गोंय विद्यापीठ
ताळगांव पठार
गोंय - ४०३ २०६
फोन: +९१-८६६९६०९०४८

Goa University
Taleigao Plateau, Goa - 403 206
Tel : +91-8669609048
Email : registrar@unigoa.ac.in
Website: www.unigoa.ac.in

(Accredited by NAAC)

GU/Acad –PG/BoS -NEP/2023/102/33 Date: 21.06.2023

CIRCULAR

The University has decided to implement the UGC Curriculum and Credit Framework for the Undergraduate Programme (CCFUP) of **Bachelor of Science in Chemistry/Bachelor of Science in Chemistry (Honours)** under the National Education Policy (NEP) 2020 from the Academic Year 2023-2024 onwards.

The approved Syllabus of Semesters I and II of the **Bachelor of Science in Chemistry/Bachelor of Science in Chemistry (Honours)** Programme is attached.

Principals of Affiliated Colleges offering the **Bachelor of Science in Chemistry/Bachelor of Science in Chemistry (Honours)** Programme are requested to take note of the above and bring the contents of this Circular to the notice of all concerned.

(Ashwin Lawande)
Assistant Registrar – Academic-PG

To,

1. The Principals of Affiliated Colleges offering the Bachelor of Science in Chemistry /Bachelor of Science in Chemistry (Honours) Programme.

Copy to:

1. The Director, Directorate of Higher Education, Govt. of Goa.
2. The Dean, School of Chemical Sciences, Goa University.
3. The Vice-Deans, School of Chemical Sciences, Goa University.
4. The Chairperson, BOS in Chemistry (UG).
5. The Controller of Examinations, Goa University.
6. The Assistant Registrar, UG Examinations, Goa University.
7. Directorate of Internal Quality Assurance, Goa University for uploading the Syllabus on the University website.

Goa University

Programme Structure for Semester I to VIII Under Graduate Programme- Chemistry										
Semester	**Major -Core**	**Minor**	**MC**	**AEC**	**SEC**	**I**	**D**	**VAC**	**Total Credits**	**Exit**
I	**CHC-100 Fundamentals of Chemistry (3T+1P)**	**CHC-111 Basic Concepts in Chemistry (4)**	**CHC-131 Introduction to Chemistry (3)**		**CHC-141 (SEC-1) Water and Soil Analysis (1T+ 2P) OR CHC-142 (SEC-2) Skills in Qualitative Organic Analysis (1T+ 2P) OR CHC-143 (SEC-3) Chemistry of Cosmetics and Perfumes (1T+ 2P)**					
II										*** EXT-1 XXX-161 (Course Title) (4)**
III	**CHC-200 Concepts in Inorganic and Physical Chemistry (4)** **CHC-201 Concepts in Organic and Analytical Chemistry(4)**	**CHC-211 Basic Industrial Chemistry (4)**	**CHC-231(MC-2) General Introduction to Environment and Sustainability (3)**		**CHC-241 (SEC-4) Mathematical Aspects in Chemistry (1T+ 2P) OR CHC-242 (SEC-5) Introductory skills in Green Chemistry (1T+ 2P) OR CHC-243 (SEC-6) Drug Synthesis and Analysis (1T+ 2P)**					

IV	**CHC-202 Organic Chemistry-I (4)** **CHC-203 Inorganic Chemistry-I (4)** **CHC-204 Physical Chemistry-I (4)** **CHC-205 Pharmaceutical Chemistry (2)**	**CHC-221 (Minor Vocational-1) Chemistry of Laboratory Management (4)**								**EXT-2 XXX-16X (Course Title) (4)**
V	**CHC-300 Organic Chemistry-II (4)** **CHC-301 Inorganic Chemistry-II (4)** **CHC-302 Physical Chemistry-II (4)** **CHC-303 Green Chemistry Techniques (2)**	**CHC-321 (Minor Vocational-2) Food Science and Nutrition (4)**				**CHC-361 (I) [2] Internship**				
VI	**CHC-304 Instrumentation in Industrial Chemical Analysis (4)** **CHC-305 Industrial Pharmaceutical Chemistry (4)** **CHC-306 Advanced Physical Chemistry-I (4)**	**CHC-322 (Minor Vocational-3) Instrumentation and Analysis (4)**								

	CHC-307 Project (4)									
VII	CHC-400 Advanced Organic Chemistry-II (4) CHC-401 Advanced Inorganic Chemistry-II (4) CHC-402 Advanced Physical Chemistry-II (4) CHC-403- Introduction to Bio-Inorganic chemistry (4)	CHC-411 Advanced Analytical Techniques-I (4) OR CHC-412 Advanced Pharmaceutical Analysis-I (4)								
VIII	CHC-404 Seminar based course (4) CHC-405 Polymer science and technology (4) CHC-406 Solid state chemistry (4) CHC-407 Organometallics (4)	CHC-413 Advanced Analytical Techniques-II (4) OR CHC-414 Advanced Pharmaceutical Analysis-II (4)					CHC-462 Dissertation (D) [12] Dissertation			

*** List of Exit Courses along with the syllabus will be provided separately.**

Name of the Programme: B.Sc.(Chemistry)
Course Code: CHC-100
Title of the course: Fundamentals of Chemistry
Number of Credits: 3T+1P
Effective from AY: 2023-24

Pre-requisites	Nil	
Course Objectives:	● To study the postulates of kinetic theory of gases and understand the deviations of real gases from ideal behaviour. ● To study the surface tension and viscosity of liquids. ● To introduce the concepts of atomic structure. ● To understand the basic concepts in organic chemistry. ● To understand the preparation and reactivity of alkanes, alkenes and alkynes.	
Content		
	Fundamentals of Physical Chemistry **Gaseous state** Postulates of Kinetic Theory of gases and deviation from ideal behaviour, Vander Waal's equation of state. Critical phenomenon; PV isotherms of real gases, continuity of states, the isotherms of Vander Waal's equation relation between critical constants and Vander Waal's constants. Law of corresponding states, reduced equation of state. Molecular velocities: root mean square, average and most probable velocities, Qualitative discussion of Maxwell's distribution of molecular velocities, collision number, mean free path and collision diameter. Numerical problems. **Liquid State** Surface Tension, Units of Surface Tension, Determination of Surface Tension by Capillary Rise Method and stalagmometer method. Viscosity, Units of Viscosity, Poiseuille equation, Measurement of Viscosity by Ostwald Method, Effect of Temperature on Viscosity of a Liquid. Numerical problems.	**No of hours** 10 05
	Fundamentals of Inorganic Chemistry **Atomic Structure:** Review of: Bohr's theory and its limitations, dual behaviour of matter and radiation, de Broglie's relation, Heisenberg Uncertainty principle. Hydrogen atom spectra. Need of a new approach to atomic structure. Introduction to Schrodinger equation (**equation not to be derived**) and wave function. Radial and angular parts of the hydrogenic wave functions (atomic orbitals) and their variations for 1s, 2s, 2p, 3s, 3p and 3d orbitals (Only graphical representation). Radial and angular nodes and their significance. Radial distribution functions and the concept of the most probable distance with special reference to 1s and 2s atomic orbitals. Quantum numbers and their significance, Discovery of spin, spin quantum number (s) and magnetic spin quantum number (ms). Shapes of s, p and d atomic orbitals, nodal planes. Rules for filling electrons in various orbitals, electronic configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy. Relative energies of atomic orbitals, Anomalous electronic configurations.	15

	Fundamentals of Organic Chemistry **Basic Organic Chemistry** Curved arrow notation, drawing electron movement with arrows, half and double headed arrows, in organic reaction mechanisms. Physical Effects, Electronic Displacements: Inductive Effect, Mesomeric effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis. Structure, shape and reactivity of organic molecules: Nucleophiles and electrophiles. Reactive Intermediates: Carbocations, Carbanions and free radicals. Strength of organic acids and bases: Comparative study with emphasis on factors affecting pKa values. Aromaticity: Benzenoids and Hückel's rule. **Aliphatic Hydrocarbons: Functional group approach for the following reactions** (Preparations & reactions) to be studied in context to their structure Alkanes: Preparation: Wurtz reaction, Kolbe's synthesis, Reactions: Free radical Substitution: Halogenation. Alkenes: Preparation: Elimination reactions: Dehydration of alcohols and dehydrohalogenation of alkyl halides Reactions: Addition of HX (Markownikoff's and anti-Markownikoff's addition) Alkynes: Preparation: Acetylene from CaC_2 and conversion into higher alkynes; by dehalogenation of tetra halides and dehydrohalogenation of vicinal-dihalides. Reactions: formation of metal acetylides, addition of HX and bromine.	08 07
	Total:	45
Pedagogy	Mainly lectures and tutorials. Seminars / term papers /assignments / presentations /industry visits/ self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.	
References / Readings	1. A. Bahl and G. D Tuli Essentials of physical chemistry ,S. Chand Publications 2020 2. Puri, Sharma, Pathania Principles of Physical Chemistry ,Vishal publishing Co. 2021 3. G. W. Castellan Physical Chemistry 4th Edition Addison-Wesley Publishing Co.2004 4. C. N. R. Rao University General Chemistry, Macmillan Publishers 1973 5. J. N. Gurtu Physical Chemistry Vol. I , Pragati Prakashan,10th Edition 2016 6. Gurtu and Gurtu Advanced Physical Chemistry, Pragati Prakashan 2019 7. J. D. Lee, *Concise Inorganic Chemistry, 5th Edn.*; Wiley India, (2003). 8. B. E. Douglas and D. H. McDaniel, *Concepts & Models of Inorganic Chemistry,* Oxford, 1970. 9. M. C. Day and J. Selbin, *Theoretical Inorganic Chemistry*, ACS Publications, 1962. 10. B. R. Puri, L. R. Sharma and K. C. Kalia, *Principles of Inorganic Chemistry*, 33rd Edn, Vishal Publishing Co. 2020 11. S. Prakash, G. D. Tuli, S. K. Basu and R D. Madan, *Advanced Inorganic Chemistry*, Vol 1, S. Chand & Company Pvt. Ltd. 2013. 12. Graham Solomon, T.W., Fryhle, C.B. & Dnyder, S.A. *Organic Chemistry*, John Wiley & Sons. 2014. 13. McMurry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning India Edition, 2013. 14. Sykes, P. *A Guidebook to Mechanism in Organic Chemistry*, Orient Longman, New Delhi. 1988. 15. Finar, I. L. *Organic Chemistry* (Vol. I & II), E.L.B.S., 5th Edition. 2001. 16. Morrison, R.T. & Boyd, R.N. *Organic Chemistry*, Pearson, 2010. 17. Bahl, A. & Bahl, B.S. *Advanced Organic Chemistry*, S. Chand, 2010. 18. Francis Carey, *Organic Chemistry*; 4th edition Edition, Tata McGraw Hill India. 2000. 19. Paula Yurkanis Bruice, *Organic Chemistry*; 3rd Edition, Pearson Education Asia. 2018. 20. Jerry March, *Advanced Organic Chemistry*; 4rd Edition, John Wiley, 2007.	

Course Outcome:	At the end of the course, students will be able to 1. Identify the properties of liquid and gases. 2. Explain the applications of liquid and gases. 3. Elucidate the atomic structure based on Quantum theory. 4. Identify the use of curved arrow notations in organic reaction mechanisms. 5. Understand various methods of preparation and reactions of alkanes, alkenes and alkynes.

Title of the course: Fundamentals of Chemistry
Number of Credits: 01 (Practicals)

Pre-requisites	Nil	
Course Objectives:	● To translate certain theoretical concepts learnt earlier into experimental knowledge by providing hands on experience of basic laboratory techniques required for chemistry. ● To introduce the fundamentals and basic techniques of volumetric and gravimetric estimations.	
Content		No of hours
	1. Determination of surface tension of two unknown liquids or dilute solutions by stalagmometer method.	04
	2. Determination of viscosity of two unknown liquids or dilute solutions by using Ostwald's viscometer.	04
	3. Study of the variation of viscosity of an aqueous solution with concentration of solute.	02
	4. Pre-Lab session (Laboratory safety, concept of normality and molarity and stoichiometric calculations)	02
	5. Calibration of Burette and Pipettes.	02
	6. To prepare 100 mL of standard 0.1 M $K_2Cr_2O_7$ solution and carry out dilution to 0.05, 0.01, 0.005, and 0.001 M in 100 mL standard flasks	02
	7. Volumetry: To prepare 100 ml of 0.1 N KHP solution and standardize the given approximate 0.1 N NaOH solution.	02
	8. Gravimetric analysis: Determination of percentage composition of the given mixture ZnO + $ZnCO_3$	02
	9. Purification of organic compounds: i) Recrystallization of Benzoic acid by using water as solvent and determination of melting point. ii) Distillation of Acetone and determination of boiling point. iii) Sublimation of Naphthalene and Determination of Melting point.	06
	10. Determination of solubility and chemical nature of both solids and liquids. Water insoluble (Acid//phenol/ Base/Neutral) and water soluble (Acid/Neutral) of given compound. (8 compounds to be analysed)	04
	Total:	30
Pedagogy:	Students should be given suitable pre- and post-lab assignments and explanation revising the theoretical aspects of laboratory experiments prior to the conduct of each experiment. Each of the experiments should be done individually by the students.	
References / Readings	1. S. W. Rajbhoj and T. K. Chondhekar, *Systematic Experimental Physical Chemistry*, Anjali Publication, Second Edition 2000. 2. Khosla, B. D.; Garg, V. C. & Gulati, A. *Senior Practical Physical Chemistry*, R. Chand & Co.: New Delhi (2011). 3. O. P. Pandey, D. N. Bajpai, S. Giri, *Practical Chemistry*, S. Chand Publication 2013.	

	4. Shikha Gulati, J. L. Sharma & Shagun Manocha, Practical *Inorganic Chemistry,* CBS Publishers, 2017. 5. G. H. Jeffery J. Bassett J. Mendham R C. Denney, *Vogel's Textbook of Quantitative Chemical Analysis*, 5th Edn., John Wiley, New York. 1989. 6. J. Mendham, R.C. Denney, J.D. Barnes, M. Thomas, *Vogel's Textbook of Quantitative Inorganic Analysis*, 6th Edn., Pearson Education Asia, 2000. 7. Svehla, G. *Vogel's Qualitative Inorganic Analysis*, Pearson Education, 2012. 8. A.I. Vogel, A., R. Tatchell, B. S. Furniss, A.J. Hannaford, *Vogel's Textbook of Practical Organic Chemistry*, 5thEd., Prentice Hall; 2011. 9. D. Pasto, C. Johnson and M. Miller, *Experiments and Techniques in Organic Chemistry*, 1st Ed., Prentice Hall, 1991. 10. L.F. Fieser, K.L. Williamson, *Organic Experiments*, 7th edition D. C. Heath, 1992. 11. R.K. Bansal, *Laboratory Manual in Organic Chemistry*, New Age International, 5thEdition, 2016.	
Course outcomes	1. To acquire the knowledge and skill of basic volumetric and gravimetric estimations. 2. The students will be able to get hands on experience on the purification techniques for organic compounds. 3. The students will be able to get hands on experience on the identification of chemical nature of organic compounds	

Name of the Programme: B.Sc.(Chemistry)
Course Code: CHC-141
Title of the course: Water and Soil Analysis
Number of Credits: (1T+2P)
Effective from AY: 2023-24

Pre-requisites	Nil	
Course Objective:	● To define the various terms encountered in sampling and study the techniques involved. ● To study methods that can be employed for the determination of the various physico-chemical parameters of water and soil.	
Content		**No of hours**
	1. **Sampling Techniques**: Terms encountered in sampling: the population or the universe, Sample, Sampling unit, increment, the gross sample, the sub sample, Analysis sample, Bulk ratio, Size to weight ratio, Random sampling, Systematic sampling, Multistage sampling, Sequential sampling. Sampling of Liquids and Solids. Preservation, storage and preparation of sample solution.	05
	2.**Analysis of soil**: Composition of soil, Concept of pH and pH measurement, chelation, chelating agents, use of indicators. Bulk density, Specific gravity, moisture content, water holding capacity, pH, electrical conductivity, alkalinity, calcium, magnesium and organic matter.	05
	3.**Analysis of water**: Definition of pure water, sources responsible for contaminating water, water purification methods (For domestic and industrial waters). Water analysis: Dissolved oxygen, free carbon dioxide, B.O.D., C.O.D. and total carbohydrates	05
	Total:	15
Pedagogy	Mainly lectures and tutorials. Seminars / term papers / assignments / presentations / industry visits / mini projects / self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.	
References / Readings	1. A. K. De, *Environmental Chemistry*. New age international Publishers, 4th Edition. 2007 2. B. K. Sharma, *Environmental Chemistry*. Krishna Prakashan Media (P) Ltd. 2014. 3. Svehla, G. *Vogel's Qualitative Inorganic Analysis*, Pearson Education, 2012. 4. Mendham, J. *Vogel's Quantitative Chemical Analysis*, Pearson, 2009. 5. Dr Sunita Rattan *Experiments in Applied chemistry*, 3rd Edition, -S. K. Kataria and Sons. 2011 6. Pandey, O.P., Bajpai D. N. & Giri S. *Practical Chemistry*, Revised Edition, (For BSc. I, II, III Year Students of All Indian Universities) S. Chand Company Pvt Limited, 2014	
Course Outcome:	At the end of the course students will be able to 1. Understand the fundamentals and techniques of water and soil sampling. 2. To describe the methods for the determination of various physico-chemical parameters of soil and water	

