गोंय विद्यापीठ
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Email : registrar@unigoa.ac.in
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(Accredited by NAAC)

GU/Acad –PG/BoS -NEP/2024/95 Date: 15.05.2024

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

CIRCULAR

In supersession to the above referred Circular, the Syllabus of Semester III to VIII of the **Bachelor of Science in Chemistry** Programme approved by the Standing Committee of the Academic Council in its meeting held on 06th, 07th and 21st March 2024 is enclosed. Further the Syllabus of Semester I and II approved earlier is also enclosed.

The Dean/ Vice-Deans of the School of Chemical Sciences and Principals of the Affiliated Colleges offering the **Bachelor of Science in Chemistry** Programme are requested to take note of the above and bring the contents of the Circular to the notice of all concerned.

ASHWIN VYAS LAWANDE
Digitally signed by ASHWIN VYAS LAWANDE
Date: 2024.05.15 16:31:12 +05'30'

(Ashwin Lawande)
Assistant Registrar – Academic-PG

To,

The Principals of Affiliated Colleges offering the Bachelor of Science in Chemistry 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.
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.

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 Water and Soil Analysis (1T+ 2P) OR					
II					CHC-142 Skills in Qualitative Organic Analysis (1T+ 2P) OR CHC-143 Chemistry of Cosmetics and Perfumes (1T+ 2P)					CHE-161 Systematic Chemistry Laboratory Techniques (1T+3P)

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 for the Course	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		**No. of Hours**
	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.	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	15

	configurations of the atoms. Stability of half-filled and completely filled orbitals, concept of exchange energy. Relative energies of atomic orbitals, Anomalous electronic configurations.	
	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
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)

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.	06

	ii) Distillation of Acetone and determination of boiling point. iii) Sublimation of Naphthalene and Determination of Melting point. 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
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	

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(Accredited by NAAC)

GU/Acad –PG/BoS -NEP/2024/100 Date: 16.05.2024

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

CIRCULAR

In supersession to the above referred Circular, the Syllabus of Semester III to VIII of the **Bachelor of Science in Microbiology** Programme approved by the Standing Committee of the Academic Council in its meeting held on 06th, 07th and 21st March 2024 is enclosed. The syllabus of Semester I and II approved earlier is also enclosed.

The Dean/ Vice-Deans of the School of Biological Sciences and Biotechnology and Principals of the Affiliated Colleges offering the **Bachelor of Science in Microbiology** Programme are requested to take note of the above and bring the contents of the Circular to the notice of all concerned.

ASHWIN VYAS LAWANDE
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Date: 2024.05.16 10:46:31 +05'30'

(Ashwin Lawande)
Assistant Registrar – Academic-PG

To,

The Principals of Affiliated Colleges offering the Bachelor of Science in Microbiology 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.

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)	English	MIC-141 Techniques in Microbiology - Staining and Microscopy (3) (1T+2P)				20	--
II			MIC-132 Microbiology in Everyday Life (3)	English	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	MIC-211 Environmental Microbiology (4)	MIC-231 Scope of Microbiology (3)	MIL	MIC-241 Dairy Microbiology (3) (1T+2P)				20	--

SEMESTER I

Name of the Programme : B.Sc. Microbiology
Course Code : MIC-100
Title of the Course : Basics of Microbiology
Number of Credits : Theory - 3, Practical - 1
Effective from AY : 2023-24

Prerequisites for the Course	NIL	
Course Objectives	1. To acquaint students with basic concepts in microbiology – history, microbial diversity, microbial growth and its control	
Content		**No. of Hours**
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)**
A	**Microbial cultivation, isolation, pure culture and preservation:** Microbial Cultivation (aerobes and anaerobic bacteria), General principles of preservation, Aerobes: enrichment, streaking, serial dilution and plating 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	**8**
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**	
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/Laboratory Experiments	
References/	1. Atlas RM, Principles of Microbiology. WM.T.Brown Publishers. (1997)	

Reading	2. Cappucino J and Sherman N, Microbiology: A Laboratory Manual. Pearson Education Limited. (2013) 3. Cooper GM and Hausman RE, The Cell: A Molecular Approach. ASM Press and Sunderland, Washington, D.C.,Sinauer Associates, MA. (2013) 4. Madigan MT, Martinko JM, Dunlap PV and Clark DP, Brock Biology of Microorganisms. Pearson International Edition. (2009) 5. Modi HA, Elementary Microbiology Vol I, Fundamentals of Microbiology. (2019) 6. Pelczar MJ, Chan ECS and Krieg NR, Microbiology. McGraw Hill Book Company. (2002) 7. Salle AJ, Fundamental Principles of Bacteriology. Tata McGraw-Hill Education. (1961) 8. Schlegel HG, General Microbiology. Cambridge , University Press. (1993) 9. Stanier RY, Ingraham JL, Wheelis ML, and Painter PR, General Microbiology. McMillan. (1992) 10. Talaro KP, Foundation in Microbiology, McGraw-Hill Education. (2020) 11. Tortora GJ, Funke BR and Case CL, Microbiology: An Introduction. Pearson Education. (2019) 12. Wiley JM, Sherwood LM and Woolverton CJ, Prescott's Microbiology. McGrawHill International (2009)
Course outcome	1. Understand different types of microorganisms and apply the knowledge of different classification systems for grouping microorganism. 2. Explain the cellular organisation of prokaryotic and eukaryotic cells. 3. Apply the techniques for obtaining and preserving pure cultures of bacteria. 4. Elaborate on physical and chemical methods of microbial control.

