Course name	Cell & Molecular Biology (Theory)
Course code	PGBOTCC3.1

Course Objectives: This course aims to

Course Objectives

- Provide concept of cells and cell as constituents of living organisms.
- Impart knowledge about cellular organization and their roles in the functioning of a cell.
- Provide concepts of cell cycle, protein sorting and transport and regulation of cellular processes.
- Make students aware about the concepts of DNA replication, transcription and translation.

Course Outcome: After completion of this course the student will be able to

Sl. No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Summarize the various aspects of cellular & molecular biology.	R, U	PO1	PSO1
CO2	Develop concepts on cellular processes like DNA replication, transcription and translation.	Ap	PO1, PO2	PSO2, PSO3
CO3	Develop and analyze an overall idea about cellular interaction, cell signalling and protein sorting.	Ap	PO1, PO2	PSO3
CO4	Explain the events of post transcriptional modification and regulation of gene expression	U, Ap	PO3	PSO4
CO5	Improve their understanding on the molecular mechanism of cell division and its regulation.	E, C	PO3, PO4	PSO4, PSO5

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Semester – III	
Course name	Genetics & Genomics (Theory)
Course code	PGBOTCC3.2

Course Objectives: This course aims to

Course Objectives

- Update the current Knowledge on genetics and genomics.
- Restate various types of gene interactions, inheritance of complex traits and genetic recombination
- Teach the mechanisms of chromosome and genome variation.

Course Outcome: After completion of this course the student will be able to

Sl. No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Outline concepts of mendelian inheritance, and its deviation.	R, U	PO1	PSO1
CO2	Illustrate different types of mutations and their impact	U, Ap	PO1, PO2	PSO1, PSO2, PSO3
CO3	Illustrate characteristics of genetics linkage and crossing over.	Ap	PO2	PSO2, PSO3
CO4	Explain the structure and function of prokaryotic and eukaryotic genomes.	An, E	PO3	PSO4
CO5	Develop software skills related to structural and functional aspects of genes and proteins.	C	PO4	PSO5

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Semester – III	
Course name	Plant Biotechnology and Recombinant DNA Technology (Theory)
Course code	PGBOTCC3.3

Course Objectives: This course aims to

Course Objectives

- Introduce students to the principles, practices and applications of plant biotechnology, and tissue culture.
- Describe the applications of genetic engineering in various fields.
- Aware students with ethical issues concerned with Genetic engineering.

Course Outcome: After completion of this course the student will be able to

Sl. No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Recall the basic concepts of plant tissue culture and explain fundamental cellular events during the process.	R, U	PO1	PSO1
CO2	Explain the basic principles, tools and techniques of Genetic engineering	U, Ap	PO1, PO2	PSO2, PSO3
CO3	Evaluate the impact of biotechnology in medical science, forensics, and conservation of biodiversity.	An, E	PO3	PSO3
CO4	Translate the concepts in future studies and debate on the GMO related issue and evaluate its significances	E	PO3, PO4	PSO3, PSO4
CO5	Design and formulate experiments to address a research problem	C	PO4	PSO5

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Semester – III	
Course name	Plant Biotechnology (Practical)
Course code	PGBOTCC3.5

Course Objectives: This course aims to

Course Objectives

- Introduce students to the plant biotechnology laboratory.
- Hands on training on media preparation, sterilization and tissue culture.
- Aware students with the lab safety issues in PTC laboratory.

Course Outcome: After completion of this course the student will be able to

Sl. No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Outline the basic organization of a plant tissue culture lab and functioning of its instruments.	U	PO1	PSO1
CO2	Demonstrate different type of sterilization technique.	Ap, An	PO2	PSO2, PSO3
CO3	Evaluate the effect of various PGRs (diff conc.) in plant tissue culture.	U, Ap, An	PO2, PO3	PSO2, PSO3
CO4	Formulate tissue culture from different plant explants.	An, E	PO2, PO3	PSO3, PSO4
CO5	Design and formulate Agrobacterium mediated transformation technique.	C	PO2, PO3, PO4	PSO4, PSO5

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Semester – III	
Course name	Cytology and Molecular Biology (Practical)
Course code	PGBOTCC3.6

Course Objectives: This course aims to

Course Objectives

- Develop basic foundation of stain preparation and techniques of cytology.
- Equip students for karyotype analysis.
- Develop knowledge on isolation and qualitative and quantitative estimation of DNA.