Title of the course: Water and Soil Analysis
Number of Credits: 02 (Practicals)

Pre-requisites	Nil	
Course Objectives:	● To help in better understanding of the techniques of sampling soil and water studied in theory, through demonstration. ● To apply the knowledge studied in theory for the determination of various physico-chemical parameters of soil and water and thereby develop related skills.	
Content		No of hours
	1. Techniques of soil sampling (Demonstration) 2. Determination of pH of soil sample 3. Determination of Bulk density of soil sample 4. Determination of Moisture content of soil sample 5. Determination of conductivity of soil sample 6. Determination of organic content in soil sample 7. Techniques of water sampling (Demonstration) 8. Determination of pH and conductivity of a water sample 9. Determination of dissolved oxygen (DO) in a given water sample 10. Determination of magnesium content 11. Determination of total hardness in the water sample 12. Determination of acidity of a water sample 13. Determination of alkalinity in a given water sample 14. Measurement of dissolved CO_2 15. Determination of total solids in water.	15 x 4 = 60
	Total:	60
Pedagogy:	Students should be given suitable pre- and post-lab assignments and explanation revising the theoretical aspects of laboratory experiments prior to the conduct of each experiment. Minimum two samples each to be analysed for every experiment involving soil and water analysis (4 hours each practical session).	
References / Readings	1. A. K. De, *Environmental Chemistry*. New age international Publishers, 4th Edition. 2007 2. B. K. Sharma, *Environmental Chemistry*. Krishna Prakashan Media (P) Ltd. 2014. 3. Svehla, G. *Vogel's Qualitative Inorganic Analysis*, Pearson Education, 2012. 4. Mendham, J. *Vogel's Quantitative Chemical Analysis*, Pearson, 2009. 5. Dr Sunita Rattan *Experiments in Applied chemistry* ,3rd Edition, -S. K. Kataria and Sons. 2011 6. Pandey, O.P., Bajpai D. N. & Giri S. *Practical Chemistry*, Revised Edition, (For BSc. I, II, III Year Students of All Indian Universities) S. Chand Company Pvt Limited, 2014.	
Course outcomes	At the end of the course students will be able to: 1. Observe and understand the techniques employed for soil and water sampling. 2. Develop skill for the determination of the various physico-chemical parameters of soil and water.	

Name of the Programme: B.Sc.(Chemistry)
Course Code: CHC-142
Title of the course: Skills in Qualitative Organic Analysis
Number of Credits: (1T+2P)
Effective from AY: 2023-24

Pre-requisites	Nil	
Course Objective:	● To understand the theoretical aspects of qualitative organic analysis ● To explain mechanistically the chemical tests in qualitative organic analysis.	
Content		**No of hours**
	1. Chemical nature of organic compounds Nature of organic compounds based on physical state of the following compounds: benzoic acid, m-nitroaniline, β-naphthol, acetone, aniline, naphthalene, benzophenone, m-dinitrobenzene (to be shown with structure); presence of saturated and unsaturated compounds using bromine water, potassium permanganate solution; water solubility of organic compounds (any two water soluble and water insoluble compounds); chemical nature of organic compounds (to be explained with reactions)- water insoluble acid/phenol/base/neutral, water soluble acid/phenol/neutral.	07
	2. Analysis of hetero elements and functional groups Detection and presence of hetero elements - N/S/X (to be explained with reactions); Detection and presence of functional groups – CH(O) acid- salicylic acid, CH(O) phenol- β-naphthol, CH(O) neutral- acetone, benzaldehyde, ethyl acetate and ethanol, CH(O)N acid p-nitrobenzoic acid, CH(O)N phenol -nitrophenol, CH(O)N base - nitroaniline , CH(O)N neutral- urea, CH(O)N,S neutral- thiourea, CH(O)Cl neutral- chlorobenzene (to be explained with reactions).	06
	3. Purification Techniques Recrystallisation, distillation, sublimation. Determination of physical constants of organic compounds- melting point, boiling point.	02
	Total:	15
Pedagogy	Mainly lectures and tutorials. Seminars / term papers /assignments / presentations / mini projects / self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.	
References / Readings	1. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., *Textbook of Practical Organic Chemistry*, Prentice-Hall, 5th edition, 1996. 2. Mann, F.G. & Saunders, B.C. *Practical Organic Chemistry* Orient-Longman, 1960. 3. Pandey, O.P., Bajpai D. N. & Giri S. *Practical Chemistry*, Revised Edition, (For BSc. I, II, III Year Students of All Indian Universities) S. Chand Company Pvt Limited, 2014. 4. N. K. Vishnoi, Advanced Practical Organic Chemistry, third edition, 2010	
Course Outcome:	At the end of the course students will be able to 1. Explain reactions involved in identifying the chemical nature of organic compounds. 2. Understand role of sodium fusion extract in detecting the presence of heteroelements. 3. Explain the reactions of various functional groups present in organic compounds. 4. Understand the need for purification techniques in organic analysis.	

Laboratory Course
Number of Credits: 02

Pre-requisites	Nil	
Course Objective:	● To get hands on experience for the systematic qualitative analysis of the organic compounds. ● To learn the purification techniques for organic compounds.	
Content		**No of hours**
	1. Purification of organic compounds: i) Solids by recrystallization process using water and ethanol as solvent and determination of melting point. ii) Simple distillation of acetone and determination of boiling point. iii) Sublimation of naphthalene/ anthracene/ camphor and determination of melting point. **2. Identification of unknown organic compounds based on water solubility, chemical type, elemental analysis, group test and physical constants** (organic spotting) i) Water soluble solids (Acid and Neutral) – *Any 3* ii) Water insoluble solids (Acid, Base, Phenol and Neutral) – *Two compounds to be analysed of each category.* iii) Liquids: Water miscible neutral, water immiscible (base/ neutral)	4 2 2 (3×4 = 12) (8×4 = 32) (2×4 = 08)
	Total:	60
Pedagogy:	Mainly laboratory work to be demonstration to students, supervision of their labwork. Prelab and Post-lab exercises / journal assessment.	
References / Readings	1. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice-Hall, 5th edition, 1996. 2. Mann, F.G. & Saunders, B.C. Practical Organic Chemistry Orient-Longman, 1960. 3. Pandey, O.P., Bajpai D. N. & Giri S. Practical Chemistry, Revised Edition, (For BSc. I, II, III Year Students of All Indian Universities) S. Chand Company Pvt Limited, 2014. 4. N. K. Vishnoi, Advanced Practical Organic Chemistry, third edition, 2010	
Course outcomes	At the end of the course students will be able to: 1. Get hands on experience for the systematic qualitative analysis of the organic compounds. 2. Acquire skills in applying purification and separation techniques for organic compounds	

Name of the Programme: B.Sc.(Chemistry)
Course Code: CHC-143
Title of the course: Chemistry of Cosmetics and Perfumes
Number of Credits: (1T+2P)
Effective from AY: 2023-24

Pre-requisites	Nil	
Course Objective:	● To explain the term Cosmeticology and define cosmetics. ● To describe preparation and uses of cosmetic products. ● To define herb and classify herbal cosmetics. ● To study the formulation and preparation of herbal skincare and haircare products. ● To understand the classification of perfumes and categorise as per the ingredients. ● To understand the importance of essential oils in cosmetic industries. ● To describe the general methods of obtaining volatile oils from plants and its composition of volatile oils.	
Content		**No of hours**
	1. Chemistry of Cosmetics Meaning of Cosmeticology. Definition of cosmetics as per EU and Indian guidelines. A general study including preparation and uses of the following: Hair dye, shampoo, face powder, shampoo, lipsticks, talcum powder, creams (cold, vanishing and shaving creams). Definition of herb, herbal medicine, herbal medicinal product, herbal drug preparation. Classification of herbal cosmetics. Herbal cosmetics for skin care (face packs, soaps). Herbal cosmetics for hair care: Henna and Hibiscus **2. Chemistry of Perfumes** Definition of Perfume. Formulation of Perfume. Sense of perfume smell-Top notes, middle notes and base notes. Classification of perfumes: Traditional and Modern. Fragrance Wheel. Comparison between deodorant and antiperspirant. Triclosan as antibacterial agent-Structure. Benefits and adverse effects of perfumes. Natural and artificial flavours with examples. Essential oils and the importance in cosmetic industries with reference to peppermint oil-Menthol, clove Oil-Eugenol, lemongrass-Geraniol, Structure, synthesis and use of 2-phenyl ethyl alcohol, Sources, Structure and uses of Jasmone, Civetone, Muscone. Methods of separation of essential oils (steam, water and vacuum distillation), solvent extraction, mechanical expression.	08 07
	Total:	15
Pedagogy	Mainly lectures and tutorials. Seminars / term papers / assignments / presentations / industry visits / mini projects / self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.	
References / Readings	1. Harry's Cosmeticology- Wilkinson, J. B., Harry, Ralph G. **H**ill Books, Leonard, 1973 2. Cosmetics science and Technology, Edward Sagarin, Inter Science Publications, 1957. 3. De Navaree, The Chemistry and Manufacture of Cosmetics- vol. 1 to 4 (Von. Nostrand) 1962. 4. Modern Cosmetics. Edgar George Thomssen, Francis Chilson (Universal Publishing). 1964 5. Formulation and Function of Cosmetics. Jellinek. S, Wiley Blackwell, 1971. 6. Cosmetic & Skin. F.V. Wells and I. Lubowe, Reinhold Publications, 1964. 7. Cosmetics- Formulation, manufacturing and Quality Control, P. P. Sharma, 5th Edition, 2014.	

	8. The Principles and Practice of Modern Cosmetics: Cosmetic materials, their origin, characteristics, uses and dermatological action, Ralph Gordon Harry, Chemical Publishing Company, 1963. 9. Drug and Cosmetics Act 1940 10. Vimaladevi M. Textbook of herbal cosmetics, CBS Publishing 1st Ed. 2015. 11. H. Panda, The complete technology book on herbal beauty products with formulation and processes, Asia pacific business press Inc. 2005. 12. John Gordon, Essential oils: A practical guide, Aetheric publishing. 2017 13. Ernst T. Theimer, Fragrance Chemistry: The Science of the Sense of Smell, Academic Press, 1982. 14. Berger, Ralf Günter, Flavors and Fragrances**:** chemistry, bioprocessing and sustainability (ed.), 1st edition. 2007. 15. K. Husnu Can Baser, Gerhard Buchbauer, Handbook of Essential Oils: Science, Technology, and Applications, Second Edition, CRC Press, 2015. 16. Olindo Secondini, Handbook of Perfumes and Flavors, 1990.
Course Outcome:	At the end of the course students will be able to 1. Define cosmetics as per EU and Indian guidelines. 2. Describe the preparation and uses of various cosmetic products mentioned. 3. Describe the formulation and packaging of cosmetics for hair - Shampoo and hair dye. 4. Classify herbal cosmetics. 5. Explain the terms herbal medicine and herbal medicinal products. 6. Describe the preparation of herbal drug. 7. Describe the formulation and preparation of Herbal cosmetics for skin care and hair care. 8. Classify the perfumes and categorize the perfume ingredients. 9. Explain the importance of essential oil in cosmetic industries. 10. Describe the composition of different volatile oils and methods of obtaining them.

Laboratory Course
Number of Credits: 02

Pre-requisites	Nil	
Course Objective:	● To translate certain theoretical concepts learnt earlier into experimental knowledge by providing hands on experience of basic laboratory techniques required for Cosmeticology and perfume chemistry. ● To understand the concept of cosmetics and develop formulation skills in the preparation of various cosmetic products.	
Content		**No of hours**
	1. Preparation of cosmetic products. (Any 8) Explain in brief about cosmetic ingredients Talcum powder, face powder, Shampoo, hair dye, Cold cream, Vanishing cream, Nail polish, nail polish remover, Shaving cream, Toothpaste, Lipsticks, eyeliner. 2. Preparation of Herbal cosmetics and its evaluation. (Any 4) Turmeric face pack, Papaya face pack, Henna hair dye, Herbal lotion, Herbal soap, Herbal shampoo 3. Extraction of essential oils as perfumery and identification of compound. (Any 5) a) Steam distillation of cinnamon sticks to cinnamon oil and identification of Cinnamaldehyde. b) Steam distillation of cloves to clove oil and identification of Eugenol. c) Water distillation of lemon peel/Orange peel to give D-Limonene. d) Extraction of banana oil from bananas (Esters as perfumery). e) Extraction of rose oil f) Extraction of citronella oil from lemongrass plant. g) Extraction of caffeine from tea. h) Extraction of jasmine oil from Jasmine flowers and identification of jasmone.	(8 x 3) = 24 (4 x 4)= 16 (5 x 4) = 20
	Total:	60
Pedagogy:	Students should be given suitable pre- and post-lab assignments and explanation revising the theoretical aspects of laboratory experiments prior to the conduct of each experiment.	
References / Readings	1. A.I. Vogel, A., R. Tatchell, B. S. Furniss, A.J. Hannaford, Vogel's *Textbook of Practical Organic Chemistry*, 5th Ed., Prentice Hall; 2011. 2. Belinda Carli, *Cosmetic Formulations: A beginners Guide*, 7th Edn, 2020. 3. Andre O. Barel Marc Paye Howard I. Maibach, *Handbook of Cosmetic Science and Technology*-Third and fourth Edition, 2009. 4. ProFound Klaus Duerbeck, *Natural Ingredients for Cosmetics*, 2005.	
Course outcomes	At the end of the course students will be able to: 1. Understand the concepts of various cosmetic products. 2. Prepare various cosmetic products. 3. Prepare various herbal cosmetic products. 4. Extract naturally flavoured compounds/essential oils.	

गोंय विद्यापीठ
ताळगांव पठार
गोंय - ४०३ २०६
फोन: +९१-८६६९६०९०४८

Goa University
Taleigao Plateau, Goa - 403 206
Tel : +91-8669609048
Email : registrar@unigoa.ac.in
Website: www.unigoa.ac.in

(Accredited by NAAC)

GU/Acad –PG/BoS -NEP/2023/102/8 Date:15.06.2023

CIRCULAR

The University has decided to implement the UGC Curriculum and Credit Framework for the Undergraduate Programme (CCFUP) of **Bachelor of Science in Microbiology/Bachelor of Science in Microbiology (Honours)** under the National Education Policy (NEP) 2020 from the Academic Year 2023-2024 onwards.

The approved Syllabus of Semesters I and II of the **Bachelor of Science in Microbiology/Bachelor of Science in Microbiology (Honours)** Programme is attached.

Principals of Affiliated Colleges offering the **Bachelor of Science in Microbiology/Bachelor of Science in Microbiology (Honours)** Programme are requested to take note of the above and bring the contents of this Circular to the notice of all concerned.

(Ashwin Lawande)
Assistant Registrar – Academic-PG

To,

1. The Principals of Affiliated Colleges offering the Bachelor of Science in Microbiology /Bachelor of Science in Microbiology (Honours) Programme.

Copy to:

1. The Director, Directorate of Higher Education, Govt. of Goa
2. The Dean, School of Biological Sciences and Biotechnology, Goa University.
3. The Vice-Deans, School of Biological Sciences and Biotechnology, Goa University.
4. The Chairperson, BoS in Microbiology.
5. The Controller of Examinations, Goa University.
6. The Assistant Registrar, UG Examinations, Goa University.
7. Directorate of Internal Quality Assurance, Goa University for uploading the Syllabus on the University website.

