Form A-7

(See OA-14 of Part A)

Proforma for the submission of the minutes of the Board of Studies

GOA UNIVERSITY

DEPARTMENT OF BOTANY

Minutes of the meeting of the Board of Studies in Botany held on 10.07.2020 at 10.30 am through online mode on Google meet

All the BoS members were present:

1. Prof. S. Krishnan, Department of Botany, Goa University, Chairperson.
2. Prof. T. D. Nikam, Department of Botany, University of Pune, Pune - External Member.
3. Prof. H. Niranjan Murthy, Department of Botany, Karnataka University, Dharwad - External member.
4. Prof. Bernard F. Rodrigues, Department of Botany, Goa University - Member.
5. Dr. Rupali Bhandari, Department of Botany, Goa University - Member.
6. Mrs. Wendy Francisca Xavier Martins, St. Xavier's College of Arts, Science and Commerce, Mapusa - Member.
7. Mrs. Manjiri Milind Barve, Dhempe College of Arts and Science, Miramar, Goa- Member.
8. Mrs. Bhagyashri L. Halarnkar, PES's College of Arts and Science, Farmagudi, Goa - Member.
9. Dr. Sima V. Kamat, PES's College of Arts and Science, Farmagudi, Goa - Member.

Special Invitees Attended:

1. Mrs. Celly Coutinho Quadros, HOD, Department of Botany, Govt. College of Arts, Science and Commerce, Quepem, Goa.
2. Mrs. Sabina Sales e Dias, HOD, Department of Botany, St. Xavier's College of Arts Science and Commerce, Mapusa, Goa.
3. Ms. Meena Miranda Verdes, HOD, Department of Botany, Carmel College of Arts, Science & Commerce for Women, Nuvem, Goa.
4. Dr. Siddhi Jalmi, Assistant Professor, Department of Botany, Goa University, Goa.

Chairperson welcomed the members of the BoS and special invitees and introduced the agenda of the meeting.

Agenda of the meeting were as follows:

1. Recommendation of Swayam courses for postgraduate and undergraduate levels.
2. Additional Optional papers and revision of existing Optional papers for PG.
3. Students from other disciplines seeking admission to Postgraduate programme in Botany AOB

Part A

(i) Recommendations regarding courses of study in the subject or group of subjects at the undergraduate level:

The following Swayam courses were recommended by the BoS at undergraduate level:

Sr. No.	Title of the Course	Credit Equivalent
1	Plant Pathology and Soil Health	3
2	Food Preservation Technology	3
3	Diseases of Horticultural Crops and their Management	2
4	Industrial Biotechnology	3
5	Organic Farming for Sustainable Agricultural Production	2
6	Functional Foods and Nutraceuticals	4

(ii) Recommendations regarding courses of study in the subject or group of subjects at the post-graduate level :

(a) The following Swayam courses were recommended by the BoS at postgraduate level:

Sr. No.	Title of the Course	Credit Equivalent
1	Academic writing	4
2	Biostatistics and Mathematical Biology	3
3	Nanotechnology in Agriculture	2
4	Organic Farming for Sustainable Agricultural Production	2
5	Biomedical Nanotechnology	1

6	Functional Foods and Nutraceuticals	4
7	Wildlife Ecology	3
8	Experimental Biotechnology	3

(b) Syllabus for following Optional papers was discussed and approved

- BOO- : Plant Biochemistry : 3 Credits
- BOO- : Lab in Plant Biochemistry: 1 Credit
- BOO- : Introduction to Omics: 3 Credits
- BOO-121: Techniques and Instrumentation in Botany: 3 Credits
- BOO-122: Lab in Techniques and Instrumentation in Botany: 1 Credit

Part B

(i) Scheme of examinations at the under-graduate level: **Nil**

(ii) Panel of examiners for different examinations at the under-graduate level: **Nil**

(iii) Scheme of examinations at the post-graduate level: **Nil**

(iv) Panels of Examiners for different examinations at post-graduate level: **Nil**

Part C

(i) Recommendations regarding preparation and publication of selection of reading material in any subject or group of subject or group of subjects and names of persons recommended for appointment to make the selection.: **Nil**

Part D

(i) Recommendations regarding general academic requirements in the Departments of University or affiliated Colleges:

Students from other disciplines seeking admission for Postgraduate Programme in Botany should appear for Subject test conducted by the Department of Botany and obtain 50% marks and then appear for GU-ART entrance exam.

- **Open to students from undergraduate degree in Life Sciences and allied disciplines, Microbiology, Biotechnology, Agricultural and Horticultural Sciences, Pharmacy and Environmental Sciences with minimum of 50% marks.**

Part E

(i) Recommendations of text books for the courses of study at the under-graduate Level: **Nil**

(ii) Recommendations of text books for the courses of study at Post-Graduate Level: **Nil**

Part F

(i) The important points/recommendations of BoS that require consideration/ approval of Academic Council (points to be highlighted) as mentioned below.

