Resolution No. AC/II(23-24).2.RPS2

S. P. Mandali's

Ramnarain Ruia Autonomous College

(Affiliated to University of Mumbai)

Syllabus for

Program: MSc Part I

Program Code: RPSBCH

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

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 Master's Degree in Science program will be able to:**
GA 1	Demonstrate in depth understanding in the relevant science discipline. Recall, explain, extrapolate, and organize conceptual scientific knowledge for execution and application and also to evaluate its relevance.
GA 2	Critically evaluate, analyse, and comprehend a scientific problem. Think creatively, experiment and generate a solution independently, check and validate it and modify if necessary.
GA 3	Access, evaluate, understand, and compare digital information from various sources and apply it for scientific knowledge acquisition as well as scientific data analysis and presentation.
GA 4	Articulate scientific ideas, put forth a hypothesis, design and execute testing tools and draw relevant inferences. Communicate the research work in appropriate scientific language.
GA 5	Demonstrate initiative, competence, and tenacity at the workplace. Successfully plan and execute tasks independently as well as with team members. Effectively communicate and present complex information accurately and appropriately to different groups.
GA 6	Use an objective, unbiased and non-manipulative approach in collection and interpretation of scientific data and avoid plagiarism and violation of Intellectual Property Rights. Appreciate and be sensitive to environmental and sustainability issues and understand its scientific significance and global relevance.
GA 7	Translate academic research into innovation and creatively design scientific solutions to problems. Exemplify project plans, use management skills, and lead a team for planning and execution of a task.
GA 8	Understand cross disciplinary relevance of scientific developments and relearn and reskill so as to adapt to technological advancements.

PROGRAM OUTCOMES

PO	Description **A student completing Master's Degree in Science program in the subject of Biochemistry will be able to:**
PO 1	Acquire necessary knowledge and skills to undertake a career in research, either in industry or in an academic set up.
PO 2	Compare and contrast the breadth and depth of scientific knowledge in the broad range of fields including Protein biochemistry, Bioenergetics, Diagnostic Biochemistry, Hormonal Biochemistry, Molecular Biology, Nutritional Biochemistry, and Nanotechnology.
PO 3	Extrapolate and comprehend the regulatory role of metabolic processes and understand the underlying cause of metabolic disorders
PO 4	Acquire thorough knowledge of Biochemical Techniques, Advanced Immunology, Physiology, Genetic Engineering, and Biotechnology
PO 5	Describe and express the biochemical basis of human diseases, protein structure and conformation, non-invasive diagnostics, clinical research, and its importance in drug development. Usage of this knowledge further for multitude of laboratory applications.
PO 6	Integrate and apply the techniques in Biophysics, Analytical Biochemistry, Clinical biochemistry, Microbiology, Molecular Biology and Basics in Bioinformatics
PO 7	Gain proficiency in laboratory techniques in both Biochemistry and Molecular Biology, and be able to apply the scientific method to the processes of experimentation and Hypothesis testing
PO 8	Develop and enhance skills & improve employability through academic, research and internship opportunities
PO 9	Gain exposure to basic research through the provision of PG research based project.
PO 10	Learn to work as a team as well as independently to compile and interpret Biological data, carry out Research investigations and draw conclusions

CREDIT STRUCTURE MSc

Semester	Mandatory	Elective	RM	OJT/FP	RP/ Internship	Cum.Credits
1	14 (3+1)*3+2	4(3+1)	4	0	0	22
2	14 (3+1)*3+2	4(3+1)	0	4 FP	0	22

Semester I

Course Code: RPSBCH.O506

Course Title: Plant Biochemistry

Type of course: Discipline Specific Elective

Academic year 2024-25

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION A student completing this course will be able to:
CO 1	Explain the structural details of the plant cell
CO 2	Illustrate the chemistry of different plant pigments in order to explore their isolation, characterization and applications in various fields
CO 3	Correlate photosynthetic process with humans and environment.
CO 4	Justify the importance of nitrogen fixation in agricultural production and environment
CO 5	Discuss the importance of secondary metabolites and its industrial applications.
CO 6	Identify the class and functions of secondary metabolites and appreciate their role in physiology of plants
CO 7	Choose appropriate plant growth regulators for development of plants
CO8	Make use of theoretical concepts of plant biochemistry and develop experimental acumen.