Goa University Programme Structure for Semester I to VIII Bachelor of Science in Microbiology										
Semester	**Major -Core**	**Minor**	**MC**	**AEC**	**SEC**	**I**	**D**	**VAC**	**Total Credits**	**Exit**
I	**MIC-100 Basics of Microbiology (4)(3T+1P)**	**MIC-111 Microbial Ecology and Environment (4)**	**MIC-131 Introduction to Microbial World (3)**		**MIC-141 Techniques in Microbiology - Staining and Microscopy (3) (1T+2P)**				**20**	**--**
II			**MIC-132 Microbiology in Everyday Life (3)**		**MIC-142 Techniques in Microbiology: Microbial Cultivation and Enumeration (3) (1T+2P)**				**20**	**MIC-161 Laboratory Skills in Microbiology (4)**
III	**MIC-200 Microbial Biochemistry (4)** **MIC 201 Molecular Biology (4)**	**MIC-211 Environmental Microbiology (4)**	**MIC-231 Scope of Microbiology (3)**		**MIC-241 Dairy Microbiology (3) (1T+2P)**				**20**	**--**
IV	**MIC-202 Cell Biology (4)** **MIC-203 Microbial Physiology (4)** **MIC-204 Microbial Genetics (4)** **MIC-205 Basic Biostatistics (2)**	**MIC-221 Instrumentation in Microbiology (4)**							**20**	**MIC-162 Quality control and assurance in microbial processes and products (4)**

V	MIC-300 Industrial Microbiology (4) MIC-301 Virology (4) MIC-302 Mycology and Protista (4) MIC-303 Introduction to Bioinformatics (2)	MIC-321 Medical Microbiology (4)				MIC-361 Internship (2)			20	
VI	MIC-304 Agricultural Microbiology (4) MIC-305 Immunology (4) MIC-306 Taxonomy and Systematics of Prokaryotes (4) MIC- 307 Project (4)	MIC- 322 Food Microbiology (4)							20	
VII*	MIC-400 Research Methodology (4) MIC-401 Haematology and Clinical Biochemistry (4) MIC-402 Genetic Engineering (4) MIC-403 Microbial Fermentation (4)	MIC-411 Waste Management and Bioremediation (4)							20	

	MIC-404 Extremophiles (4)									
VIII	**MIC-405 Pharmaceutical Microbiology (4)** **MIC-406 Epidemiology and emerging Diseases (4)** **MIC-407 Bioethics and IPR in Microbiology (4)** **MIC-408 Marine Microbiology (4)**	**MIC-412 Nanotechnology (4)**					**MIC-461 Dissertation (12)**		**20**	

*** Students opting for Honours with Research shall have to undergo, MIC-400 Research Methodology (4) Course in Sem VII and along with any three other Major Courses. Students opting for Honours shall have to enroll for Major Courses MIC-401, MIC-402, MIC-403 and MIC-404 in Semester VII.**

Name of the Programme: Bachelor of Science in Microbiology
Course Code: MIC-100 (Major course)
Title of the Course: BASICS OF MICROBIOLOGY
Number of Credits: Theory - 3, Practical - 1
Effective from Academic Year: 2023-24

Prerequisites	NIL	
Objectives	To acquaint students with basic concepts in microbiology – history, microbial diversity, microbial growth and its control	
Content		
1	**Unit - 1**	**(15)**
A	**Introduction and history of microbiology:** Historical developments in microbiology, Development of microbiology as a discipline, Spontaneous generation v/s biogenesis, Contributions of Leeuwenhoek, Pasteur, Koch, Lister, Fleming, Lister, Fleming, development of various microbiological techniques and the golden era of microbiology, Role of microorganisms in fermentation, Germ theory of disease, Development of the field of Soil microbiology, Contributions of Beijerinck, Winogradsky, Waksman, Establishment of fields of Medical Microbiology and Immunology through the work of Ehrlich, Metchnikoff, Jenner.	8
B	**Microbial Diversity and classification:** Discovery and General characteristics (Occurrence, mode of nutrition, morphology, reproduction) of different groups of microorganisms, Acellular : viruses, viroids, prions - definitions and examples Cellular: Prokarya (Archaea, Eubacteria), Eukarya (Algae, fungi, protozoa) Systems of classification: Binomial nomenclature, Classification schemes such as (Linnaeus, Haeckel, Whittaker and Woese)	7
2	**Unit – 2**	**(15)**
A	**Prokaryotic cell structure and function:** Structure of prokaryotic cell (archae and eubacteria), Cell size, shape and arrangement, Components of the cell: Glycocalyx, slime, capsule, flagella, endoflagella, fimbriae and pili; Cell-wall: Composition and detailed structure of Gram-positive and Gram-negative cell walls, lipopolysaccharide (LPS), Spheroplasts, protoplasts, L forms, Cell Membrane: Structure, function and chemical composition of bacterial cellular membrane, Differences in the cell wall and cell membrane of archaea, Cytoplasmic inclusions: Endospore, Reserve materials (glycogen granules, lipid granules, PHA, PHB, volutin and sulphur granules), Other inclusions: metachromatic granules, carboxysomes, gas vacuoles, magnetosomes	8
B	**Eukaryotic cell structure and function:** Comparison in cell structure of yeast and fungi, Comparison between plant and animal cells, Cell wall; Plasma membrane; Modification of plasma membrane and intracellular junctions; Cytoskeleton, Protoplasm Eukaryotic cell organelles: nucleus, endoplasmic reticulum, golgi apparatus and protein sorting and transport, mitochondria, chloroplast, Ribosome; Centriole, lysosomes, peroxisomes, endosome and microbodies	7
3	**Unit 3**	**(15)**
C	**Microbial cultivation, isolation, pure culture and preservation:** Microbial Cultivation (aerobes and anaerobic bacteria), General principles of preservation, Aerobes: enrichment, streaking, serial dilution and plating	8

	methods (surface spreading, pour plate), Anaerobes: modified media (thioglycolate, Robertson's cooked meat media), modified techniques (pour plate, roll tube technique, overlay with paraffin oil), modified glassware and instruments (Brewers plate, spray plate, candle jar, Brewers jar, Gas Pak Anaerobic Jar), Methods of preservation of pure cultures, Preservation of cultures in continuous metabolic state: period transfer, overlaying with mineral oil, storage in sterile soil, Preservation of cultures in suspended metabolic state: storage in silica gel, drying in vacuum, lyophilization, cryopreservation, Culture collection centres / culture banks and their role	
B	**Microbial growth control: principle and applications:** Definition of important terms: disinfection, sterilization, antiseptic, sanitizer, germicide. Physical methods of microbial control: Heat: dry heat (incineration, hot air oven), moist heat and pressure (autoclave) moist heat (pasteurisation), low temperature (freezing, refrigeration), filtration (depth filters, membrane filters, HEPA filters), desiccation, osmotic pressure (concept of hypotonicity, hypertonicity, isotonicity, mode of lysis - plasmolysis, plasmoptysis, surface tension (CTAB, SDS), ultrasonic waves (sonicator), radiation (non-ianising – UV, ionising –gamma Xrays) Chemical methods of microbial control: heavy metal (mercury), Halogens (chlorine), Alcohols (ethanol), Phenols (triclosan), Quaternary ammonium compounds, Aldehydes (glutaraldehyde), Dyes (gentian violet), Sterilizing gases (ethylene oxide)	**7**
4	**Unit - 4 - Practical**	**(30)**
1.	Microbiology Good Laboratory Practices (GLP) and Biosafety.	2
2.	Study of morphological characteristics of protozoans, fungi, and algae using permanent slides.	2
3.	Monochrome staining, Negative staining, Gram's staining, Lactophenol-cotton blue staining	4
4.	Staining of intracellular structure: endospore, metachromatic granules.	4
5.	Preparation of culture media for bacterial cultivation; synthetic media, complex media, Nutrient agar, MacConkey agar.	2
6.	Isolation of pure cultures of bacteria by streaking method.	4
7.	Determination of viable count by spread plate method and pour plate method.	4
8.	Sterilization using physical methods: dry heat (hot air oven), moist heat (autoclaving)	2
9.	Testing the efficacy of sterilization using chemical methods: Determination of phenol coefficient.	2
10.	Study of the structure of cell organelles through electron micrographs.	2
11.	Preservation of cultures by periodic transfer and overlaying with mineral oil.	2
Pedagogy:	Lectures/tutorials/assignments/Demonstration	
References/ Reading	Atlas RM, Principles of Microbiology. WM.T.Brown Publishers. (1997) Cappucino J and Sherman N, Microbiology: A Laboratory Manual. Pearson Education Limited. (2013) Cooper GM and Hausman RE, The Cell: A Molecular Approach. ASM Press and Sunderland, Washington, D.C.,Sinauer Associates, MA. (2013) Madigan MT, Martinko JM, Dunlap PV and Clark DP, Brock Biology of Microorganisms. Pearson International Edition. (2009)	

	Modi HA, Elementary Microbiology Vol I, Fundamentals of Microbiology. (2019) Pelczar MJ, Chan ECS and Krieg NR, Microbiology. McGraw Hill Book Company. (2002) Salle AJ, Fundamental Principles of Bacteriology. Tata McGraw-Hill Education. (1961) Schlegel HG, General Microbiology. Cambridge , University Press. (1993) Stanier RY, Ingraham JL, Wheelis ML, and Painter PR, General Microbiology. McMillan. (1992) Talaro KP, Foundation in Microbiology, McGraw-Hill Education. (2020) Tortora GJ, Funke BR and Case CL, Microbiology: An Introduction. Pearson Education. (2019) Wiley JM, Sherwood LM and Woolverton CJ, Prescott's Microbiology. McGrawHill International (2009)	
Course outcome	◆ Understand different types of microorganisms and apply the knowledge of different classification systems for grouping microorganism. ◆ Explain the cellular organisation of prokaryotic and eukaryotic cells. ◆ Apply the techniques for obtaining and preserving pure cultures of bacteria. ◆ Elaborate on physical and chemical methods of microbial control.	

Name of the Programme: Bachelor of Science in Microbiology
Course Code: MIC-141 (Skills enhancement Course)
Title of the Course: Techniques in Microbiology - Staining and Microscopy
Number of Credits: Theory - 1 , Practical - 2
Effective From AY: 2023-24

Prerequisites:	NIL	
Course Objectives:	To impart foundational microbiology laboratory techniques. To impart training in handling of light microscope. To recognize and describe bacterial cell morphology and cellular structure based on different staining techniques	
Content	**Theory (1 Credit)**	
1	**UNIT 1 - Principles of Staining and Microscopy:**	**(15)**
1.1	**Stains:** Principle of staining, Chromophore and Auxochrome groups, Different types of dyes: Acidic, Neutral, and Basic, Water and Fat soluble, Leuco, Fluorescent, and Compound dyes, Dyes used in selective media, and as pH indicators. Different methods of fixation, Fixatives, Mordants, Decolourisers. Types of staining techniques: Simple staining, Differential staining, and Specialized staining.	**7**
1.2	**Microscopy:** Parts of a light microscope; Lens systems: Condenser, Objective, and Occular; Magnification; Resolution. Use of microscope for determination of motility, and size of cells (Micrometry). Principle, working, and applications of: Bright field, Dark field, Phase contrast, Epifluorescence, Confocal, Electron Microscopy.	**8**
	Practical (2 Credits)	
2	**UNIT -2 Simple Staining Techniques**	**(30)**
2.1	1. Preparation of cell suspension aseptically, preparation and fixation of smears. 2. Monochrome staining using basic and acidic dyes (Negative staining).	5
2.2	Differential staining: 3. Gram staining method. 4. Acid-fast staining method.	5
2.3	Staining of cellular structures: 5. Capsule staining using Maneval's method. 6. Flagella staining using Leifson's method. 7. Cell wall staining using Chance's method. 8. Cell wall staining using Dayr's method. 9. Metachromatic granules staining Albert's method. 10. Lipid granules staining using Sudan Black B stain. 11. DNA staining using Feulgen method. 12. Endospore staining using Shaeffer and Fulton's method.	20
3	**UNIT - 3 Specialized Staining Techniques**	**(30)**
3.1	Staining of different types of cells 1. Spirochaetes staining 2. Lactophenol cotton blue staining of fungi. 3. Malarial parasite staining by Giemsa's method. 4. Staining of bacterial/algal cells using the fluorescent stains (DAPI and Acridine orange). 5. Blood staining using Leishman's and Geimsa's method.	16
3.2	Electron Microscopy	08

	6. Sample preparation for Scanning Electron Microscopy. 7. Study of microorganisms using Scanning Electron micrographs. 8. Transmission Electron Micrographs.	
3.3	9. Measurement of cell size using Micrometry. 10. Motility of cells using Hanging drop technique. 11. Preparation of permanent slides.	06
Pedagogy	Lectures/Practicals/Field Trips	
References/ Reading:	Cappuccino, J.G. and Sherman, N. Microbiology: A Laboratory Manual. Pearson Education Limited, London. (2013) Gerhardt, P., R. G. E. Murray, R. N. Costilow, E. W. Nester, W. A. Wood, N. R. Krieg, and G. B. Phillips. Manual of methods for general microbiology. ASM Press, Washington, DC. (1981). Gerhardt, P., R. G. E. Murray, W. A. Wood, and N. R. Krieg. Methods for general and molecular bacteriology. ASM Press, Washington, DC. (1994). Leboffe, M. J., and B. E. Pierce. Microbiology: laboratory theory and applications. Morton Publishing Company, Englewood, CO. (2002). Nelson D.L. and Cox M.M. Lehninger Principles of Biochemistry, W.H. Freeman and Company. (2022) Norris J. R., Ribbons D. W. Wiley M.J., Methods in Microbiology. Volume 1. (1969) Sherwood L.M. and Woolverton C.J. Prescott, Harley and Klein's Microbiology, McGraw Hill. (2022 Wilson K. and Walker J. Principles and Techniques of Biochemistry and Molecular Biology. Cambridge University Press. (2018)	
Course Outcomes:	◆ Perform staining and microscopy. ◆ Operate different types of microscopes. ◆ Observe various types of cells and cellular structures using different microscopes. ◆ Analyse and interpret results of a range of staining techniques.	

Name of the Programme: Bachelor of Science in Microbiology
Course Code: MIC- 142 (Skills enhancement course)
Title of the Course: Techniques in Microbiology - Microbial Cultivation and Enumeration
Number of Credits: Theory - 1, Practical - 2
Effective From AY: 2023-24

Prerequisites:	NIL	
Course Objectives:	To equip the students with the skills and techniques required for the cultivation and enumeration of microorganisms	
Content	**Theory (1 Credit)**	
1	**UNIT - 1 Microbial cultivation and enumeration**	**(15)**
1.1	Composition and ingredients of media, Preparation and storage of media, Types of Media: Natural and synthetic, complex and chemically defined media, selective media, differential media, enriched and enrichment media, transport media. Measurement of pH, Buffers and buffering capacity. Sterilization of media using physical Methods: Heat (Autoclave, Pasteurization, Tyndallization), Filtration (Diatomaceous earth filters, membrane filters)	08
1.2	Direct and indirect methods of enumerations, Petroff-Hausser Counting Chamber, Membrane filtration technique, Flow cytometry, Coulter counters, Use of fluorescent dyes to determine viability	07
	Practical (2 Credits)	
2	**UNIT - 2 Techniques for cultivation of microorganisms**	**30**
2.1	Growth media, and inoculation 1. Preparation of Growth Media (solid and liquid): Complex and Synthetic, Differential, Selective, and Enriched 2. Study of aseptic techniques: plugging, transfer or pouring of media, preparation of slants and butts and inoculum 3. Isolation of bacteria from environmental samples (soil, water, food, etc.) 3.a. Sample collection and processing 3.b. Enrichment of cultures 3.c. Serial dilution technique 3.d. Pour plate and spread plate techniques 3.e. Streak Plate techniques: Parallel line, T-streak, Continuous, Radial, and Quadrant 3.f. Study of colony characteristics 4. Storage and maintenance of cultures	10
2.2	Cultivation of different types of microorganisms 1. Cultivation of microaerophilic bacteria 2. Cultivation of anaerobic bacteria using anaerobic jar 3. Cultivation of yeast and fungi 4. Cultivation of cyanobacteria 5. Cultivation of viruses/ bacteriophages	12
2.3	Growth curve of bacteria 1. Study of growth curve of bacteria (E. coli) by turbidimetric 2. Study of growth curve of bacteria (E. coli) by plate count method. 3. Calculation of generation time, and specific growth rate of bacteria.	08
3	**UNIT - 3 Enumeration of Microorganisms**	**30**
3.1	Direct microscopic methods of enumeration using	08

	1. Breed's smear 2. Membrane filtration technique 3. Petroff-Hausser counting chamber	
3.2	Indirect methods of enumeration 1. Measurement of optical density and turbidity 2. Standard Plate Count or Viable Count Technique 3. Most Probable Number 4. Measurement of cell mass (dry weight) 5. Chlorophyll determinations to measure phototrophic protist and cyanobacterial populations 6. Plaque assay for enumeration of viruses	22
Pedagogy	Lectures/Practicals in laboratory/Field Trips	
References/ Reading:	Cappuccino, J.G. and Sherman, N. Microbiology: A Laboratory Manual. Pearson Education Limited, London. (2013) Gerhardt, P., R. G. E. Murray, R. N. Costilow, E. W. Nester, W. A. Wood, N. R. Krieg, and G. B. Phillips. Manual of methods for general microbiology. ASM Press, Washington, DC. (1981). Gerhardt, P., R. G. E. Murray, W. A. Wood, and N. R. Krieg. Methods for general and molecular bacteriology. ASM Press, Washington, DC. (1994). Leboffe, M. J., and B. E. Pierce. Microbiology: laboratory theory and applications. Morton Publishing Company, Englewood, CO. (2002). Nelson D.L. and Cox M.M. Lehninger Principles of Biochemistry, W.H. Freeman and Company. (2022) Norris J. R., Ribbons D. W. Wiley M.J., Methods in Microbiology. Volume 1. (1969) Willey JM, Sherwood LM, and Woolverton CJ. Prescott's Microbiology. McGraw Hill Higher Education. (2022) Wilson K. and Walker J. Principles and Techniques of Biochemistry and Molecular Biology. Cambridge University Press. (2018)	
Course Outcomes:	◆ Demonstrate key concepts of microbial growth, cultivation, and enumeration ◆ Collect and process sample for microbial analysis. ◆ Prepare media for the cultivation of different types of microorganisms ◆ Process and analyze the samples for microbial detection and enumeration	

गोंय विद्यापीठ
ताळगांव पठार
गोंय - ४०३ २०६
फोन: +९१-८६६९६०९०४८

Goa University
Taleigao Plateau, Goa - 403 206
Tel : +91-8669609048
Email : registrar@unigoa.ac.in
Website: www.unigoa.ac.in

(Accredited by NAAC)

GU/Acad –PG/BoS -NEP/2023/102/7 Date: 16.06.2023

CIRCULAR

The University has decided to implement the UGC Curriculum and Credit Framework for the Undergraduate Programme (CCFUP) of **Bachelor of Science in Botany/Bachelor of Science in Botany (Honours)** under the National Education Policy (NEP) 2020 from the Academic Year 2023-2024 onwards.