Course Outcome: After completion of this course the student will be able to

Sl. No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Outline basic foundation of stain preparation and techniques of cytology.	R, U	PO1	PSO1
CO2	Plant mitotic & meiotic chromosomal analyses.	Ap, An	PO2, PO3	PSO2, PSO3
CO3	Compare & contrast karyotype in different plant species.	An	PO2, PO3	PSO2, PSO3, PSO4
CO4	Formulate isolation, qualitative and quantitative estimation of DNA.	E, C	PO4	PSO3, PSO5
CO5	Design and formulate amplification of DNA.	E, C	PO4	PSO4, PSO5

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Semester – IV	
Course name	Research Methodology and Bioinstrumentation (Theory)
Course code	PGBOTCC4.1

Course Objectives: This course aims to

Course Objectives

- Select and define appropriate research problem and parameters
- Discuss different methodologies and techniques used in research work.
- Assess the basic function and working of analytical instruments used in biological research.

Course Outcome: After completion of this course the student will be able to

Sl. No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Develop the ability to apply the methods while working on a research project work	U, Ap	PO1, PO3	PSO1
CO2	Explain different sampling methods, research designs and codes of research.	An	PO2, PO3	PSO2, PSO3
CO3	Assess the quality of research paper and scientific misconduct.	An, E	PO2, PO3	PSO3
CO4	Develop necessary skills to perform research in their own field.	E, C	PO3	PSO3, PSO4
CO5	Develop basic knowledge on function and working of analytical instruments used in biological research.	C	PO4	PSO4, PSO5

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Semester – IV	
Course name	Phytochemistry and Herbal Technology (Theory)
Course code	PGBOTCC4.2

Course Objectives: This course aims to

Course Objectives

- Elaborate cultivation, collection, processing, storage and conservation of medicinal plants.
- Discuss the therapeutic applications of herbs, poisonous plants; and Edible Vaccines.
- Describe different types of secondary metabolites, their properties, classification, test for identification and isolation techniques.
- Develop knowledge on quality assessment of plant-based drugs.

Course Outcome: After completion of this course the student will be able to

Sl. No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Outline the history and scope of herbal medicine.	R, U	PO1	PSO1
CO2	Summarize the cultivation, collection, processing, storage and conservation of medicinal plants.	U, Ap	PO1, PO2	PSO2, PSO3
CO3	Evaluate different types of secondary metabolites, their properties, classification, test for identification and isolation techniques.	An, E	PO2, PO3	PSO2, PSO3
CO4	Discuss the therapeutic applications of herbs, poisonous plants; and edible vaccines.	An, E	PO3	PSO4
CO5	Develop knowledge on quality assessment of plant-based drugs.	E, C	PO3, PO4	PSO4, PSO5

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Semester – IV	
Course name	Genetics and Plant Biotechnology 1 (Theory)
Course code	PGBOTME4.1A

Course Objectives: This course aims to

Course Objectives

- Elaborate basics of genetics covering prokaryotic to yeast and higher eukaryotic domains.
- Explain relationship between phenotype and genotype in genetic traits.
- introduce students to the principles, practices and application of plant biotechnology, germplasm conservation and biopharmaceuticals.