- **Swayam courses as listed above for postgraduate and undergraduate levels for approval.**
- **Syllabus of M.Sc. Optional papers as mentioned above for approval.**
- **As mentioned in Part-D (i) for approval.**

(ii) The declaration by the Chairperson, that the minutes were read out by the Chairperson at the meeting itself.

Date: 10. 07. 2020

Place: Goa University

13.07.2020
Signature of the Chairperson

Part G. The Remarks of the Dean of the Faculty

i) The minutes are in order
ii) The minutes may be placed before the Academic Council with remarks if any.
iii) May be recommended for approval of Academic Council.
iv) Special remarks if any.

Date: 13/7/2020

Place

Signature of the Dean

Programme: M. Sc. (Botany)
Course Code: BOO-451
Title of the course: Plant Biochemistry
Number of Credits: 3
Effective from AY: 2020-2021

Prerequisites for the course:	Students should have studied B. Sc. Botany with a basic knowledge of plant physiology and biochemistry at the UG level.	
Objective:	This paper provides the deeper understanding of isomerism of biomolecules, biomembranes, bioenergetics and regulation of metabolic pathways in plants. Students will also learn mechanism of enzyme action with introduction to cellular and molecular mechanism of signal transduction.	
Content:	1. **Biomolecules:** Structure, function and isomerism: Organization and composition of eukaryotic cells; integration and control of cellular functions; amino acid composition of proteins; higher levels of protein organization; dynamic aspects of protein structure and protein stability. Plant biopolymers: Cellulose, hemicellulose, xylan and pectin. Biominerals in plant such as phytoliths and calcium oxalate.	**10 hours**
	2. **Mechanism of enzyme action:** Introduction to enzymes; Michaelis-Menten model; enzyme kinetics as an approach to understanding mechanism; enzymatic reactions; regulatory enzymes; reversible and irreversible covalent modifications of enzymes.	**6 hours**
	3. **Metabolic pathways and regulation:** Major metabolic pathways and their regulation; biosynthesis of amino acids; purine and pyrimidine metabolism; metabolic interrelationships; biosynthesis of vitamins.	**8 hours**
	4. **Biomembranes and Bioenergetics:** Physico-chemical properties of biological membranes; their distribution and organization; intrinsic and extrinsic proteins; transport of biomolecules across membrane; passive and active transport; role of membrane in cellular metabolism. Bioenergetics: Thermodynamics; exergonic and endergonic reactions; redox potential; high energy compounds; ATP structure and its significance.	**8 hours**
	5. **Expression and signal transduction:** Gene expression in eukaryotes; genetic control of enzyme synthesis; cell surface receptors; G proteins coupled secondary messenger and response to	**4 hours**

	environmental changes and other stimuli.	
Pedagogy:	Lecture through PPT/e-learning/Assignments/Seminars/Self study	
References/Readings	1. **Berg, Jeremy M** (2012) Biochemistry. WH Freeman and Company, New York. 2. **Bowsher C** (2008) Plant Biochemistry. Garland Science, New York. 3. **Brown TA** (2018) Biochemistry. Viva Books Pvt. Ltd., New Delhi. 4. **Buchanan, Bob B** (2000) Biochemistry and Molecular Biology of plants. Maryland American Society. 5. **Buchanan, Bob B** (2007) Biochemistry and Molecular Biology of Plants. I K International Pvt. Ltd., New Delhi. 6. **Campbell** D (1999) Biochemistry. Saunders College Publishing, Philadelphia. 7. **Cooper GM** (2000) The Cell: A Molecular Approach. Sinauer Associates, Sunderland (MA). 8. **Davies D** (1980) The Biochemistry of Plants. Academic Press, USA. 9. **Devlin TM** (2011) Textbook of Biochemistry with Clinical Correlations. John Wiley and Sons, Inc., New York. 10. **Donald V and Judith GV** (2011) Biochemistry. John Wiley and Sons Asia Pvt. Ltd., New Jersey. 11. **Garret RH and Grisham CM** (2010) Biochemistry. Cengage Learning, Boston. *12.* **Hames D** (2005) Biochemistry. Taylor and Francis, New Delhi. 13. **Heldt, Hans-Walter** (2005) Plant Biochemistry. Reed Elsevier India Pvt. Ltd., New Delhi. 14. **Heldt, Hans-Walter** (2011) Plant Biochemistry. Academic Press, Amsterdam, USA. 15. **Jones R** (2000) Biochemistry and Molecular Biology of Plants, American Society of Plant Physiologists, USA. 16. **Lehninger AL** (2013) Principles of Biochemistry. WH Freeman and Company, New York. 17. **Lodish H, Berk A, Kaiser CA, Krieger M, Bretscher A, Ploegh H, Amon A and Scott MP** (2013) Molecular Cell Biology. WH Freeman and Company, New York. 18. **Lubert S** (2002) Biochemistry. WH Freeman and Company, New York. 19. **Metzler P, David E** (2006) Biochemistry. Elsevier India Pvt. Ltd., New Delhi. 20. **Mishra SR** (2010) Plant Biochemistry. Discovery Publishing House Pvt. Ltd., New Delhi. 21. **Mishra SR** (2011) Understanding Plant Biochemistry.	