The approved Syllabus of Semesters I and II of the **Bachelor of Science in Botany/Bachelor of Science in Botany (Honours)** Programme is attached.

Principals of Affiliated Colleges offering the **Bachelor of Science in Botany/Bachelor of Science in Botany (Honours)** Programme are requested to take note of the above and bring the contents of this Circular to the notice of all concerned.

(Ashwin Lawande)
Assistant Registrar – Academic-PG

To,

1. The Principals of Affiliated Colleges offering the Bachelor of Science in Botany /Bachelor of Science in Botany (Honours) Programme.

Copy to:

1. The Director, Directorate of Higher Education, Govt. of Goa.
2. The Dean, School of Biological Sciences and Biotechnology, Goa University.
3. The Vice-Deans, School of Biological Sciences and Biotechnology, Goa University.
4. The Chairperson, BOS in Botany.
5. The Controller of Examinations, Goa University.
6. The Assistant Registrar, UG Examinations, Goa University.
7. Directorate of Internal Quality Assurance, Goa University for uploading the Syllabus on the University website

Goa University
Programme Structure for Semester I to VIII Bachelor of Science in Botany

Semester	Major -Core	Minor	MC	AEC	SEC	I	D	VAC	Total Credits	Exit
I	BOT-100 Fundamentals of Botany (3T+1P)	BOT-111 Plants in Everyday Life (4)	BOT-131 Kitchen Gardening (3)		BOT-141 Nursery and Gardening (1T+2P)					
II			BOT-132 Ecosystem Diversity (3)		BOT-142 Fruits and Vegetable Processing (1T+2P)					BOT-161 Floriculture (1+3)
III	BOT-201 Diversity of Microbes and Nonflowering plants (3+1) BOT-202 Cell Biology and Biomolecules (3+1)	BOT-211 Algal Resources and Its Utilization (3+1)	BOT-231 Plant Propagation Methods (3)		BOT-241 Herbal Technology (1T+2P)					

IV	BOT-203 Diversity of Flowering plants (3+1) BOT-204 Plant Anatomy and Embryology (3+1) BOT-205 Plant ecology and phytogeography (3+1) BOT-206 Biofertilizers (1+1)	BOT-221 Mushroom Cultivation (4) [VET]							20	BOT-261 Organic farming (1+3)
V	BOT-300 Plant taxonomy and phylogeny (3+1) BOT-301 Cytogenetics & Plant breeding (3+1) BOT-302 Plant physiology (3+1) BOT-303 Plant tissue culture (1+1)	BOT-321 Applied Botany and Entrepreneurship (4) [VET]				BOT-361 Internship-2			20	
VI	BOT-304 Plant biochemistry (3+1)	BOT-322 Environmental							20	

	BOT-305 Microbiology and plant pathology (3+1) **BOT-306 Molecular biology & Genetic engineering (3+1)** **BOT-307 Minor Project (4)**	**Pollution and Management (4) [VET]**								
VII	**BOT-400 Agricultural techniques & disease management (3+1)** **BOT-401 Instrumentation Techniques (4)** **BOT-402 Research methodology (4)** **BOT-403 Biostatistics & Mathematical Biology (3+1)**	**BOT-411 Seed Technology (3+1)**							**20**	

VIII	**BOT-404 Clinical Botany (3+1)** **BOT-405 Bioinformatics and Computational Biology (3+1)** **BOT-406 Algal and Fungal Technology (3+1)** **BOT-407 Phytochemistry and Pharmacognosy (3+1)**	**BOT-412 Plants Towards Sustainable Future (3+1)**				**#BOT-462 Project - (12)**			**20**	

Major [Disciplinary/Interdisciplinary Major (Core)]; Minor (Disciplinary/Interdisciplinary Minors); MC (Multidisciplinary Courses); VET (Vocational Education and Training); AEC (Ability Enhancement Courses); I/D (Internship/Apprenticeship/Dissertation); VAC (Value Added Courses).

#Honors with research programme students shall opt any 4 credits course from BOT-405 to BOT-408.

Name of the Programme: B. Sc (Botany)
Course Code: BOT-111
Title of the Course: Plants in Everyday Life
Number of Credits: 4
Effective from AY: 2023-24

Prerequisites for the course:	Nil	
Course Objective(s):	This course is designed to give an overview of how plants are indispensable to humans. It gives a broad exposure to the various aspects of plant resource & its utilization.	
Content:	**Module 1: Plant services to humans in everyday life** Introduction to science of Botany, plant resources in everyday life. **Role of plants:** Air purifier (photosynthesis); plants used in rituals/festivals; Pollution removal (phytoremediation and its types), pollution indicator (lichens), and nutrient source (litter manure, organic manure). Familiarizing the students to identify plants based on morphology of plant parts. Identify common wild plants using live plants/ herbarium/photographs etc.	**2 hours** **4 hours** **4 hours**
	Common wild plants and their utilization: Identification and utilization of following plants: Hirda (*Terminalia chebula*), Behda (*Terminalia bellirica*), Matti (*Terminalia elliptica*), Kinal (*Terminalia paniculata*), Savar (*Ceiba pentandra*), Kate-savar (*Bombax ceiba*), Bhillo mad (*Caryota urens*), Arjun/Pandruk (*Sterculia foetida*), Kumyo (*Careya arborea*), Asale (*Microcos paniculata*), Charan (*Buchanania cochinchinensis*), Chunna (*Ziziphus rugosa)* and Kanna (*Carissa carandas*). **Grandma's herbal pouch**: Following plants to be studied with respect to botanical source, part of the plant used, and medicinal uses: Tulsi (*Ocimum sanctum*), Adulsa (*Adhatoda vasica*), Ale (*Zingiber officinale*), Halad (*Curcuma longa*), Kate kuvar (*Aloe vera*), Kirayte (*Andrographis paniculata*), Ganjan (*Cymbopogon citratus*), Ottalao (*Coleus aromaticus*), Vaikhand (*Acorus calamus*), Punarnava (*Boerhaavia diffusa*), Paripat (*Oldenlandia corymbosa*) and Gulvel (*Tinospora cordifolia*).	**2 hours** **3 hours**
	Module 2: Plant resources and utilization-I (including brief description of plants and/or plant parts used). a. **Cereals**: Rice, Wheat, Maize b. **Millets:** Ragi, Jowar and Bajra c. **Legumes**: Bengal gram, Green gram, Red gram, Black gram and Cowpea. d. **Cash crops:** Cashew, Sugarcane and Cocoa. e. **Plantation crops:** Coconut, Banana, Mango and Jackfruit. f. **Edible oils:** Groundnut, Coconut, Soyabean and Palm Oil. g. **Starch and tuber crops:** Potato, Sweet potato and Yam	 **2 hours** **2 hours** **2 hours** **2 hours** **3 hours** **2 hours** **1 hour**

	h. **Vegetable crops**: Red amaranth, Radish, Lady's finger, Teren, Kudduki, Ankur and Taikhilo.	**1 hour**
	Module 3: Plant resources and utilization-II (including brief description of plant and/or plant parts used). a. **Spices:** Chillies, Nutmeg, Clove, Black pepper, Cardamom, Star anise (Chakriful) and Dagad phul (*Parmotrema perlatum*). b. **Beverages:** Tea and Coffee (including processing). c. **Eco-friendly use of plant parts**: Banana fresh leaves, Arecanut spathe, Kumyo leaves (*Carea arborea*), Jackfruit leaves and Bamboo culm. d. **Oils:** Eucalyptus, Rose and Orange peel (including methods of extraction) e. **Fibres:** Coir, Cotton, Jute, Banana and Sisal Including method of separation of spathe, drying and storing of fibre of banana and; Collection, drying, processing and extraction of fibre from *Agave* leaf (demonstration/video) f. **Timber:** Teak (Sailo), Rose wood (Shisham), Matti and Bamboo. g. **Rubber:** *Hevea brasiliensis* (including demonstration of rubber extraction process)	 **2 hours** **2 hours** **2 hours** **4 hours** **2 hours** **1 hour**
	Module 4: Utilization of plants in value added products **Herbal based hair dyes:** Role of ingredients used in formulation; preparation of herbal dyes; application of hair dye; evaluation and uses of hair dye (Henna, Bhringaraj, Hibiscus, Amla). Including demonstration on preparation of herbal hair dye and evaluation/testing on hair wig. **Herbal cosmetics and aromatics:** Introduction and scope, Extraction Methods-Maceration, infusion, decoction, distillation and tinctures, Types of herbal preparations. Plants used in cleansers (Neem, Cucumber, Rose), scrubs (Marigold, Neem), wash (Rose –face wash, hibiscus & amla- hair wash & oil), packs (Neem, Tulsi, Sandalwood, Turmeric) and creams (Rose, Jasmin, Marigold). Extraction of essential oil from lemon grass / orange peel or citrus fruit peel. Preparation of Henna powder from Henna leaves and Aloe gel from *Aloe vera*. Preparation of plant based holi colours. **Paper making from plants:** Paper industry and paper manufacturing; Raw materials, Processing and kinds of paper, paper Industry in India. Method of making of handmade paper with demonstration/video. Demonstration on preparation of herbal formulation/herbal tea. Field visit in the campus to identify the plants of economic importance and report preparation.	**3 hours** **3 hours** **2 hours** **1 hour** **3 hours** **1 hour** **1 hour** **1 hour**
Pedagogy:	Lectures/ Tutorials/Assignments/Presentation / Demonstration/Field visit/Team based learning.	

References/ Readings:	**Billings S and Collingwood S** (2013). The Big book of home remedies. Lulu.com publisher. **Buckley, C** (2020). Plant Magic: Herbalism in Real Life. Roost Books Publishers, New York. **Chrispeels, MJ and Sadava, DE** (1994). Plants, Genes and Agriculture. Jones & Bartlett Publishers. **Fuller, KW and Gallon, JA** (1985). Plant Products and New Technology. Clarendon Press, Oxford, New York. **Hill, AF** (1952)**.** Economic Botany: A Textbook of Useful Plants and Plant Products. McGraw Hill Publishing Company Ltd., New Delhi. **Kochhar, SL** (2012). Economic Botany in the Tropics. MacMillan India Ltd., New Delhi. **Purohit, SS and Vyas, SP** (2008). Medicinal Plant Cultivation: A Scientific Approach. Agrobios, India. **Rao, RS** (1985-1986). Flora of Goa, Diu, Daman & Nagar-Haveli. 2 Volumes. Botanical Survey of India. **Shailesh, R** (2019). Everyday Ayurveda: The complete book of Ayurvedic home remedies. Notion Press, India. **Sambamurty AVSS and Subramanyam NS** (1989). A Textbook of Economic Botany. Wiley Eastern Ltd., New Delhi. **Sen, S (**2009). Economic Botany. NCBA Publishers, New Delhi. **Sharma, OP** (1996). Hill's Economic Botany. Tata McGraw Hill Publishing Company Ltd., New Delhi. **Simpson BB and Conner-Ogorzaly M** (1986). Economic Botany - Plants in Our World. McGraw Hill, New York. **Singh V, Pande PC and Jain DK** (2009). A Text Book of Economic Botany. Rastogi Publications, Uttar Pradesh. **Trivedi, PC** (2006). Medicinal Plants: Ethnobotanical Approach. Agrobios, India. **Upadhyay, R** (2023). Botany for B.Sc. students, Economic Botany, Ethnomedicine and phytochemistry/Commercial Botany and phytochemical Analysis. S. Chand and Company Ltd. Publishers, India. **Wickens, GE** (2001). Economic Botany: Principles & Practices. Kluwer Academic Publishers, The Netherlands.	
Course Outcomes:	1. Recall various economically and medicinally important plant species used in day-to-day life. 2. Explain the uses of economically important plants and illustrate the processing of various plant parts. 3. Analyze the utilization of various plant resources in day-to-day life. 4. Apply theoretical knowledge in utilization, and report generation of economical and medicinal plants. Create awareness on conservation of medicinal plants and use of natural plant products as alternatives to synthetic products.	

Name of the Programme: B. Sc (Botany)
Course Code: BOT-141
Title of the Course: Nursery and Gardening
Number of Credits: 3 (1 Theory + 2 Practical)
Effective from AY: 2023-24

Prerequisites for the course:	Should have basic knowledge of Biology.	
Course Objective(s):	This course aims to increase the understanding about the different types of gardens, their features and routine operations in nursery management and gardening. The practical component of this course aims to impart skill in designing a plant nursery, different types gardens, cultivation practices to be followed in operating a plant nursery and garden.	
Content:	**Module 1: Plant nursery, gardens and their management** Definition, objectives and scope of a plant nursery and garden. Plant nursery layout, infrastructure, planning and seasonal activities; marketing challenges. Different types of gardens and their design: indoor garden (gardening in window boxes, tubs, troughs, trays and hanging baskets; vertical garden; terrarium; bonsai) and outdoor garden (landscape, avenue plantation, park, rock garden, water garden, terrace garden and kitchen garden). Features of a garden (fence, hedge, edge, steps, drives and paths; arches, pergolas, lawns, carpet bed, flower bed, shrubbery, border, topiary, plant supports, garden adornments). Preparation of soil, methods of breaking seed dormancy, planting (direct seeding and transplanting), hardening, irrigation, manuring, staking, pinching, pruning and defoliation; management of pests and diseases.	**15 hours**
	Practicals (30P = 30 × 2 hours) 1. Preparation of a layout sketch of a nursery. 2. Preparation of layout sketches of any 2 types of gardens. 3. Familiarization with various tools, implements and plant supports. 4. Identification and description of any 2 plants used for avenues, hedges, flower beds, lawns, ornamental shrubs, rock garden, water garden and indoor garden. 5. Raising of any 2 seedlings in seed trays, preparation of potting mix, transplanting of seedlings in pots and bags; care and maintenance of plants till flowering/maturity. 6. Treatment of seeds of coriander or other suitable seeds to break dormancy and to find germination percentage of treated seeds. 7. Propagation of plants by cutting, layering, budding, grafting, runners, suckers, corms, bulbs, bulbils and tubers. 8. Preparation of a coir stick/coir basket. 9. Preparation of a garden in window boxes, troughs and trays	 **2 hours** **4 hours** **2 hours** **4 hours** **6 hours** **2 hours** **6 hours** **2 hours** **4 hours**

	(any 2). 10. Preparation of a terrarium. 11. Preparation/creation of a vertical garden and its after care. 12. Preparation of potting medium and cultivation of different types of potted plants (foliage, succulent, anthurium and orchid). 13. Demonstration of cultivation of house plants and after care of upright and climbing plants. 14. Cultivation of any 3 vegetables in the College Botanical Garden (red amaranth, cluster beans, cucurbits, chillies, lady's finger, ginger and tomato). 15. Preparation of compost. 16. Field visit to a plant nursery or landscape garden.	**2 hours** **4 hours** **4 hours** **4 hours** **6 hours** **4 hours** **4 hours**
Pedagogy:	Lectures, practical, field visits, participatory learning, seminars, assignments etc.	
References/ Readings:	**Acquaah, G** (2019). Horticulture: Principles and Practices (4th edition). India: Pearson India Education Services Pvt. Ltd. **Agrawal, PK** (1993). Hand Book of Seed Technology. Department of Agriculture and Cooperation, National Seed Corporation Ltd., New Delhi. **Alphonso, N** (2004). Home Gardening. Agriculture Officers' Association, Panaji – Goa. **Bose, TK and Mukherjee, D** (1972). Gardening in India. Oxford & IBH Publishing Co., New Delhi. **Courtier, J and Clarke, G** (1997). Indoor plants: The Essential Guide to Choosing and Caring for Houseplants. Reader's Digest, New York. **Edmond, JB, Musser, AM and Andrews, FS** (1957). Fundamentals of Horticulture. McGraw Hill Book Co., New Delhi. **Janick, J** (1979). Horticultural Science (3rd edition). W.H. Freeman & Co., San Francisco, USA. **Kumar, N** (1997). Introduction to Horticulture. Rajalakshmi Publications, Nagercoil. **Randhawa, GS and Mukhopadhyay, A** (1986). Floriculture in India. Allied Publishers Limited, New Delhi. **Rao, KM** (2005). Textbook of Horticulture (2nd edition). MacMillan India Limited, New Delhi. **Rao, PS** (2016). Vegetable Crops Production. Sonali Publications, New Delhi. **Sandhu, MK** (1989). Plant Propagation. Wiley Eastern Ltd., Bangalore. **Stevenson, V** (1984). Plants and Flowers in the Home. Treasure Press, London. **Trivedi, PP** (1987). Home Gardening. Indian Council of Agricultural Research, New Delhi. **Zingare, AK** (2013). A Manual of Gardening. Satyam Publishers & Distributors, Jaipur.	