DETAILED SYLLABUS

Course Code	Unit	Course/ Unit Title Plant Biochemistry RPSBCH.O506	Credits/ Hours 3 / 45 Hours
I	**1**	**Overview of Plant cell structure, plant pigments & plant metabolism**	**15**
	1.1	Plant cell wall (structure), Overview of Leaf structure – Upper epidermis, palisade mesophyll, spongy mesophyll, lower epidermis, Guard cells and stomata	

	1.2.1	Specialized plant cells (in brief) – Parenchyma, Sclerenchyma, Collenchyma, Xylem and phloem, Bulliform cells	
	1.2.2	Concept of apoplast, apoplastic and symplastic pathways	
	1.2	Plant pigments –	
	1.2.1	Primary pigment - Chlorophyll (Types and function)	
	1.2.2	Role of accessory pigments and their biological significance Carotenoids, Xanthophylls, Betalains, Anthocyanins and other flavonoids	
	1.3	Plant Micronutrients	
	1.4	Nitrogen metabolism	
	1.4.1	Sources of Nitrogen, different forms of nitrogen in plants	
	1.4.2	Conversion of nitrate to nitrite & finally to ammonia, biological nitrogen fixation in plants	
	1.4.3	Sulphur metabolism, Phosphorous metabolism	
II	**2**	**Photosynthesis, Photorespiration and plant movements**	**15**
	2.1	Photosynthesis	
	2.2.1	Light reactions: Light harvesting complexes, Absorption of light, Photophoshorylation: Cyclic and Non-cyclic (Z scheme)	
	2.2.2	Dark reactions: Calvin cycle, regulation of Calvin cycle	
	2.3	C4 cycle and CAM pathway	
	2.4	Synthesis of glucose, starch, sucrose	
	2.5	Photorespiration, Photoperiodism and photoinhibition	
	2.6	Physiology of plant movements Physical movements – Xerochasy, Hydrochasy Vital movements – Protoplasmic streaming, paratonic movements Tactic movements – Chemotaxis, Phototaxis, Thermotaxis Tropic movements – Chemo / geo / hydro / photo / thigmo tropism Nastic movements – Seismonasty, Nyctynasty, Photonasty, Chemonasty, Thermonasty	
III	**3**	**Regulation of plant growth, secondary metabolites and Sexual reproduction in plants**	**15**
	3.1	Plant Growth Substances	

		Structure and Function of - Auxins, Gibberellins, Cytokinins, Ethylene and Abscisic Acid	
	3.2	Secondary metabolites of plants Nitrogen containing compounds (Alkaloids), Terpenes & Phenolic compounds – Shikimic acid pathway, Mevalonic acid pathway, MEP Pathway	
	3.3	Reproduction in plants and PTC	
	3.3.1	Asexual reproduction in gymnosperms. Life Cycle of Gymnosperms.	
	3.3.2	Sexual Reproduction in angiosperms: Structure of plant gametes. Life cycle of angiosperm	
	3.3.3	Double fertilization in plants	
	3.4	Post fertilization events in plants	

	Course code- RPSBCHP.O506 **Practical Title-** Practicals based on RPSBCH.O506	1 Credit
1 2 3 4 5 6 7	Phytochemical analysis – Qualitative test Quantitative estimation of Total Phenolic content Quantitative estimation of Alkaloids content Quantitative estimation of Flavonoids content Quantitative estimation of Saponins content Estimation of antioxidant capacity of plant extract Separation of plant pigments by Adsorption Column Chromatography & TLC	1 Credit

References:

1. Biochemistry & Molecular Biology of Plants - Bob B. Buchanan - Wilhelm Gruissem and Russel L. Jones
2. Plant Biochemistry - Heldt H.-W., Piechulla B.
3. Methods in plant biochemistry and molecular biology - Dashek, William V
4. Plant Secondary Metabolites: Occurrence, Structure and Role in the Human Diet - Alan Crozier
5. Plant Physiology - Taiz and Zeiger - Sinauer Associates Inc.
6. Plant Biochemistry - Caroline Bowsher, Martin steer, Alyson Tobin - Garland science
7. Plant Biochemistry - P.M Dey and J.B. Harborne - Academic Press
8. Biochemical methods - S Sadashivam and A Manickam - New Age International publishers.

Modality of Assessment: Semester I
DSE

A) Internal Assessment- 40%- 30 Marks

Sr No	Evaluation type	Marks
1	Class test	20
2	Class test/ Project/ Assignment/ Presentation	10
	TOTAL	**30**

B) External Examination- (Semester End) 60%- 45 Marks

Semester End Theory Examination:

1. Duration - These examinations shall be of **Two hours** duration.
2. Theory question paper pattern:

Paper Pattern:

Question	Options	Marks	Questions Based on
Q1.	Any 3 out of 4	15	UNIT I
Q2.	Any 3 out of 4	15	UNIT II
Q3.	Any 3 out of 4	15	UNIT III
	TOTAL	**45**	

Semester End Practical Examination:

Practical Examination Pattern:

	Particulars	Marks
1	Laboratory work	20
2	Viva & Journal	05
	TOTAL	**25**

Semester II

Course Code: RPSBCH.E516

Course Title: Nutraceuticals & Functional Foods

Type of course: Discipline Specific Elective

Academic year 2024-25

COURSE OUTCOMES:

COURSE OUTCOME	DESCRIPTION A student completing this course will be able to:
CO 1	Propose the basics of Nutraceuticals Science
CO 2	Conclude the Properties, structure and functions of various Nutraceuticals
CO 3	Demonstrate the use of Nutraceuticals as remedies
CO 4	Develop Novel Food and food Ingredients: Polysaccharides, low caloric sweeteners
CO 5	Illustrate the effect of Anti-nutritional factors
CO 6	Justify the importance of consumption prebiotics and probiotics in diet
CO 7	Explain limitations of Nutraceuticals & Functional foods
CO 8	Make use of theoretical concepts of plant biochemistry and develop experimental acumen.

DETAILED SYLLABUS

Course Code	Unit	Course/ Unit Title Nutraceuticals & Functional Foods RPSBCH.E516	Credits/ Hours 3 / 45 Hours
I	**1**	**Nutraceutical Science**	**15**
	1.1	Introduction to Nutraceuticals as Science	
	1.2	Classification, scope & future prospects of the Nutraceutical Science	
	1.3	Sources of Nutraceuticals.	
		Plant sources, Animal sources, Microbial sources and Minerals	
	1.4	Applied aspects of the Nutraceutical Science.	

	1.5	Relation of Nutraceutical Science with other Sciences	
	1.5.1	Medicine, Human physiology, genetics, food technology, chemistry and nutrition.	
	1.6	Analysis of nutraceuticals- Techniques (Spectroscopic, Voltammetric, Chromatographic)	
II	**2**	**Bioceuticals**	**15**
	2.1	Properties, structure and functions of various Nutraceuticals	
	2.1.1	Glucosamine, Octacosanol, Lycopene, Carnitine, Melatonin and Ornithine alpha ketoglutarate	
	2.1.2	Use of proanthocyanidins, grape products, flaxseed oil, minor millets as Nutraceuticals.	
	2.3	Development of Novel Food and food Ingredients:	
	2.3.1	Naturally produced flavour modifiers, Single Cell Proteins, Marine Algae as food supplements.	
	2.4	Food supplements and food ingredients as by products – Fishery, poultry/animal husbandry and agriculture/dairy industries.	
III	**3**	**Anti-nutritional Factors & Limitations of Nutraceuticals**	**15**
	3.1	Anti-nutritional factors present in foods	
	3.1.1	Types of inhibitors present in various foods and how they can be inactivated	
	3.2	General idea about role of Probiotics and Prebiotics as nutraceuticals. Recent advances in techniques & feeding of substrates.	
	3.3	Assessment of nutritional status and Recommended Daily allowances.	
	3.4	Nutrient Effect of Specific Nutrients : Proteins and Peptides and Nucleotides, Trans fats, Vitamins, Minerals	
	3.5	Issues on functional foods and nutraceuticals in animals	

	Course code- RPSBCHP.E516 **Practical Title-** Practicals based on RPSBCH. E516	1 Credit
1 2 3 4 5	To determine the lactose present in the Soy-milk by Cole's method Determination of reducing sugars by Benedict's Method Protein Estimation by Pyne's method Determination of Hardness of water Estimation of phytic acid	

6	Estimation of Vitamin C by Folin Phenol method	
7	Optimization and Analysis of probiotics	

References:

1. Nutraceuticals: Efficacy, Safety and Toxicity by Ramesh C. Gupta
2. Nutraceuticals: The Complete Encyclopedia of Supplements, Herbs, Vitamins and Healing Foods by Arthur J. Roberts, Genelle Subak-Sharpe, et al.
3. Advances in Nutraceutical Applications in Cancer: Recent Research Trends and Clinical Applications (Nutraceuticals) by Sheeba Varghese Gupta and Yashwant V Pathak
4. Nutraceuticals in Health and Disease Prevention (Infectious Disease and Therapy Book 6) by PETER. PAUL HOPPE, Klaus Kramer, et al.
5. Nutrigenomics and Nutraceuticals: Clinical Relevance and Disease Prevention by Yashwant V. Pathak and Ali M. Ardekani
6. Pharmaceuticals to Nutraceuticals: A Shift in Disease Prevention by Dilip Ghosh and R.B.Smarta
7. Handbook of Nutraceuticals and Functional Foods (Modern Nutrition) by Robert E.C. Wildman and Richard S. Bruno

Modality of Assessment: Semester II

DSE

A) Internal Assessment- 40%- 30 Marks

Sr No	Evaluation type	Marks
1	Class test	20
2	Class test/ Project/ Assignment/ Presentation	10
	TOTAL	**30**

B) External Examination- (Semester End) 60%- 45 Marks
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Semester End Practical Examination:

Practical Examination Pattern:

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