	Discovery Publishing House Pvt. Ltd., New Delhi. 22. **Nelson DL, Cox MM and Lehninger AL** (2013) Principles of Biochemistry. Freeman, New York. 23. **Nicholas CP and Lewis S** (1999) Fundamentals of Enzymology. Oxford University Press Inc., New York. 24. **Ochs, Raymond S** (2014) Biochemistry. Jones and Bartlett Learning, Burlington. 25. **Sheehan D** (2009) Physical Biochemistry. Wiley-Blackwell, West Sussex. 26. **Sheehan M** (1994) Biochemistry and Molecular Biology. Thomas Nelson and Sons, United Kingdom. 27. **Singh SK** (2009) Plant Physiology and Biochemistry. Campus Books International, New Delhi. 28. **Voet DJ, Voet JG and Pratt** CW (2008) Principles of Biochemistry. John Wiley and Sons, Inc., New York. 29. **Voet DJ** (1995) Biochemistry. John Wiley and Sons, New York.	
Learning Outcomes:	Students will be able to demonstrate a depth of knowledge of biochemical processes together with a better understanding of interaction and regulation of various metabolic pathways.	

Programme: M. Sc. (Botany)
Course Code: BOO-452
Title of the course: Lab in Plant Biochemistry
Number of Credits: 1
Effective from AY: 2020-2021

Prerequisites for the course:	Knowledge of the subject at UG level to be able to prepare various types of solutions, and handle basic laboratory tools and techniques.	
Objective:	This course is designed primarily to relate the learning of concepts in classroom to demonstrate experimental foundation of underline concepts/principles mainly on aspects of biomolecules, its metabolic processes and enzymes.	
Content:	1. Extraction and estimation of proteins from plants. (2P) 2. Extraction and estimation of amino acids from plants. (2P) 3. Extraction and estimation of total sugar and non reducing sugars from plant samples. (2P) 4. Separation of protein by PAGE (preparation of gel, preparation of protein sample, running, development and documentation of gel). (3P) 5. Extraction and purification of lipids from leaf samples. (1P) 6. Separation of glycolipids, phospholipids and neutral lipids (chromatographically). (3P) 7. Quantitative estimation of phospholipids and glycolipids (spectrophotometrically). (2P) 8. Activity of enzyme phosphoenol pyruvate carboxylase (PEPC). (1P) (Note: Any 10 practical exercises will be conducted.)	4 hours 4 hours 4 hours 6 hours 2 hours 6 hours 4 hours 2 hours
Pedagogy:	Wet laboratory exercises	
References/Readings:	1. **Bhainagar R** (1987) Manual of Practical Biochemistry. Delhi IBT Publishing, New Delhi. 2. **Boyer R** (2000) Modern Experimental Biochemistry. Delhi Pearson Education, New Delhi. 3. **Cooper TG** (2011) The Tools of Biochemistry. Wiley India Pvt. Ltd., New Delhi. 4. **Devi P** (2005) Principles and Methods of Plant Molecualr Biology, Biochemistry and Genetics. Jodhpur Agrobios, Jodhpur. 5. **Harborne JB** (2007) Phytochemical Methods. Chapmann	

	and Hall, London. 6. **Harisha S** (2006) Biotechnology Procedures and Experiments Handbook. Firewall Media, New Delhi. 7. **Jayaraman J** (2011) Laboratory Manual in Biochemistry. John Wiley and Sons Ltd. 8. **Palmer T and Bonner** T (2003) Enzymes: Biochemistry, Biotechnology, Clinical Chemistry. Woodhead Publishing House, Chichester, England. 9. **Plummer DT** (2014) An Introduction to Practical Biochemistry. Tata McGraw Hill publishing company Ltd., New Delhi. 10. **Sadasivam S and Manickam A** (2009) Biochemical Methods. New Age International Pvt. Ltd. New Delhi. 11. **Segel I H** (2010) Biochemical Calculations. John Wiley and Sons, California, USA. 12. **Sheehan D** (2009) Physical Biochemistry: Principles and Applications. John Wiley and Sons Ltd, Chichester, England. 13. **Verma P, Ashish S** (2014) Laboratory Manual for Biotechnology. S. Chand and Company Pvt. Ltd., New Delhi. 14. **Wharton, David** (1972) Experiments and Methods in Biochemistry. The Macmillan Co., London. 15. **Wilson K and Walker J** (2010). Principles and Techniques of Biochemistry and Molecular Biology. Cambridge University Press, UK.	
Learning Outcomes:	Students will be able to develop competence in handing various biochemical techniques and apply them in isolating and analyzing different biological molecules.	