Course Outcomes:	On completion of this course students will be able to: 1. Explain the objective and scope of a plant nursery and garden. 2. Describe the different types of gardens and their features. 3. Analyze the different routine operations in nursery management and gardening. 4. Develop skills in designing a plant nursery and different types of gardens, routine operations in gardening and nursery management, cultivation practices for entrepreneurial opportunities.	

Name of the Programme: B. Sc (Botany)
Course Code: BOT-142
Title of the Course: Fruits and Vegetable Processing
Number of Credits: 3 (1 Theory + 2 Practical)
Effective from AY: 2023-24

Prerequisites for the course:	Should have basic knowledge of Biology.	
Course Objective(s):	This course is designed to give an overview of different types of fruits and vegetables, their composition and methods used in processing and preservation. The practical component of this course deals with imparting skills in preparation of various processed products.	
Content:	**Module 1: Fruits and Vegetables: Methods of processing and processed products** Fruits - Definition, types of fruits (fleshy and dry) with examples. Vegetables - Definition, types of vegetables (leafy, stem, root, flower and fruit) with examples. Composition of fruits and vegetables. Maturation and ripening of fruits. Spoilage of fruits and vegetables. Pigmentation in fruits and vegetables. Principles of processing and preservation. Harvesting and pre-processing. Methods of processing: Drying, pickling, fermentation, freezing and dehydration, canning. Scope and importance of processing and preservation.	**15 hours**
	Preparation of the following products: a. **Frozen vegetables -** Carrots (*Daucus carota*), Cauliflower (*Brassica oleracea* var. *botrytis*) and peas (*Pisum sativum*). b. **Dehydrated products** - Potato (*Solanum tuberosum*) chips and garlic (*Allium sativum*) powder. c. **Preparation of pickles from fruits and vegetables** - Bilimbli (*Averrhoa bilimbi)*, karanda (*Carissa carandas*), bitter gourd (*Momordica charantia*) and brinjal *(Solanum melongena)*. d. **Canning of fruits** - Preparation of sugar syrup and canning of jackfruit (*Artocarpus heterophyllus*) and pineapple (*Ananas comosus*). e. **Canning of vegetables** - Preparation of brine and canning of green mango (*Mangifera indica*). f. **Fermentation** - Vinegar and wine. g. **Juices & squashes** - Amla (*Phyllanthus emblica*) juice, kokum (*Garcinia indica*) juice, pineapple (*Ananas comosus*) squash. h. **Jams and Marmalades** - Guava (*Psidium guajava*) jam, orange (*Citrus sinensis*) marmalade. i. **Sauces and Ketchups** - Tomato (*Solanum lycopersicum*), chilli (*Capsicum annuum*) sauce and ketchup.	
	Practicals (30P = 30 × 2 hours)	**4 hours**
	1. Study of fruits (Amla, banana, guava, jackfruit, mango, papaya, pineapple, cashew and kokum) and vegetables (Cucumber,	

	tomato, ash gourd, little gourd, ladyfinger, radish and brinjal), their composition and use in value-added products. 2. Techniques of sterilization and packing. 3. Determination of pH and ascorbic acid content of any C*itrus* fruit. 4. Microscopic observation of yeast (*Saccharomyces cerevisiae*). 5. Preparation of any one type of pickle. 6. Preparation of kokum syrup/lemon/ginger cordial. 7. Preparation of fruit juice and squash. 8. Preparation of tomato puree and tomato ketchup. 9. Preparation of jam and marmalade from suitable fruits. 10. Preparation of tutti fruity from raw papaya. 11. Preparation of raisins.	**2 hours** **2 hours** **2 hours** **2 hours** **2 hours** **4 hours** **4 hours** **6 hours** **4 hours** **2 hours**
	12. Preparation of chutney from fruit and vegetable. 13. Preservation of green peas and carrots by freezing. 14.Preparation of vinegar from toddy or any suitable fruit and assessment of pH. 15. Preparation of papad from jackfruit/breadfruit. 16. Preparation of amla and ginger candy. 17. Preparation of wine from any suitable fruit. 18. Determination of alcohol content of wine by hydrometer method/specific gravity method. 19. Field visit to a distillation unit or a food processing unit.	**4 hours** **2 hours** **4 hours** **2 hours** **2 hours** **6 hours** **2 hours** **4 hours**
Pedagogy:	Lectures, Practicals, Assignment, Presentations, Field visit.	
References/ Readings:	**Ashraf, SM** (2008). Handbook of Fruit and Vegetable products. Agrobios, India. **Cruess, WV** (2004). Commercial Fruit and Vegetable Products. Agrobios, India. **Dubey, RC** (1993). A Textbook of Biotechnology. S. Chand & Company Pvt. Ltd., New Delhi. **Frazier, WC** and **Westhoff, DC** (2008). Food Microbiology. Tata Mc. Graw Hill Education Private Limited, New Delhi. **Lal G**, **Siddappa**, **GS** & **Tandon, GL** (2019). Preservation of fruits & Vegetables. ICAR, New Delhi. **Manay**, **SN** and **Shadaksharaswamy, M** (2008). Foods: Facts and Principles. New Age International, Bengaluru. **Narang, RK** (2010). Fruit and Vegetable Preservation Techniques. APH Publishing Corporation, Delhi. **Potter, NN** and **Hotchkiss, HJ** (1996). Food Science. CBS Publishers & Distributors, New Delhi. **Rahman, MS** (2020). Handbook of food preservation (3rd Edition). CRC-press, United States. **Ranganna, S** (1986). Handbook of analysis and quality control for fruits and vegetable products (2nd Edition). Tata Mc Graw-Hill Publishing Company Limited, New York.	

	Saldanha, E (2010). Successful Goan home wines. Rajhauns Vitaran, Goa. **Srilakshmi, B** (2007). Food Science. New Age International (P) Limited, New Delhi. **Srivastava, RP** and **Kumar, S** (2017). Fruit and Vegetable Preservation- Principles and Practices (3rd edition). CBS publishers and distributors Pvt Ltd., India. **Thompson, AK** (2003). Fruit and Vegetables - Harvesting, Handling and Storage (2nd Edition). Blackwell Publishing Ltd., US. **Verma, LR** and **Joshi, VK** (2000). Post harvest technology of Fruits and vegetables- handling, processing, fermentation, and waste management. Vol I & II, Indus Publishing, New Delhi. **Wolff, IA** (1982). CRC Handbook of Processing and Utilization in Agriculture. CRC series in Agriculture, Vol II, part-I, CRC press, California.	
Course Outcomes:	On completion of this course students will be able to: 1. Recall the types of fruits and vegetables used for processing. 2. Explain the principles of fruits and vegetable processing. 3. Analyse the different methods used in processing of fruits and vegetables. 4. Apply the skills in preparation of various processed products for entrepreneurial opportunity.	

गोंय विद्यापीठ
ताळगांव पठार
गोंय - ४०३ २०६
फोन: +९१-८६६९६०९०४८

Goa University
Taleigao Plateau, Goa - 403 206
Tel : +91-8669609048
Email : registrar@unigoa.ac.in
Website: www.unigoa.ac.in

(Accredited by NAAC)

GU/Acad –PG/BoS -NEP/2023/102/42 Date: 21.06.2023

CIRCULAR

The University has decided to implement the UGC Curriculum and Credit Framework for the Undergraduate Programme (CCFUP) of **Bachelor of Science in Industrial Chemistry/Bachelor of Science in Industrial Chemistry (Honours)** under the National Education Policy (NEP) 2020 from the Academic Year 2023-2024 onwards.

The approved Syllabus of Semesters I and II of the **Bachelor of Science in Industrial Chemistry/Bachelor of Science in Industrial Chemistry (Honours)** Programme is attached.

Principals of Affiliated Colleges offering the **Bachelor of Science in Industrial Chemistry/Bachelor of Science in Industrial Chemistry (Honours)** Programme are requested to take note of the above and bring the contents of this Circular to the notice of all concerned.

(Ashwin Lawande)
Assistant Registrar – Academic-PG

To,

1. The Principals of Affiliated Colleges offering the Bachelor of Science in Industrial Chemistry /Bachelor of Science in Industrial Chemistry (Honours) Programme.

Copy to:

1. The Director, Directorate of Higher Education, Govt. of Goa.
2. The Dean, School of Chemical Sciences, Goa University.
3. The Vice-Deans, School of Chemical Sciences, Goa University.
4. The Chairperson, BOS in Chemistry (UG).
5. The Controller of Examinations, Goa University.
6. The Assistant Registrar, UG Examinations, Goa University.
7. Directorate of Internal Quality Assurance, Goa University for uploading the Syllabus on the University website.

Goa University

Programme Structure for Semester I and II Under Graduate Programme- Industrial Chemistry Double Major										
Semester	**Major -Core**	**Minor**	**MC**	**AEC**	**SEC**	**I**	**D**	**VAC**	**Total Credits**	**Exit**
I	**CHC-100 Fundamentals of Chemistry (4)** **ICD-100 Fundamentals of Industrial Chemistry (4)**	**CHC-111 Basic Concepts in Chemistry (4)** **ICD-111 General Industrial Chemistry (4)**	**CHC-131 Introduction to Chemistry (3)**		**CHC-141 (SEC-1) Water and Soil Analysis (1T+2P)** **OR** **CHC-142 (SEC-2) Skills in Qualitative Organic Analysis (1T+2P)** **OR** **CHC-143 (SEC-3) Chemistry of Cosmetics and Perfumes (1T+2P)**					
II										***EXT-1 XXX-161 (Course Title) (4)**

*** List of Exit Courses along with the syllabus will be provided separately.**

Note: Programme structure for Sem III to VIII shall be provided separately.

Name of the Programme: B.Sc. (Chemistry)
Course Code: CHC-111
Title of the course: Basic Concepts in Chemistry
Number of Credits: 4+0
Effective from AY: 2023-24

Pre-requisites	Nil	
Course Objectives:	● To define the terms and state laws involved in thermodynamics and chemical equilibrium. ● To solve numerical based on chemical energetics and chemical equilibrium. ● To understand the development of periodic table and periodic trends. ● To explain the theories of acids and bases. ● To understand IUPAC nomenclature of organic compounds. ● To understand the types of organic reactions, reactive intermediates and importance of selected organic compounds.	
Content		**No of hours**
	Thermodynamics I Thermodynamics I: Definition of thermodynamic terms, system, surroundings etc. Types of thermodynamic systems and thermodynamic processes. Intensive and extensive properties. Concept of heat and work, first law of thermodynamics, definition of internal energy and enthalpy. Heat capacity – heat capacities at constant volume and at constant pressure and their relationship, calculation of w, q, dU & dH for the expansion of ideal gases under isothermal and reversible conditions. Numerical problems are expected **Solutions** Solutions of liquids in liquids, Raoult's law and deviation from Raoult's Law (Ways of expressing concentration: Molarity, Normality, Molality Mole fraction, parts per million) Solutions of gases in Liquids: Factors influencing the solubility of gases. Henry's law. Numerical problems **Chemical Equilibrium** Free energy change in a chemical reaction. Thermodynamic derivation of the law of chemical equilibrium. Definition of ΔG and ΔG^{o}, Le Chatelier's principle. Relationships between Kp, Kc and Kx for reactions involving ideal gases.	08 05 07
	Introduction to the periodic table Development of the periodic table- Dobereiner's Triads, Newland's Law of Octaves, Mendeleev's periodic table and Modern periodic table (Theories and limitations), Classification of the elements into s,p,d and f -block elements on the basis of electronic configuration, Trends in the periodic table (atomic and ionic size) **Acid- Base Theories** Arrhenius Concept, Bronsted Theory, The Lux – Flood Solvent Systems, Solvent System theory and Lewis Concept of Acids and Bases. (Theories and limitations)	12 08

	Carbon, IUPAC nomenclature of organic compounds, and aromaticity. Valency of carbon-structure of methane, sp^3 hybridisation. Selected functional group of organic compounds with IUPAC nomenclature (alkanes, alkenes, alkynes, alcohols, ethers, carboxylic acids, esters, thiol, amine, amides, halides, nitriles, nitro compounds aldehydes and ketones). Concept of aromaticity, Huckel's Rule, nomenclature of benzenoids (halo, nitro, alkyl), naphthalene and anthracene compounds.	10
	Types of organic reactions and structure, properties and uses of selected organic compounds Types of organic reactions with two examples of each: addition, elimination, substitution, oxidation, reduction and rearrangement. Structure and stability of intermediates carbocation, carbanion, free radical. Structure, properties and uses of the following selected organic compounds. Ethanol, acetone, ethyl acetate, formaldehyde, acetylene, benzoic acid, n-butane, chloroform, diethyl ether, cresol, benzaldehyde, aniline, urea, glucose, lauric acid. Preparation of ethanol, benzoic acid, acetone, acetylene, ethyl acetate, diethyl ether.	10
	Total:	60
Pedagogy	Mainly lectures and tutorials. Seminars / term papers /assignments / presentations /industry visits/ self-study or a combination of some of these can also be used. ICT mode should be preferred. Sessions should be interactive in nature to enable peer group learning.	
References / Readings	1. A. Bahl, B.S Bahl and G.D. Tuli, *Essentials of Physical Chemistry,* S. Chand Publication. 2009 2. Puri, Sharma and Pathania, *Principles of Physical Chemistry*. 47th edition. 2020 3. Castellan, G.W. *Physical Chemistry* 4th Ed. Narosa. 2004. 4. C. N. R. Rao., University General Chemistry,Macmillan Publishers 1973 5. J.N.Gurtu Physical Chemistry Vol.I ,Pragati Prakashan,10th Edition 2016 6. Gurtu and Gurtu Advanced Physical Chemistry,Pragati Prakashan 2019 7. Samuel Glasstone Textbook of Physical chemistry Macmillan Publications 2nd Edition 1953 **8.** R.L.Madan Chemistry for degree students S.Chand Publications 2nd revised edition 2014 **9.** J. D. Lee, *Concise Inorganic* Chemistry, 5th Edn. Wiley India. 2003. 10. P. W. Atkins, T. L. Overton, J. P. Rourke, M. T. Weller & F. A. Armstrong, *Shriver & Atkins' Inorganic Chemistry*, 5th Edn.; Oxford University Press (2010). 11. N. N. Greenwood & A. Earnshaw, *Chemistry of the Elements*, 2nd Edn., Pergamon Press, Exeter. 1984. 12. F. A. Cottton, G. Wilkinson and P. L. Gaus, *Basic Inorganic Chemistry.* 3rd Edn. Wiley India. 2007 13. B. R. Puri, L. R. Sharma and K. C. Kalia, *Principles of Inorganic Chemistry,* 33rd Edn, Vishal Publishing Co. 2020. 14. S. Prakash, G. D. Tuli, S. K. Basu and R D. Madan, Advanced Inorganic Chemistry, Vol 1, S. Chand &Company Pvt. Ltd. 2013. 15. Graham Solomon, T.W., Fryhle, C.B. & Dnyder, S.A. *Organic Chemistry*, John Wiley & Sons. 2014. 16. McMurry, J.E. *Fundamentals of Organic Chemistry*, 7th Ed. Cengage Learning India Edition, 2013. 17. Sykes, P. A *Guidebook to Mechanism in Organic Chemistry*, Orient Longman, New Delhi. 1988. 18. Finar, I.L. *Organic Chemistry* (Vol. I & II), E.L.B.S., 5th Edition. 2001.	