Course Outcome: After completion of this course the student will be able to

Sl. No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Outline basic ideas on chromosome biology and apply molecular markers for crop improvement.	U, Ap	PO1	PSO1
CO2	Explain the mechanism of eukaryotic gene regulation and epigenetics.	Ap, An	PO1, PO2	PSO1, PSO2
CO3	Analyze and interpret quantitative genetic experiments	An, E	PO3	PSO2, PSO3
CO4	Discuss knowhow and exhibition of contemporary knowledge in Biotechnology for economic utilization.	E, C	PO3	PSO4
CO5	Develop concepts on plant tissue culture techniques on research problems pertinent to crop improvement and biotechnology industry.	C	PO4	PSO4, PSO5

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Semester – IV	
Course name	Genetics and Plant Biotechnology II (Theory)
Course code	PGBOTME4.2A

Course Objectives: This course aims to

Course Objectives

- Describe fundamental principles of structural & functional genomics.
- Develop an understanding of basic theory of these computational tools implicated in biological research.
- Gain working knowledge on different methodologies, techniques commonly used in genomics, proteomics and metabolomics

Course Outcome: After completion of this course the student will be able to

Sl. No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Summarize the fundamental principles of structural & functional genomics.	U, Ap	PO1	PSO1
CO2	Develop a thorough idea on genome editing and its tools.	Ap, An	PO1, PO2	PSO2, PSO3
CO3	Develop an in-depth understanding of the computational tools implicated in biological research.	Ap, An	PO3	PSO3, PSO4
CO4	Examine and interpret the structural and functional aspects of gene through in silico research.	An, E	PO2, PO3	PSO4, PSO5
CO5	Discuss techniques commonly used in genomics, proteomics and plant metabolic engineering.	E, C	PO3, PO4	PSO5

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Semester – IV	
Course name	Genetics and Plant Biotechnology (Practical)
Course code	PGBOTME4.3A

Course Objectives: This course aims to

Course Objectives

- Develop basic foundation of stain preparation and techniques of cytology.
- Equip students for karyotype analysis, and study of chromosome abnormalities.
- Develop knowledge on in silico techniques to understand DNA structure, gene organization, translation and protein structure prediction.

Course Outcome: After completion of this course the student will be able to

Sl. No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Analyze gene, protein sequence, develop protein interaction map and decode biological significance therein.	Ap, An	PO2, PO3	PSO2, PSO3
CO2	Develop knowledge on DNA, RNA, protein isolation techniques from different plant samples.	Ap, An	PO2, PO3	PSO2, PSO3
CO3	Design and formulate electrophoretic techniques and PCR primers for their own experiments.	E, C	PO3, PO4	PSO3, PSO4
CO4	Design and execute mutagenesis experiments.	E, C	PO4	PSO4, PSO5
CO5	Design and execute plant tissue culture experiments.	E, C	PO4	PSO4, PSO5

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Semester – IV	
Course name	Diversity and Ecology of algae (Theory)
Course code	PGBOTME4.1A

Course Objectives: This course aims to

Course Objectives

- Familiarize the student with diversity of the major life forms of algae.
- Provide knowledge on the biology, ecology and interrelationships among different algal groups.
- Gain working knowledge on different methodologies, techniques commonly used in genomics, proteomics and metabolomics

Course Outcome: After completion of this course the student will be able to

Sl. No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Outline knowledge on the biology, ecology and interrelationships between algal groups.	R, U	PO1	PSO1
CO2	List the habitats and biodiversity of algae.	Ap, An	PO1	PSO1
CO3	Categorize algal members on the basis of their harmful/beneficial role.	An,	PO1, PO2, PO3	PSO2, PSO3
CO4	Develop understanding on the evolutionary interrelationships between different algal groups.	E, C	PO3	PSO3, PSO4
CO5	Discuss the role of algal members in carbon sequestration, global warming and biological ocean acidification	E, C	PO3, PO4	PSO3, PSO5

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Semester – IV	
Course name	Advanced phycology and algal biotechnology (Theory)
Course code	PGBOTME4.2B

Course Objectives: This course aims to

Course Objectives

- Familiarize the student with distribution of algae in various habitats.
- Provide knowledge on algal bioresources and their uses.
- Gain working knowledge on different industrial applications of algae.