Programme: M.Sc. (Botany)
Course Code: BOO-453
Title of the Course: Introduction to Omics
Course Credit: 3

Prerequisite for the Course:	Should have basic knowledge of structure of genome, genes, structure of proteins, metabolism.	
Objective:	This course will make students familiarize with terminology, underlying principals and methodology in genomics, transcriptomics, proteomics and metabolomics. Thrust of the paper is Protein dynamics, protein trafficking machinery and autophagy for protein turnover. The role of protein networks in mediating cellular responses and transmitting signals will be highlighted with emphasis on giving relevant examples for the use in future research work.	
Content:	**1. Genomics:** Classical genomics, Mendelian Genetics, Forward/Reverse Genetics, Linking Genotype and phenotypes, use of mutants. Large Scale genomic Sequencing: Platforms for next generation sequencing (NGS), whole genome sequencing, targeted sequencing, ChIP sequencing, Applications of Genome sequencing. Epigenetic regulation in Plants, DNA methylation, Histone modification, Plant Mediator Complex. Transcriptomics: Differential expression, Alternate splicing, RNA sequencing, ENCODE, Epigenomic analysis. **2. Proteomics:** Protein structure and function, amino acids, peptides, protein synthesis. Post translational modification of proteins: Glycosylation, Phosphorylation, Acetylation, Methylation, Ubiquitinylation, Identification of post-translational modification in proteins, protein phosphorylation assay. Protein transport and Secretion, Protein targeting and trafficking, ER Golgi dynamics in protein sorting, dynamics of membrane bound protein, mechanism of protein secretion. Protein degradation: Ubiquitin-proteosome pathway, Lysosomal Proteolysis, role of autophagy and vesicular trafficking in degradation of protein. Essentials of Protein-protein interaction: Protein interacting motifs, multi-protein complex, application of protein interactions, databases and tools to study Protein interactome. Protein Networks in Plant signaling: Introduction to plant signaling, types of membrane receptors (Membrane receptors, intracellular and extracellular receptors, G-protein coupled	11 hours 18 hours

	receptors, ion channels, Pattern recognition receptors), components of cell signaling (secondary messengers, sensors and effectors, Two-component system, signal perception), Types of signaling pathways, reversible phosphorylation and dephosphorylation, role of plant signaling in development and immunity. **3. Metabolomics:** Overview of Metabolites, basics of metabolic pathways, errors of metabolism, sample preparation, extraction, derivatization, Targeted v/s untargeted metabolomics, Identification of molecular features and metabolites, structural confirmation, application of metabolomics in diagnosis.	7 hours
Pedagogy:	Lectures/Tutorials/Seminars/Assignment/Self study	
References/ Readings:	**António, C.** (2018) Plant Metabolomics- Methods and Protocols, Humana press, Hertfordshire, UK. **Cooper, G.M.** (2000) The Cell: A Molecular Approach. 2nd edition. Sunderland (MA): Sinauer Associates, UK. **Karp, G.** (2009) Cell and molecular biology: Concepts and experiments, 7th edition. John Wiley & Sons, USA. **Kramer, I. M.** (2015) Signal Transduction, 3rd edition, University of Bordeaux, Talence, France. **Nelson, D. L., Cox, M. M., & Lehninger, A. L.** (2013) Principles of biochemistry (p. 245), Freeman, New York. **Primrose, S. B. and Twyman, R. M.** (2006) Principles of gene manipulation and genomics, Blackwell Publishing, Australia. **Reece, R. J.** (2004) Analysis of genes and genomes. John Wiley & Sons Ltd. **Saraswathy, N. and Ramalingam, P.** (2011) Concepts and Techniques in Genomics and Proteomics. Biohealthcare Publishing (Oxford) Limited, New York. **Segev, N.** (2009) Trafficking Inside Cells, Springer science Business media, USA. **Sessa, G.** (2012) Molecular Plant Immunity. John Wiley & Sons, Inc, Isarel. **Voet, D., Voet, J. G. and Pratt, C. W.** (2016) Fundamentals of biochemistry: life at the molecular level. John Wiley & Sons, USA. **Walker, J. M. and Rapley, R.** (2008) Molecular Biomethods Handbook, Hertfordshire, UK. **Wilson, K. and Walker, J.** (2010) Principles and techniques of biochemistry and molecular biology, 7th edition. Cambridge University Press, UK.	
Learning outcome:	Students will get familiar with principles and applications in Genomics, Transcriptomics, Proteomics and Metabolomics. They will be able to apply basic concepts in research work.	