	19. Morrison, R.T. & Boyd, R.N. *Organic Chemistry*, Pearson, 2010. 20. Bahl, A. & Bahl, B.S. *Advanced Organic Chemistry*, S. Chand, 2010. 21. Francis Carey, *Organic Chemistry*; 3rd Edition, Tata McGraw Hill India. 2000. 22. Paula Yurkanis Bruice, *Organic Chemistry*; 3rd Edition, Pearson Education Asia. 2018 23. Jerry March, *Advanced Organic Chemistry*; 4rd Edition, John Wiley. 2007. 24. https://www.jagranjosh.com/general-knowledge/list-of-important-organic-compounds-1456306311-1
Course Outcome:	At the end of the course, students will be able to 6. Explain the terms involved in chemical thermodynamics and equilibrium. 7. Evaluate different thermodynamic parameters. 8. Discuss the development of Modern Periodic table and periodic trends 9. Classify the acids and bases using the various theories. 10. Write the names and structures of the organic compounds using IUPAC nomenclature. 11. Understand the importance of selected organic compounds.

गोंय विद्यापीठ
ताळगांव पठार
गोंय - ४०३ २०६
फोन: +९१-८६६९६०९०४८

Goa University
Taleigao Plateau, Goa - 403 206
Tel : +91-8669609048
Email : registrar@unigoa.ac.in
Website: www.unigoa.ac.in

(Accredited by NAAC)

GU/Acad –PG/BoS -NEP/2023/102/36 Date: 15.06.2023

CIRCULAR

The University has decided to implement the UGC Curriculum and Credit Framework for the Undergraduate Programme (CCFUP) of **Bachelor of Science in Mathematics/Bachelor of Science in Mathematics (Honours)** under the National Education Policy (NEP) 2020 from the Academic Year 2023-2024 onwards.

The approved Syllabus of Semesters I and II of the **Bachelor of Science in Mathematics/Bachelor of Science in Mathematics (Honours)** Programme is attached.

Principals of Affiliated Colleges offering the **Bachelor of Science in Mathematics/Bachelor of Science in Mathematics (Honours)** Programme are requested to take note of the above and bring the contents of this Circular to the notice of all concerned**.**

(Ashwin Lawande)
Assistant Registrar – Academic-PG

To,

1. The Principals of Affiliated Colleges offering the Bachelor of Science in Mathematics /Bachelor of Science in Mathematics (Honours) Programme.

Copy to:

1. The Director, Directorate of Higher Education, Govt. of Goa
2. The Dean, School of Physical and Applied Sciences, Goa University.
3. The Vice-Deans, School of Physical and Applied Sciences, Goa University.
4. The Chairperson, BOS in Mathematics.
5. The Controller of Examinations, Goa University.
6. The Assistant Registrar, UG Examinations, Goa University.
7. Directorate of Internal Quality Assurance, Goa University for uploading the Syllabus on the University website.

Goa University

Programme Structure for Semester I to VIII Under Graduate Programme - Mathematics

Semester	Major -Core	Minor	MC	AEC	SEC	I	D	VAC	Total Credits	Exit
I	Major-1 MAT-100 (Foundational Mathematics) (3L+1P)	Minor -1 MAT-111 (Elementary Mathematics) (3L+1T) OR MAT-112 (Elementary Statistics) (3L+1T)	MC-1 MAT-131 (Mathematical Techniques in Competitive Exams) (3L)		SEC-1 MAT-141 (Numerical Analysis using Python/SageMath) (1L+2P)				20	
II			MC-2 MAT-132 (Discreptive Statistics) (3L)		SEC-2 MAT-142 (Statistical Methods Using R/SPSS/PSPP) (1L+2P)				20	MAT-161 (4)*
III	Major- 2 MAT-200 (Calculus of One Variable) (3L+1T)) Major- 3 MAT-201 (Ordinary Differential Equations) (3L+1T)	Minor -3 MAT-211 (Matrix Algebra) (3L+1P) OR MAT-212 (Enumerative Combinatorics) (3L+1P) OR MAT-213 (Transformation Techniques) (3L+1P)	MC-3 MAT-231 (Basic Financial Mathematics) (3L)		SEC-3 MAT-241 (Technical Typesetting Using LaTeX) (1L + 2P)				20	

IV	**Major-4 MAT-202 (Analysis) (3L+1T)** **Major-5 MAT-203 (Linear Algebra) (3L+1T)** **Major-6 MAT-204 (Basic Number Theory) (3L+1T)** **Major-7 MAT-205 (Analytical 2D Geometry) (2L)**	**Minor-4 VET MAT-221 (Probability Theory) (3T+1P)** **OR** **MAT-222 (Theory of Equations) (3L+1T)** **OR** **MAT-223 (Graph Theory) (3L+1T)**							20	**MAT-162 (4)***
V	**Major-8 MAT-300 (Riemann Integration and Improper Integrals) (3L+1T)** **Major- 9 MAT-301 (Group Theory I) (3L+1T)** **Major- 10 MAT-302 (Metric Spaces) (3L+1T)** **Major- 11 MAT-303 (Analytical 3D Geometry) (2L)**	**Minor-5 VET MAT-321 (Linear Programming Problems) (3L+1T)** **OR** **MAT-322 (Applied Statistics) (3L+1T)** **OR** **MAT-323 (Bio Mathematics) (3L+1T)**				**Internship (2)**			20	

VI	**Major-12 MAT-304 (Group Theory II) (3L+1T)** **Major- 13 MAT-305 (Complex Analysis) (3L+1T)** **Major- 14 MAT-306 (Vector Calculus) (3L+1T)** **Major- 15 MAT-307 (Project) (3L+1T)**	**Minor-6 VET MAT-324 (Operations Research) (3T+1P) OR MAT-325 (Econometrics) (3L+1T) OR MAT-325 (Mathematical Demography) (3L+1T)**							20	
VII	**Major-16 MAT-400 (Advanced Real Analysis) (3L+1T)** **Major- 17 MAT-401 (Rings and Fields) (3L+1T)** **Major- 18 MAT-402 (Advanced Linear Algebra) (3L+1T)** **Major- 19 MAT-403 (Advanced Complex**	**Minor -7 MAT-411 (Difference Equations) (3L+1T) OR MAT-412 (Measure Theory) (3L+1T)**							20	

	Analysis) (3L+1T)									
VIII	**Major-20 MAT-404 (Functions of Several Variables) (3L+1T)** **Major-21 MAT-405 (Topology) (3L+1T)** **Major- 22 MAT-406 9Functional Analysis) (3L+1T)** **Major- 23 MAT-407 (Advanced Differential Equations) (3L+1T)**	**Minor-8 MAT-413 (Integral Equations) (3L+1T) OR MAT-414 (Partial Differential Equations) (3L+1T)**							20	

*** List of Exit Courses along with the syllabus will be provided separately**.

Name of the Programme: B.Sc. (Mathematics)
Course Code: MAT-131
Title of the Course: Mathematical Techniques in Competitive Exams
Number of Credits: 3 (3L)
Effective from AY: 2023-24

Prerequisites	NIL	
Course Objectives	To make students competent enough to answer competitive examinations like Banks, Post Office, SSC, LIC, CDS, CSAT, CAT, CMAT, GMAT, MAT, UPSC, CBI, CPO, Civil Services, Hotel Management, Railway, Police, Defence, etc.	
Content		Hours
Unit I	**Ratio and Proportion:** Ratio; Comparison of ratios; Proportion. **Mixture or Alligation:** Mixture; Rule of mixture or allegation. **Partnership:** Types of partnerships; Types of partners. **Problems Based on Ages:** Rules for problems based on ages.	15
Unit II	**Work and Time:** Basic rules related to work and time. **Work and Wages:** Important points. **Pipes and Cisterns:** Facts related to pipes and cisterns. **Clock and Calendar:** Clock; Calendar; Day Gain/Loss.	15
Unit III	**True Discount and Banker's Discount:** True discount; Banker's discount. **Speed, Time and Distance:** Basic formulae related to speed, time and distance. **Problems Based on Trains:** Basic rule related to problems based on trains. **Boats and Streams:** Concepts and formulae on boats and streams.	15
Pedagogy	Lectures/Problem Solving/Self study.	
References/Readings	1) R. Verma: *Fast Track Objective Artithmtic*, Arihant Publications Limited, 2017. (**Principal Text**) 2) A. Sharma: *How to Prepare for Quantitative Aptitude for CAT*, 9th Edition, McGraw Hill, 2021. 3) P. K. Mishra, and R. Mishra: *Elementary & Advanced Mathematics For Competitive Exams*, Source Books, 2018. 4) R. S. Aggarwal: *Quantitative Aptitude for Competitive Examinations*, S. Chand Publications, 2017. 5) R. Mathuriya: *Mathematics for all Competitive Exams SSC (Pre./Mains),* Sunita Publications, 2017.	
Course Outcomes	The student will be able to, 1. Apply mathematical techniques in solving problems. 2. Identify tricks in solving problems quickly. 3. Employ various strategies to solve problems arising in various competitive exams. 4. Manage time in answering several questions appearing in the exam.	

Name of the Programme: B.Sc. (Mathematics)
Course Code: MAT-132
Title of the Course: Descriptive Statistics
Number of Credits: 3 (3L)
Effective from AY: 2023-24

Prerequisites	NIL	
Course Objectives:	To make students aware of various statistical tools and techniques that can be employed in data analysis and simple research.	
Content		Hours
Unit I	**Data Visualization** Introduction to Statistics: Definition and scope of Statistics; Concepts of statistical population and sample; Variates and attributes. Types of Data: Quantitative and Qualitative data, Cross-sectional and Time-series data, Discrete and continuous data. Different types of scales: Nominal, Ordinal, Interval and Ratio. Collection and Scrutiny of Data: Primary data, Secondary data – its major sources, Complete enumeration; Construction of tables with one or more factors of classification; Frequency distributions and cumulative frequency distributions and their graphical representations (Histograms, frequency polygon, Ogives).	15
Unit II	**Data Summarization** Measures of Central Tendency: Mean, Median, Mode. Measures of Dispersion: Range, Quartile deviation, Mean deviation, Standard deviation, Coefficient of variation, Skewness and Kurtosis.	15
Unit III	**Correlation and Regression** Bivariate data: Scatter diagram; Karl Pearson's coefficient of correlation; Spearman's rank correlation coefficient. Bivariate Regression Analysis: Regression lines; Properties of regression coefficients; Residual variance. Principle of least squares and fitting of polynomials and exponential curves.	15
Pedagogy	Lectures/Problem Solving/Self study.	
References/Readings	1) S. C. Gupta: *Fundamentals of Statistics,* 7th Edition, Himalaya Publishing House, 2018. (**Principal Text**) 2) A. M. Goon, M. K. Gupta, and B. Dasgupta: *Fundamentals of Statistics, Vol. I*, 8th Edition, The World Press, Kolkata, 2016. 3) S. C. Gupta, and V. K. Kapoor: *Fundamentals of Mathematical Statistics*, 12th Edition, S. Chand and Sons, Delhi, 2020. 4) S. P. Gupta: *Statistical Methods,* S. Chand & Sons, 2017. 5) S. Bernstein, and R. Bernstein: *Schaum's Outlines: Elements of Statistics I – Descriptive Statistics and Probability*, McGraw Hill, 2020.	
Course Outcomes	The student will be able to,	

	1. Understand concepts of sample v/s. population and Identify different types of scales. 2. Distinguish between primary and secondary data and Organize the Statistical data. 3. Calculate measures of central tendencies and variations. 4. Interpret correlation and regression.	

गोंय विद्यापीठ
ताळगांव पठार
गोंय - ४०३ २०६
फोन: +९१-८६६९६०९०४८

Goa University
Taleigao Plateau, Goa - 403 206
Tel : +91-8669609048
Email : registrar@unigoa.ac.in
Website: www.unigoa.ac.in

(Accredited by NAAC)

GU/Acad –PG/BoS -NEP/2023/102/50 Date: 30.06.2023

CIRCULAR

Ref. No.GU/Acad –PG/BoS -NEP/2023/102/17 dtd:14.06.2023

In supersession to the above referred Circular, the updated approved Syllabus of the UGC Curriculum and Credit Framework for the Undergraduate Programme (CCFUP) of **Bachelor of Arts in Psychology/Bachelor of Arts in Psychology (Honours)** under the National Education Policy (NEP) 2020 for Semesters I and II with following changes is enclosed:

Course Code: PSY-111
Title of the Course: CHILD PSYCHOLOGY
References/Readings:

Books for Reference:

1. Berk, L. E. (2014). Child Development. New Delhi: Pearson Education Dorling Kindersley India pvt ltd.
2. Kauffman, J. M. (2001). Characteristics of Emotional and Behavioural Disorders of Children and Youth. (Seventh Edition). Merrill Prentice Hall.
3. Santrock, J.W. (2013). Child Development (13th Edition). New Delhi: Tata McGraw Hill
4. Santrock , J.W. Children (14th Edition). New Delhi: Tata McGraw Hill
5. Papalia, D. E., Olds, S. W., & Feldman, R. (2012). Human Development. (12thEd). McGraw Hill, International Edition 2.

Books for reading:

1. Berk, L. E. (2004). Development through the lifespan. (3rd Ed). New Delhi: Pearson Education Dorling Kindersley India.
2. Cook, J. L., & Cook, G. (2009). Child development: principles and perspectives. Boston: Pearson Education
3. Crandell, T. L., Crandell, C. H., & Zanden, J. W. V. (2009). Human Development. (9th Ed). New York: McGraw Hill.
4. Dacey, J. S. & Travers, J. F. (2004). Human Development across the lifespan.(5th Ed). McGraw Hill . 5. Feldman, R. S. (2014). Development across the life span. (7th Ed). New Jersey: Pearson Education.

Principals of Affiliated Colleges offering the **Bachelor of Arts in Psychology**/**Bachelor of Arts in Psychology (Honours)** Programme are requested to take note of the above and bring the contents of this Circular to the notice of all concerned.

(Ashwin Lawande)
Assistant Registrar – Academic-PG

To,

1. The Principals of Affiliated Colleges offering the Bachelor of Arts in Psychology **/**Bachelor of Arts in Psychology (Honours) Programme.

Copy to:

1. The Director, Directorate of Higher Education, Govt. of Goa
2. The Dean, D.D. Kosambi School of Social Science and Behavioural Studies, Goa University.
3. The Vice-Deans, D.D. Kosambi School of Social Science and Behavioural Studies, Goa University.
4. The Chairperson, BoS in Psychology.
5. The Controller of Examinations, Goa University.
6. The Assistant Registrar, UG Examinations, Goa University.
7. Directorate of Internal Quality Assurance, Goa University for uploading the Syllabus on the University website.