Course Outcome: After completion of this course the student will be able to

Sl. No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Outline algal distribution, habitats in freshwater & marine environments.	R, U	PO1	PSO1
CO2	Develop an idea how the algal bio resources will be utilised and explored.	U, Ap	PO2	PSO1, PSO2
CO3	Dissect the various aspects of algal economic importance with special reference to biotechnological & other industrial applications.	An	PO3	PSO3
CO4	Explain how the micro & macro algal natural products will processed in industry for different purposes.	E	PO3, PO4	PSO3, PSO4
CO5	Evaluate the impact of abiotic stress in algal species.	C	PO3	PSO4

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Semester – IV	
Course name	Phycology (Practical)
Course code	PGBOTME4.3B

Course Objectives: This course aims to

Course Objectives

- Develop knowledge on various algal habitats and algal identification.
- Equip students for isolation and culture of microalgae from different habitats.
- Develop knowledge various economically important algal species.

Course Outcome: After completion of this course the student will be able to

Sl. No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Develop knowledge on various algal habitats.	Ap, An	PO1	PSO1
CO2	Analyze enzyme, pigment, secondary metabolite composition from various algal sources.	Ap, An	PO2	PSO2, PSO3
CO3	Identification of algal microflora from different habitats.	An	PO2, PO3	PSO3
CO4	Design and execute water quality assessment.	E, C	PO3, PO4	PSO4
CO5	Execute handling and culture of economically important algae.	E, C	PO4	PSO4, PSO5

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Semester – IV	
Course name	Taxonomy of Angiosperms (Theory)
Course code	PGBOTME4.1C

Course Objectives: This course aims to

Course Objectives

- Deals with naming and classification of plants their interrelationships.
- Aware the students with recent developments in plant systematic and phylogenetics.
- Understand various classification systems, nomenclature and interdisciplinary approaches.
- Recognize members of the major angiosperm families by identifying their diagnostic features.

Course Outcome: After completion of this course the student will be able to

Sl. No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Outline the wide activities in angiosperm and trends in classification system.	R, U	PO1	PSO1
CO2	Develop the concepts of taxonomy and systematics	Ap	PO1, PO3	PSO3
CO3	Explain concept of species and speciation.	An, E	PO3	PSO3
CO4	Discuss the importance of rules, principles and recommendations in taxonomy.	E, C	PO3	PSO3
CO5	Discuss the general range of variations in the group of angiosperms.	C	PO3	PSO4

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Semester – IV	
Course name	Taxonomy of Angiosperms (Theory)
Course code	PGBOTME4.2C

Course Objectives: This course aims to

Course Objectives

- Provide knowledge on evolution of floral organs.
- Elucidate the contribution of various data sources in plant taxonomy.
- Comprehend the role biodiversity and conservation in plant taxonomy.

Course Outcome: After completion of this course the student will be able to

Sl. No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Develop knowledge on evolution of floral organs.	U	PO1	PSO1
CO2	Survey the contribution of various data sources in plant taxonomy.	Ap, An	PO1, PO2	PSO2
CO3	Discuss the principles of biosystematics numerical taxonomy.	E, C	PO3	PSO3
CO4	Estimate the role biodiversity and conservation in plant taxonomy.	C	PO3, PO4	PSO4, PSO5

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Semester – IV	
Course name	Taxonomy of Angiosperms (Practical)
Course code	PGBOTME4.3C

Course Objectives: This course aims to

Course Objectives
<ul style="list-style-type: none"> • Provide a thorough overview of taxonomic literature. • Aware students in preparation of artificial keys. • Collect plant samples and preparation of herbarium specimens.

Course Outcome: After completion of this course the student will be able to

Sl. No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Preparation of botanical keys by locating key characters.	U	PO1, PO2	PSO1, PSO2
CO2	Collection of plants and preparation of herbarium specimens	Ap, An	PO2	PSO2
CO3	Use of computer based softwares and statistical methods as an aid in plant taxonomy	E, C	PO3	PSO3
CO4	Provide lab-based training in writing species descriptions and illustration.	C	PO3, PO4	PSO5

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Semester – IV	
Course name	Intellectual Property Rights (IPR) (Theory)
Course code	PGBOTSOC4A

Course Objectives: This course aims to

Course Objectives
<ul style="list-style-type: none"> Recognize the importance of IP and to educate the pupils on basic concepts of IPR. Identify the significance of practice and procedure of Patents. Learn the procedure of obtaining patents, copyrights, trademarks & industrial design.