Goa University
Programme Structure for Semester I to VIII Under Graduate Programme

Semester	Major -Core	Minor	MC	AEC	SEC	I	D	VAC	Total Credits	Exit
I	Major- 1 PSY 1-100 ESSENTIALS OF PSYCHOLOGY (3T+1P)	Minor -1 PSY-111 CHILD PSYCHOLOGY (4)	MC-1 PSY-131 PSYCHOLOGY OF ADJUSTMENT (3)		SEC-1 PSY-141 PERSONALITY DEVELOPMENT (1T+2P)					
II			MC-2 PSY-132 ENVIRONMENTAL PSYCHOLOGY (3)		SEC-2 PSY-142 STRESS MANAGEMNET (1T+2P) SEC-3					EXT-1 PSY-161 (4)*
III	Major- 2 PSY-200 ATTITUDES AND SOCIAL COGNITION (3T+1P) Major- 3 PSY-201 HEALTH PSYCHOLOGY (4)	Minor -3 PSY-211 (ADOLESCENT PSYCHOLOGY (4)	MC-3 PSY-231 SPORTS PSYCHOLOGY (3)		SEC-3 PSY-241 RELATIONSHIP PSYCHOLOGY (1T+2P)					
IV	Major-4 PSY-202 SOCIAL INFLUENCE AND GROUP PROCESSES (3T+1P) Major-5 PSY-203 POSITIVE PSYCHOLOGY (4) Major-6	Minor-4 VET PSY-221 DEVELOPING PSYCHOLOGICAL SKILLS (4)								EXT-2 PSY-162 (4)*

	PSY-204 STATISTICS FOR PSYCHOLOGY (4) **Major-7 PSY-205 ADULTHOOD AND GERIATRICS PSYCHOLOGY (2)**									
V	**Major-8 PSY-300 PSYCHOLOGICAL TEST AND MEASUREMENTS (3T+1P)** **Major- 9 PSY-301 COUNSELLING PSYCHOLOGY (4)** **Major- 10 PSY-302 ABNORMAL PSYCHOLOGY-1 (4)** **Major- 11 PSY-303 RESEARCH METHODOLOGY (2)**	**Minor VET -5 PSY-321 QUALITATIVE DATA ANALYSIS (4)**				**INTERNSHIP (2)**				
VI	**Major-12 PSY-304 COGNITIVE PSYCHOLOGY (3T+1P)** **Major- 13 PSY-305 HUMAN FACTORS AT WORK**	**Minor VET-6 PSY-322 ESSENTIAL LIFE SKILLS (4)**								

	(4) **Major- 14** **PSY-306** **ABNORMAL PSYCHOLOGY-2** **(4)** **Major- 15** **PSY-307** **PROJECT** **(4)**									
VII	**Major-16** **PSY-400** **ORGANIZATIONAL PSYCHOLOGY (3T+1P)** **Major- 17 PSY-401** **THEORIES OF PERSONALITY (4)** **Major- 18 PSY-402** **BIOPSYCHOLOGY (4)** **Major- 19 PSY-403** **EDUCATIONAL PSYCHOLOGY (4)**	**Minor -7** **PSY-411** **RESEARCH TECHNIQUES AND ANALYSIS** **(4)**								
VIII	**Major-20** **PSY-404** **PSYCHOLOGICAL INTERVENTIONS (3T+1P)** **Major-21** **PSY-405** **CONSUMER PSYCHOLOGY** **(4)**	**Minor-8** **PSY-412** **COMMUNITY MENTAL HEALTH** **(4)**								

	Major- 22 **PSY-406** **CRIMINAL PSYCHOLOGY (4)** **Major- 23** **PSY-407** **DEADDICTION PSYCHOLOGY (4)**									

*** Exit courses List along with the syllabus will be provided separately**

Name of the Programme: UG DEGREE PROGRAMME PSYCHOLOGY
Course Code: PSY-131
Title of the Course: PSYCHOLOGY OF ADJUSTMENT
Number of Credits: 03
Effective from AY: 2023-24

Pre-requisites for the Course:	Nil	
Course Objectives:	1. **Understand** adjustment challenges and **apply** the principles of adjustment to facets of the contemporary world 2. **Analyse** concepts and modern trends in the psychology of adjustment. 3. **Develop** skills required for effective life adjustment.	
Content:	**CHAPTER 1: ADJUSTING TO THE MODERN WORLD** 1. Meaning of Adjustment: Definition 2. Characteristics of Effective Adjustment: Accurate perception of reality, ability to cope with stress and anxiety, positive self-image, good interpersonal feelings 3. Emotional Intelligence and Personal Growth: Enhancing emotional intelligence, adjustment and personal growth 4. Cultural intelligence and critical thinking: how attitudes towards human diversity and critical thinking are linked with life-adjustment Skill Based Activities: Process of knowing yourself- SWOC Analysis/ Johari Window, enhancing emotional and cultural intelligence.	No of hours 15hours
	CHAPTER 2: GENDER, SEXUALITY AND INTIMATE RELATIONSHIPS 1. Gender and Gender Identity: Gender identity, gender roles and sexuality, on being transgender 2. Adjusting to Intimate Relationships: Sharing responsibilities, communication, conflict, mindfulness, safe sex practices, understanding intimate partner violence 3. Sexual Orientation in Contemporary Society: Changing views of sexuality, Adjustment of LGBTQIA+ individuals, homophobia, coming out 4. Relationships and Sexuality in a Digital Age: online dating apps, sexting, safe social networking, cybercrime Skill Based Activities: Developing the art of communication- listening, speaking, and body language, building relationships with friends, family, intimate relationships.	15hours
	CHAPTER 3: ADJUSTING TO PERSONAL AND PROFESSIONAL LIFE CHALLENGES 1. Finding a career that fits 2. Job satisfaction, job stress, and work-life balance 3. Adjustment to changes during emerging and early adulthood 4. Adjusting to changes within families: divorce, single parenthood, death and dying Skill Based Activities: Goal setting, team work, preparing a CV/Resume, interview skills, time Management.	15hours
Pedagogy:	1. A blend of traditional teaching techniques- lecturing and problem-based learning may be used in the classroom.	

	2. The ideas addressed in this course can be better explored through experiential learning tools such as group discussions, role play, debates, flipped learning demonstrations and sharing of experiences, among others, during lectures. 3. Facilitators are also encouraged to use ICT tools **such as** Power Point Presentations/ Ted talks/ documentary of science to facilitate engagement with syllabus topics.
References/ Readings	**Books:** 1. Alex, K. (2011). *Soft skills: Know yourself & know the world.* New Delhi: S. Chand & Company Ltd. 2. Wadkar, A. (2016). *Life skills for success.* New Delhi: Sage. 3. Baumgardner, S. & Crothers, M. (2014). *Positive psychology.* Noida: Pearson Education India. 4. Duffy K.G., Atwater E. (2014) *Psychology for living: Adjustment, growth and behaviour today.* (11th Ed.)India. Pearson Education. 5. Rathus, S.A., Nevid, J.S. (2019). *Psychology and the challenges and life: Adjustment and growth* [14th ed.]. Hoboken, NJ: Wiley Publication. 6. Sherfield, R.N., Montgomery, R.J., & Moody, P.G. (2010). *Cornerstone*: *Developing soft skills*. Delhi: Pearson. 4th Edition. 7. Weiten, W.D, Hammer, D.S, Yost, E. (2018). *Psychology applied to modern life* [12th ed.]. Boston, MA: Cengage Learning. **Article in Scholarly Journal:** 1. Ang, S., Rockstuhl, T., & Tan, M. L. (2015). Cultural intelligence and competencies. *International encyclopedia of social and behavioral sciences, 2*, 433-439. Retrieved from: http://www.soonang.com/wp-content/uploads/2017/04/2015-Ang-et-al-IlEncyclopedia-of-he-Social-and-Behavioral-Sciences_CI-and-Competencies.pdf *2.* Oliver, S., & Duncan, S. (2019). Looking through the Johari window. *Research for All.* 3. Sherin Farhana, E. V. (2022). Cyber Crimes and the Victimisation of Women. Issue 1 Int'l JL Mgmt. & Human., 5, 1877. **E-Resources:** 1. IGNOU (2017). Unit-20: Sexuality and sex education. *Egyankosh.* Retrieved from: https://egyankosh.ac.in/bitstream/123456789/35088/1/Unit-20.pdf 2. IGNOU (2021). Unit-2 Family Planning and Parenting. *Egyankosh.* Retrieved from: https://egyankosh.ac.in/bitstream/123456789/80014/1/Unit-2.pdf
Course Outcomes:	At the end of this course, the learner will be able to: 1. **Explain** contemporary perspectives regarding psychology of life adjustment. 2. **Apply** skills for effective adjustment in the modern world. 3. **Harness** critical perspectives regarding questions of gender, sexuality, and intimate relationships. 4. **Develop** values and competences for facing challenges at work and in families. **Suggestions:** All skill-based activities may be recorded in a journal and may be marked as a part of continuous assessment.

Name of the Programme: UG DEGREE PROGRAMME PSYCHOLOGY
Course Code: PSY-132
Title of the Course: ENVIRONMENTAL PSYCHOLOGY
Number of Credits: 03
Effective from AY: 2023-24

Pre-requisites for the Course:	Nil	
Course Objectives:	1. Explore and understand various perspectives on human-environment interrelationships 2. Gain insight into the ways in which the environment influences our feelings and experiences 3. Understand the role of the environment on health and quality of life	
Content:	**CHAPTER ONE: CHANGING BEHAVIOR TO SAVE THE ENVIRONMENT** 1. Environmental Psychology: Definition and Characteristics 2. Values and Attitudes 3. Guiding Environmentally Responsible Behavior 4. Strategies to Encourage Environmentally Responsible Behavior **CHAPTER TWO: CLIMATE CHANGE & ENVIRONMENTAL STRESS** 1. Understanding of Climate Change 2. Assessing the Risk of Climate Change 3. Conceptualization of Stress 4. Effects of Environmental Stress **CHAPTER THREE: HEALTH BENEFITS OF NATURE & QUALITY OF LIFE** 1. Measures of Health and Nature 2. Nature & Clinical Health 3. Green Space and Public Health 4. Mechanisms Linking Nature to Health 5. Measures of Quality of Life 6. Environment and Quality of Life: Research Overview	No of hours 15hours 15hours 15hours
Pedagogy:	1. A blend of traditional teaching techniques- lecturing and problem-based learning may be used in the classroom. 2. The ideas addressed in this course can be better explored through experiential learning tools such as group discussions, role play, debates, flipped learning demonstrations and sharing of experiences, among others, during lectures. 3. Facilitators are also encouraged to use ICT tools **such as** Power Point Presentations/ Ted talks/ documentary of science to facilitate engagement with syllabus topics.	
References/ Readings	**BOOKS FOR STUDY:** 1. Steg, L., & Groot, M. (2019). *Environmental Psychology: An Introduction*. Wiley-Blackwell. 2. Bell, P. A., Greene, T. C., Fisher, J. D., & Baum, A. (2006). *Environmental psychology* (4th ed.). Harcourt. **SUGGESTED READINGS:** 1. Bechtel, R. B. & Churchman, A. (2002). Handbook of Environmental Psychology. New York: Wiley & Sons 2. Erlbaum. Gieseking, J., W. Mangold, C. Katz, S. Low, and S. Saegert. (2014). The People, Place, and Space Reader. New York, Routledge.	

	3. Gifford, R. (2007). Environmental psychology: Principles and practice (5th ed.). Colville, WA: Optimal Books Heft, H. (2001). 4. Ecological psychology in context: James Gibson, Roger Barker, and the legacy of William James's radical empiricism. Psychology Press.
Course Outcomes:	At the end of this course, the learner will be able to: 1. Understand various perspectives on human-environment interrelationships 2. Gain insight into the ways in which the environment influences feelings and experiences 3. Appreciate the nature connectedness. 4. Understand the impact of climate change and behaviour 5. Students will understand the role of the environment on health and quality of life

गोंय विद्यापीठ
ताळगांव पठार
गोंय - ४०३ २०६
फोन: +९१-८६६९६०९०४८

Goa University
Taleigao Plateau, Goa - 403 206
Tel : +91-8669609048
Email : registrar@unigoa.ac.in
Website: www.unigoa.ac.in

(Accredited by NAAC)

GU/Acad –PG/BoS -NEP/2023/156/1 Date: 30.06.2023

CORRIGENDUM

Refer: No: GU/Acad –PG/BoS -NEP/2023/102/45 Dated: 23.06.2023

In supersession to the above referred Circular, the updated approved Syllabus of the Value-Added Courses (VAC) for Semesters I and II with following changes is enclosed.

1. Students shall be required to opt for One Course from each Category A, B C and D during the First Year. (4 VAC Courses of 2 Credits each. 2 Courses of 2 Credits each in Semester I and 2 Courses of 2 Credits each in Semester II.)

2. The Course Code for the Course "NCC (Army) 2" shall be VAC-120 and the Course Code for "NCC (Navy) 2" shall be "VAC-121".

(Ashwin Lawande)
Assistant Registrar – Academic-PG

To,

1. The Principals of Affiliated Colleges offering the UG General Education Programme.

Copy to:

1. The Director, Directorate of Higher Education, Govt. of Goa
2. All Dean of Schools/Faculty.
3. The Vice-Deans of Schools, Goa University.
4. The Chairperson, BoS in Interdisciplinary and Transdisciplinary Studies
5. The Controller of Examinations, Goa University.
6. The Assistant Registrar, UG Examinations, Goa University.
7. Directorate of Internal Quality Assurance, Goa University for uploading the Syllabus on the University website.

Students shall be required to opt for One Course from each Category A, B C and D during the First year. (4 VAC Courses of 2 Credits each. 2 Courses of 2 Credits each in Semester I and 2 Courses of 2 Credits each in Semester II.)

Course Code	Value Added Courses (VAC)	Credits
A	**Environmental Science And Education**	
VAC-100	Environmental Studies I	2
VAC -101	Environmental Studies II	2
VAC -102	Environmental Practices in Goa	2
VAC- 103	Sustainable Development and Ecology	2
B	**Understanding India**	
VAC -104	Constitutional Values and Obligations	2
VAC-105	Elections and Electoral Management in India	2
VAC-106	NCC (Army) 1	2
VAC-120	NCC (Army) 2	2
VAC-107	NCC (Navy) 1	2
VAC-121	NCC (Navy) 2	2
VAC-108	Introduction to the Folktales of India	2
VAC-109	Indian Economic Thought	2
C	**Digital & Technological Solutions**	
VAC-110	Awareness of Cyber Crimes and Security	2
VAC-111	E-Waste Management	2
VAC-112	Green Energy Systems	2
VAC-113	Medical Gadgets for Health Care	2
D	**Health & Wellness, Yoga Education, Sports & Fitness**	
VAC-114	Health and Wellness	2
VAC-115	Yoga and Ayurveda	2
VAC-116	Life Skills	2
VAC-117	Youth Empowerment using Mind Management	2
VAC-118	Health and Physical Education	2
VAC-119	Exercise Science and Nutrition for Fitness	2

Name of the Programme: UG General Education Programmes
Course Code: VAC-102
Number of Credits: 02
Title of the Course: Environmental Practices in Goa
Effective from AY: 2023-24

Pre-requisites for the Course:	Nil	
Course Objectives:	1. To introduce and acquaint students to Goa's rich Natural Heritage and the importance of sacred groves of Goa. 2. Create awareness in students about role of Sacred Groves, Oral Traditions & myths in Conserving Biodiversity.	
Content: **Unit I:**	**Sacred Groves** 1. Meaning of Nature worship, Sacred groves, Protector spirits and Natural Heritage 2. Types of Sacred Groves. 3. Ecological importance of sacred Groves in Goa. 4. Guardian Spirits of Goa 5. Threats to sacred groves and biodiversity in Goa. 6. Strategies to protect the Sacred Groves	**15 hours**
Unit II:	**Intertwining Culture, Religion and Society** 1. Oral Traditions protecting Goa's biodiversity. 2. Meaning and types of Nature worships 3. Myths contributing towards protection nature 4. Common taboos and beliefs in the practice of Nature worship. 5. Goan practices and rituals related to Nature worship 6. Ecological Festivals of Goa.	**15 hours**
Pedagogy:	Multimedia and ICT based teaching learning.	
References/ Readings:	1. Kerkar, Rajendra. *Sacred Groves of Goa.* Saligao, Goa: Goa State Biodiversity Board,2019 2. Kerkar, Rajendra. *Natural Heritage of Goa*. Panaji, Goa: Broadway Publishing House, 2006. 3. Gadgil, Madhav and Vartak, V.D. "Sacred groves of India : A plea for Continued conservation" *Journal of Bombay Natural History Society*, vol. 72, 1975. 4. Alvares, Claude (ed.). *Fish, Curry and Rice*, Mapusa: The Goa Foundation, 2002.	
Course Outcomes:	1. Develop respect for rich Heritage of Goa and also work towards protection of Nature. 2. Promote and inculcate intrinsic values toward Biodiversity by replacing human- centered approach with bio-centric values.	

Name of the Programme: UG General Education Programmes
Course Code: VAC-103
Title of the Course: Sustainable Development and Ecology
Number of Credits: 02
Effective from AY: 2023-24

Pre-requisites for the Course:	Nil	
Course Objectives:	1. To create awareness of environmental issues and need for sustainable development 2. To highlight current ecological issues and alternatives measures	
Content: **Unit I:**	**Concept of Sustainable Development** 1. Social Ecology and Bio-regionalism 2. Role of Corporate Social Responsibility (CSR) in sustaining ecology and development 3. Role of Ecofeminism in sustaining ecology 4. Dimensions of the 'Common Concerns' on Environment and Human wellbeing. 5. Geo-Politics 6. Economic Sustainability: Modifying Natural Resource Use.	**15 hours**
Unit II:	**Ecological Measures for Sustainable development** 1. Controlled use of natural resources 2. Re-cycling of E-waste 3. Eco-farming 4. Save Soil Movement 5. Scientific Challenges of the 21st Century 6. Developing a Global Vision	**15 hours**
Pedagogy:	Lectures, Discussions and Tutorials	
References/ Readings:	1. Jardins, Joseph R. Des: *Environmental Ethics: An Introduction to Environmental Philosophy,* 3rd Ed. Belmont CA: Wadsworth, 2001. 2. Sanwal, Mukul: *The World's Search for Sustainable Development – A Perspective from the Global South"*, Delhi: Cambridge University Press, 2015. 3. Frey, R. G. and Heath Wellman Christopher (eds.): *A Companion to Applied Ethics*, Malden: Blackwell Publishing, 2005. 4. Pojman, Louis P.: *Environmental Ethics: Readings in Theory and Application* 3rd Ed, Belmont: Thomson Wadsworth, 2001.	
Course Outcomes:	To make students understand the various concepts under ecological issues and sustainable development. Students will be acquainted with various measures for sustainable development	

B. Understanding India

Name of the Programme: UG General Education Programmes
Course Code: VAC-104
Title of the Course: Constitutional Values and Obligations
Number of Credits: 02
Effective from AY: 2023-24

Prerequisites	Nil	
Course Objectives:	1. understand Constitutional Values. 2. be familiar with Fundamental Rights, Obligations of a State and Fundamental Duties	
Content:	**Unit 1: Evolution and structure of the Constitution** Constituent Assembly and the Constitution: Drafting of the Constitution, Tenets of Preamble including Secular, Socialist, Democratic, Republic, Republic State, Justice, Equality, Fraternity and Liberty. Main features of Indian Constitution: Basic Structure of Constitution. Rigidity and Flexibility, Federal structure, Rule of Law, Separation of Powers, Parliamentary Form of Government, Independent Judiciary and Citizenship.	15 hours
	Unit 2: Fundamental Rights, Directive Principles of State Policy and Fundamental Duties Fundamental Rights : Right to Equality, Freedom of Speech and Expression, Right to Life and Personal Liberty, Right against Exploitation, Right to Freedom of Religion, Cultural and Educational Rights and Right to Constitutional Remedies. Directive Principles of State Policy and its enforceability. Fundamental Duties: Moral Duty and Civic Duty ,Concept of Environmental Constitutionalism, PILs filed invoking Fundamental Duties and Judicial approach to Fundamental Duties.	15 hours
Pedagogy:	**1 Lectures/Interactive Sessions/ Group Discussions/ Assignments** **2 .Experiential Learning** : Identifying violations of Fundamental Rights in society by conducting interviews of affected parties. Reflections on violation of Fundamental Rights during Group discussion Conducting a survey on awareness about Fundamental Duties	
Reference/ Readings:	Basu, D. D. (2019). *Introduction to Constitution.* Lexis Nexix. Kashyap, S. C. (2019). *Our Constitution : An Introduction to India's Constitution and Consitutional Law.* National Book Trust, India. Jain, M. P. (2022). *Indian Constitutional Law.* Lexis Nexis. Shukla, V.N. (2023). *Constitution of India.* Eastern Book Company.	
Course	At the end of the course, the students will be able to: 1. Explain the relevance of Constitution of India in a democratic setup. 2. Describe the Fundamental Rights and Fundamental Duties. 3. Explain the policy of governance 4. Develop ability to apply the Values and State policy enshrined in the Constitution in national life.	

C. Digital & Technological Solutions

Name of the Programme: UG General Education Programmes
Course Code: VAC-110
Title of the Course: Awareness of Cyber Crimes and Security
Number of Credits: 02
Effective from AY: 2023-24

Pre-requisites	Nil	
Course Objectives:	This course is intended to: ● Introduce to students the awareness of cybercrimes and cyber security – concepts, theory. ● Covers various techniques which enable the student to analyse the threats and attacks due to cybercrimes. Explains mitigation techniques and policies for cyber security.	
Content:	**Unit 1: Cyber Crime against Individuals and Organisations** Cyber Crime- Overview, Internal and External Attacks, Attack Vectors. Cybercrimes against Individuals – E-mail spoofing and online frauds, Phishing and its forms, Spamming, Cyber-defamation, Cyberstalking, Cyber Bullying and harassment, Computer Sabotage, Pornographic offenses, Password Sniffing. Keyloggers and Screen loggers**.** Cyber Crimes against Women and Children. Cybercrime against organization – Unauthorized access of computer, Password Sniffing, Denial-of-service (DOS) attack, Backdoors and Malwares and its types, E-mail Bombing, Salami Attack, Software Piracy, Industrial Espionage, Intruder attacks. Security policies violations, Crimes related to Social Media, ATM, Online and Banking Frauds. Intellectual Property Frauds. Cyber Crimes against Women and Children.	**urs**
	Unit 2: Global perspective on Cyber crimes and Cyber Security A global perspective on cybercrimes, Phases of cyber-attack –Reconnaissance, Passive Attacks, Active Attacks, Scanning, Gaining Access, Maintaining Access, Lateral movement and Covering Tracks. Detection Avoidance, Types of Attack vectors, Zero-day attack, Overview of Network based attacks. Introduction to Cyber Security. Confidentiality, Integrity and Availability – Triad. Attacks: Threats, Vulnerabilities and Risk. Risk Management, Risk Assessment and Analysis. Information Classification, Policies, Standards, Procedure and Guidelines. Controls: Physical, Logical and Administrative; Security Frameworks, Defence in-depth: Layers of security. Identification and Authentication – Factors. Authorization and Access Controls- Models, Methods and Types of Access Control.	**urs**
Pedagogy:	Lectures/Tutorial	

References/ Readings:	1. Godbole Nina and Belapore Sunit; “Cyber Security: Understanding Cyber Crimes, Computer Forensics and Legal Perspectives”, Wiley Publications,2011. 2. Jain Atul; “Cyber Crime: Issues, Threats and Management”, 2004 3. Yar Majid; “Cybercrime and Society”, Sage Publications, 2006 4. Whiteman Michael E and Mattord Herbert J; “Principles of Information Security”, Vikas Publishing House, New Delhi, 2003. 5. Matt Bishop, “Computer Security Art and Science”, Pearson/PHI, 2002. 6. Indian Institute of Banking & Finance *Prevention Of Cyber Crimes And Fraud Management* Macmillan, Delhi, 2020 7. Prashant Mali *Cyber Law & Cyber Crimes Simplified,* Cyberinfo Media, Delhi, 2017 8. Vishwanath Paranjape *Cyber Crimes and Law*, Central Law Agency, Allahabad, 2019
Course Outcomes	Students will, ● Aware of the various cybercrimes and will able to guide others. ● Understand the global problems faced by individuals, organisations due to cybercrimes and attacks. ● Apply the cyber security analysis to mitigate and prevent such attacks.

Name of the Programme: UG General Education Programmes
Course Code: VAC-118
Title of the Course: Health and Physical Education
Number of Credits: 2
Effective from AY: 2023-24

Prerequistes	Nil
Course Objectives:	● Develop an understanding of the relationship among physical activity, fitness, and health and the physiological and psychological benefits of physical activity. ● Impart knowledge of theoretical foundations of motor development and learning, cognitive and affective dimensions of physical activity, and physical activity interventions for mental health conditions. ● Make students understand the components of physical fitness, how to measure them, and develop skills in the prescription of physical activity for different populations while also considering safety. ● Acquire practical skills in a range of exercises including cardiovascular, resistance, core strengthening, flexibility, circuit training, low-intensity interval training, sports and recreational activities, yoga, and Pilates. ● Develop knowledge of basic nutrition and hydration practices, stress management techniques, injury prevention, and fitness assessment and goal setting. ● Learn to create personalized fitness plans and understand how to review and adjust them to meet individual goals. ● Enhance critical thinking and decision-making abilities in selecting appropriate physical activity for individual needs, preferences, and abilities.
Content:	**Chapter 1: Introduction to Health and Physical Education** **rs** • Defining health and physical education • The relationship between physical activity, fitness, and health • The physiological and psychological benefits of physical activity • The relationship between physical activity and chronic diseases **Chapter 2: Theoretical Foundations of Health and Physical Education** • Understanding the principles of motor development and learning. **rs** • Cognitive and affective dimensions of physical activity. • Physical activity interventions for mental health conditions • The role of physical activity in promoting mental health. **Chapter 3: Physical Activity Guidelines and Prescription** • The components of physical fitness and how to measure them • The development of physical activity guidelines and their impact **rs** • Prescription of physical activity for different populations • Safety considerations in physical activity **Chapter IV Practical Component:** Practical Component 15 Hours

No:	**Module**	**Activities**	**Hours**
1	Warm-up exercises and stretching	Basic warm-up exercises and stretching	**1**
2	Cardiovascular exercises	Jogging, running, cycling, etc.	**1**

3	Resistance training	Weightlifting, bodyweight exercises	**1**
4	Core strengthening exercises	Planks, crunches, leg lifts	**1**
5	Flexibility exercises	Static stretching (Active and Passive)	**1**
6	Circuit training	Circuit-based exercises	**1**
7	Low-intensity interval training (LIIT)	LIIT-based exercises	**1**
8	Sports and recreational activities	Indigenous sports	**1**
9	Yoga and Pranayama	Hath Yoga and Basic Techniques of Pranayama & Meditation	**1**
1	Nutrition and hydration	Basic nutrition guidelines and hydration practices	**1**
1	Mental health and stress management	Basic stress management techniques	**1**
1	Injury prevention and first aid	Basic injury prevention techniques	**1**
1	Fitness assessment and goal setting	Basic fitness assessment techniques and goal setting	**1**
1	Personalized fitness plans	Creation of personalized fitness plans	**2**

Pedagogy:	● Lecture-based teaching ● Active learning ● Experiential learning ● Collaborative learning ● Personalized learning ● Self-directed learning ● Flipped classroom ● Project-based learning	
References/ Readings:	**Single Author Book** Bean, A. (2008). The Complete Guide to Strength Training (Complete Guides). Bloomsbury Sport. Bompa, T. O. (2018). Periodization: Theory and Methodology of Training. Human Kinetics. Bompa, T. O. (2019). Periodization-6th Edition: Theory and Methodology of Training. Human Kinetics. Delavier, F. (2010). Strength Training Anatomy. Human Kinetics. Foran, B. (2001). High-Performance Sports Conditioning. Human Kinetics. Karpinski, C., & Rosenbloom, C. (2017). Sports Nutrition: A Handbook for Professionals. Academy of Nutrition and Dietetics. Shirl J. Hoffman. (2018) Introduction to Kinesiology: Studying Physical Activity" **Three or More Authors** A.K. Uppal, V.L.G Kumar, M.M Panda. Biomechanical in physical education and exercise science. A.K. Uppal, V.L.G Kumar, M.M Panda. Kinesiology in physical education and exercise science. Mack, G., & Casstevens, D. (2002). Mind Gym: An Athlete's Guide to Inner Excellence. McGraw Hill Professional. **E-books** "Essentials of Strength Training and Conditioning" by National Strength and Conditioning Association "Health and Physical Education: A Practical Approach for Primary Schools" by Sue Chedzoy. National Strength and Conditioning Association. (2011). NSCA's Essentials of Personal Training. Human Kinetics.	
Course Outcomes:	After studying this course, the students will be able to: 1. know the difference and relationship among physical activity, fitness, and health and describe the physiological and psychological benefits of physical activity; 2. analyze the theoretical foundations of motor development and learning, cognitive and affective dimensions of physical activity, and physical activity interventions for mental health conditions; 3. evaluate the components of physical fitness, how to measure them, and develop skills in the prescription of physical activity for different populations while also considering safety; 4. demonstrate practical skills in a range of exercises including cardiovascular, resistance, core strengthening, flexibility, circuit training, low-intensity interval training, sports and recreational activities, yoga, and Pilates; a 5. apply knowledge of basic nutrition and hydration practices, stress management techniques, injury prevention, and fitness assessment and goal setting to promote health and wellness; and 6. develop personalized fitness plans and evaluate and adjust them to meet individual goals.	

गोंय विद्यापीठ
ताळगांव पठार
गोंय - ४०३ २०६
फोन: +९१-८६६९६०९०४८

Goa University
Taleigao Plateau, Goa - 403 206
Tel : +91-8669609048
Email : registrar@unigoa.ac.in
Website: www.unigoa.ac.in

(Accredited by NAAC)

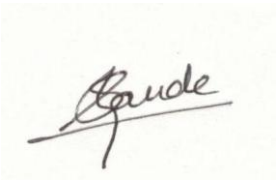
GU/Acad –PG/BoS -NEP/2023/192 Date: 07.07.2023

CIRCULAR

The University has decided to implement the UGC Curriculum and Credit Framework for the Undergraduate Programme (CCFUP) for UG General Education Programmes under the ordinance OA-38 from the Academic Year 2023-2024 onwards.

The approved Syllabus of **Ability Enhancement Courses (AEC)** for Semesters I and II is attached.

Principals of Affiliated Colleges offering the UG General Education Programme are requested to take note of the above and bring the contents of this Circular to the notice of all concerned.



(Sanket Gaude)
Offg. Assistant Registrar – Academic-PG

To,

1. The Principals of Affiliated Colleges offering the UG General Education Programme.

Copy to:

1. The Director, Directorate of Higher Education, Govt. of Goa
2. All Deans of Schools/Faculty.
3. The Vice-Deans of Schools, Goa University.
4. The Chairperson, BOS in English.
5. The Controller of Examinations, Goa University.
6. The Assistant Registrar, UG Examinations, Goa University.
7. Directorate of Internal Quality Assurance, Goa University for uploading the Syllabus on the University website.

Name of the Programme: Bachelor of Arts- English
Course Code: ENG-151
Title of the Course: Communicative English: Spoken and Written
Number of Credits: 02
Effective from AY: 2023-24

Pre-requisites for the Course:	Interest in improving spoken and written English skills	
Course Objectives:	• To listen, understand and convey information • To listen and respond appropriately to the contributions of others • To understand others and present facts, ideas and opinions • To articulate experience and express what is thought, felt and imagined • To communicate clearly and fluently • To use grammatically correct language • To use a register appropriate to the audience and context	
Content:	**UNIT 1** • Verbal and non-verbal Skills: importance of pronunciation, enunciation, diction, articulation, intonation and body language. • Group Discussion: persuasion, negotiation, leading and participating. • Interview Skills: techniques of answering and conducting interviews. • Delivering Speeches: balancing rhetoric and empathy to connect with the audience. **UNIT 2** • Communication through Letters: cover letters, letters of goodwill, complaint letters and invitation letters. • Email Correspondence: components, format, attachments, content and language. • Writing Reports: format and steps. • Drafting Speeches: special occasion, motivational, informative, and extemporaneous.	**(15 hou** **(15 hou**
Pedagogy:	Topics to be taught using interactive teaching and the workshop method.	
References/Readings:	• Beebe, S. A., & Beebe, S. J. Public Speaking: An audience centered approach. 8th ed, 2012 • Hancock, Mark. English Pronunciation in Use. Cambridge UP, 2003 onwards. • Krishna Mohan and N. P. Singh. Speaking English Effectively. Macmillan India Ltd ISBN: 0333925521 • Lougheed, Lin. Business Correspondence: A Guide to Everyday Writing. Longman, 2003. • Murphy, Raymond. Murphy's English Grammar. Cambridge UP. • Vyas Manish A., Yogesh L. Patel. Tasks for the English Classroom. Macmillan, 2012. • Online Resource – The homepage of NATE (National Association of Teaching English) while a national British association, has many resources which are in effect international. Series: English Writing Frames – Copiable books. Could be used in used in conjunction with any language/Communication skills course. A systematic resource, with step–by-step practical exercises and photocopiable frames to practice with.	

Course Outcomes:	On completion of the course, the student will be able to do the following: • Elicit and show respect for the views of others as well as be culturally sensitive. • Display emotional stability and self-confidence. • Apply critical thinking skills through decision-making and problem-solving. • Demonstrate effective written communication for an intended purpose and audience that follows genre/disciplinary conventions that reflect creation, organization, precision, and revision.

Name of the Programme: Bachelor of Arts
Course Code: ENG-152
Title of the Course: Digital Content Creation in English
Number of Credits: 02
Effective from AY: 2023-24

Pre-requisites for the Course:	Knowledge of the digital medium coupled with an interest to create content for various online digital platforms	
Course Objectives:	• To introduce students to the process, genres and types of writing for digital platforms • To enhance multimedia literacy skills among students • To build confidence and ability in using digital technology for communication	
Content:	**Unit 1 –Digital Presentations** • Use of various software PowerPoint / Prezi (the Zooming Presentation Editor)/ Mind-Mapping Software • Learning the principles of slide designing - Slide: ology/Zen • Presentation skills (tone of voice, body language, eye-contact, etc.) **Unit 2 – Content creation** Creating a blog **Digital Story Telling** • Elements of a story and preparation of a storyboard • Create/compose the digital story using appropriate software	**(15 hours)** **(15 hours)**
Pedagogy:	A combination of traditional writing skills and the use of technology to create, share and publish written content by introducing the students to a variety of digital tools, such as word processors, blogging platforms, and social media	
References/Readings:	• Frazel, Midge. Digital Storytelling: Guide for Educators, International Society for Technology in Education, 2010. • Hindle, Tim. Making Presentations. Dorling Kindersley Publishers, 1999. • Raina, Roshan Lal et al. Professional Communication. Himalaya Publishing House, 2012/ later editions • Reynolds, Garr. Presentation Zen: Simple Ideas on Presentation Design and Delivery. 2nd edition, Voices that Matter, 2011. • Zelazny, Gene. Say it with Presentations. Tata McGraw Hill Education, 2004.	
Course Outcomes:	On completion of the course, the student will be able to do the following: • Create and deliver individual presentations using a variety of digital software • Compose and present a digital story • Identify and distinguish between different genres of writing • Write a book/ film review • Interpret graphic data to arrive at an informed conclusion	