Course Outcome: After completion of this course the student will be able to

Sl. No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Distinguish and explain various forms of IPRs.	An, E	PO3	PSO3
CO2	Apply statutory provisions to protect particular form of IPRs.	An, E	PO3	PSO4
CO3	Analyse rights and responsibilities of holder of Patent, Copyright, Trademark, Industrial Design.	Ap, An	PO3, PO4	PSO3, PSO4
CO4	Identify procedure to protect different forms of IPRs national and international level.	E, C	PO3, PO4	PSO5

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Semester – IV	
Course name	Biosafety Management (Theory)
Course code	PGBOTSOC4B

Course Objectives: This course aims to

Course Objectives
<ul style="list-style-type: none"> Recognize public health definitions and their relative advantages. Perform a detailed Biological Risk Assessment, based on agent and procedure-specific properties. Define the different Biosafety Levels, list the minimum controls required, and describe the type of agents appropriate for each level. Implement the principles of biological containment.

Course Outcome: After completion of this course the student will be able to

Sl. No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Outline the benefit of a framework for essential public health functions.	R, U	PO1	PSO1
CO2	Plan a detailed Biological Risk Assessment, based on agent and procedure-specific properties.	An	PO2, PO3	PSO2, PSO3, PSO4
CO3	Evaluate the different Biosafety Levels, and describe the type of agents appropriate for each level.	Ap, E	PO3, PO4	PSO3, PSO4
CO4	Adapt and formulate the principles of biological containment.	C	PO3, PO4	PSO4

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Semester – IV	
Course name	Post-harvest management of Crops (Theory)
Course code	PGBOTSOC4C

Course Objectives: This course aims to

Course Objectives

- Cover every aspect from “farm to table”.
- Study various changes occurring in fruits and vegetables during the pre-and post-harvest stages.
- Gain knowledge on physiology, biochemistry and on various technologies involved relevant to shelf-life extension.

Course Outcome: After completion of this course the student will be able to

Sl. No.	Course Outcomes	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Outline the principles of post-harvest technology.	R, U	PO1	PSO1, PSO2
CO2	Illustrate the physiological & biochemical changes occurring during fruits and vegetables development.	U, An	PO1, PO2	PSO2, PSO3
CO3	Discuss the role and the significance of proper post-harvest handling to maintain the quality of fruits and vegetables.	E, C	PO3	PSO3
CO4	Analyse various aspects of quality control and evaluation.	An, C	PO4	PSO4, PSO5

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Principal
Ramakrishna Mission
Vivekananda Centenary College
Rahara, Kolkata-700 118



Ramakrishna Mission Vivekananda Centenary College
Rahara, Kolkata-700118

DEPARTMENT OF BOTANY

Programme Outcomes, Programme Specific
Outcomes, Course Objectives and Course Outcomes
of the *PhD Botany* Syllabus
Session 2018-2019



Website : www.rkmvccrahara.org Email : rkmvccollege@rkmvccrahara.org

Phone : 033-25682049, ; Fax : 033-25682049



Principal
Ramakrishna Mission
Vivekananda Centenary College
Rahara, Kolkata - 118

PROGRAM OUTCOMES (PO):

After completion of the Ph.D. Degree program, the students will be able to

PO No.	Program Outcomes	Cognitive Level
PO1	Understands and apply theories, methodologies, and knowledge to address fundamental questions in their primary area of study.	U, Ap
PO2	Demonstrate the gained knowledge and skills in oral and written and hence communicate them to publish and present work in their field.	E, C
PO3	Develop a mastery of analysing skills and knowledge at a level required for college and university undergraduate teaching in their discipline and assessment of student learning.	An
PO4	Develop the intellectual independence that epitomizes true scholarship and Pursue research of significance in the discipline under the guidance of an advisor.	C

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PROGRAMME SPECIFIC OUTCOMES (PSO):

After the successful completion of this course, the student will be able to:

PSO No.	Program Specific Outcomes	Cognitive Level
PSO1	Develop specialization in a particular area of biological research.	U, Ap
PSO2	Inculcate logical reasoning among students and help them develop ability to solve problems modern biological techniques.	E, C
PSO3	Train the students a wide range of analytical and/or experimental and/or computational techniques that can be applied in biological research.	An, C
PSO4	Design and formulate experiments to conduct independent research.	C

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Course Name: **Research Methodology**

Course Code: **PHDBOT01**

Course Objectives (PHDBOT01)

The prime objectives of the course are:

- Develop the ability to choose methods appropriate to research aims and objectives.
- Understand the advantages and disadvantages of particular research method.
- Develop skill of critical thinking and the skill of qualitative and quantitative data analysis and presentation.
- Prepare students for organizing and conducting research in a more appropriate manner.

Course Outcomes

On successful completion of the course students will be able to:

CO. No.	Course Outcome	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Understand the objectives, motivation and types of research	U	PO1	PSO1
CO2	Define and formulate a research problem	R, C	PO4	PSO2
CO3	Collect data (primary or secondary) based on the formulated problem and analyse the data.	An	PO2	PSO3
CO4	Analyse the data with hypothesis testing, generalization and interpretation.	An, C	PO3	PSO3
CO5	Discuss the application of results and write the thesis.	Ap, E	PO3	PSO4

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Name of the Course: **Computer Applications**

Course Code: **PHDBOT02**

Course Objectives (PHDBOT02)

The prime objectives of the course are:

- To develop competency in technical writing.
- To master the fundamentals of writing LaTeX and Python scripts.
- To acquire Object Oriented Skills in Python.
- To develop the skill of designing Graphical user Interfaces in Python and LaTeX.
- To develop the ability to write database applications in Python.



Course Outcomes (PHDBOT02)

On successful completion of the course students will be able to:

CO. No.	Course Outcome	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Explain and use TeX and LaTeX.	An	PO2	PSO2
CO2	Understand the advantages of LaTeX over other more traditional software's.	U	PO1	PSO1
CO3	Prepare handouts and presentations using LaTeX.	C	PO4	PSO3
CO4	Understand the core BioPython scripting elements such as variables and flow control structures.	U, Ap	PO1	PSO1
CO5	Use BioPython to analyze biological data files.	E, C	PO3	PSO3

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Name of the Course: **Literature Review**

Course Code: **PHDBOT03**

Course Objectives (PHDBOT03)

The prime objectives of the course are:

- To learn to review and assess scientific literature critically.
- To write and present an overview of the relevant literature for a specific research topic.
- To develop knowledge, insight, and academic skills.
- To develop transferable skills & interpersonal skills.

Course Outcomes

On successful completion of the course students will be able to:

CO. No.	Course Outcome	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Identify and retrieve relevant publications within a field of research and write a literature review by searching the literature systematically.	An, E	PO2	PSO4
CO2	Select representative scientific sources from several perspectives relevant to the assignment.	E	PO2	PSO3
CO3	Write a research proposal for obtaining Financial assistance from national funding agencies.	C	PO4	PSO4
CO4	Draw conclusions related to the research problem and give recommendations towards new research opportunities.	C	PO4	PSO4



CO 5	Represent and systematically structure a discussion on the theories and experimental results and define, design and write a literature review independently	An, C	PO3	PSO2
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Name of the Course: Advance Level Elective Course

Course Code: PHDBOT04

Course Outcomes (PHDBOT04)

On successful completion of the course students will be able to:

CO No.	Course Outcome	Cognitive Level	POs Addressed	PSOs Addressed
CO1	Understand the objectives, motivation and types of molecular biology research.	An	PO1	PSO1
CO2	Explain and use advanced molecular biology and biochemical techniques.	U	PO2	PSO2
CO3	Prepare handouts and presentations using LaTeX.	C	PO4	PSO3
CO4	Analyse the research data with advanced statistical softwares.	U, Ap	PO1	PSO1
CO5	Discuss the application of advanced biological techniques and applied botany.	E, C	PO3	PSO3

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S. K. Das

Principal
Ramakrishna Mission
Vivekananda Centenary College
Rahara, Kolkata-700 118