ATMANIRBHAR BHARAT
SWAYAMPURNA GOA

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(Accredited by NAAC)

GU/Acad –PG/BoS -NEP/2023/543 Date: 03/01/2023

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

CIRCULAR

In supersession to the above referred circular, the updated approved Syllabus of **Bachelor of Science in Industrial Chemistry** Programme with following changes is enclosed.

- Added Skill Enhancement Course, **ICD-141 'Analysis of food products'.**

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

ASHWIN VYAS LAWANDE
Digitally signed by ASHWIN VYAS LAWANDE
Date: 2024.01.03 15:36:01 +05'30'

(Ashwin Lawande)
Assistant Registrar – Academic-PG

To,

1. The Principals of Affiliated Colleges offering the Bachelor of Science in Industrial Chemistry 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) OR ICD-141 (SEC-4) Analysis of food products (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. Industrial Chemistry
Course Code: ICD -111
Title of the course: General Industrial Chemistry
Number of Credits: 4+0
Effective from AY: 2023-24

Pre-requisites	Nil	
Course Objectives:	• To make students to understand basics in industrial chemistry. • The important operations like distillation, evaporation, mixing and crystallization will prove their indispensability in chemical industry. • To make students aware about basic instrumental techniques used in industry.	
Content		**No of hours**
	Nomenclature: Generic names, Trade names and nomenclature of some industrially important chemicals	5
	Dimensions and Units: Basic chemical calculations – atomic weight, molecular weight, equivalent weight, Mole concept, Avogadro's number, composition of liquid and gaseous mixtures.	5
	Renewable Natural Resources: Cellulose & Starch. Their properties & modifications. Important industrial chemicals derived from cellulose & starch. Alcohols, ethanol (industrial solvent) and alcohol-based chemicals, including oxalic acid & furfural.	15
	Unit operations: **Distillation:** Introduction- Single and fractional distillation, Batch and continuous distillation. Azeotropic and extractive distillation **Evaporation:** Introduction- Equipments- short tube (standard) evaporator, forced circulation evaporators, falling film evaporators, climbing film (outward flow) evaporators & wiped film (agitated) evaporators.	15
	Mixing: Concept of Mixing, Types of Mixers	10
	Crystallization: Crystal geometry, principles of crystallization, nucleation, crystal growth, vacuum crystallizer **Industrial pollution:** Pollutants and their statutory limits, pollution evaluation methods. Solid waste management & Industrial safety.	
	Basic analytical equipment: Principles, working & applications of pH meter, conductivity meter, potentiometer, colorimeter.	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 textbook of Industrial Chemistry by Pol, Date, Adhav & Shinde (Manali Prakashan, Pune). 2021 2. UGC course material as prescribed by UGC 3. J. A. Kent: Riegel's Handbook of Industrial Chemistry, CBS Publishers, New Delhi. 1997. 4. The Chemical Process Industries, by R. Norris Shreve McGRAW-HILL BOOK COMPANY, INC. 1945. 5. Engineering chemistry by Jain & Jain. 17th Edition, Dhanpat Rai Publishing company. 2015	

	6. Unit Operations in Chemical Engineering, Warren McCabe, Julian Smith, Peter Harriott 7. Unit Operations – I, K A Gavhane, 25th Edition, Nirali Prakashan. 2015. 8. Instrumental methods of Chemical Analysis by B K Sharma, Krishna Prakashan, 2014. 9. Analytical Chemistry by Gary Christian, Kevin A. Schug, & Purnendu Dasgupta, 7th Edition, John Wiley & Sons. 2013.
Course Outcome:	At the end of the course, students will be able to 1. Study nomenclature and learn generic names, trade names & proper names of different industrially important compounds 2. Understand basic unit operations carried out in industries such as distillation, evaporation, mixing and crystallization and understand the instrumentation. 3. Understand about statutory limits of pollutants, the solid waste management and Industrial safety with respect to chemical hazards. 4. Understand principles, working and applications of basic analytical instruments

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GU/Acad –PG/BoS -NEP/2024/97 Date: 15.05.2024

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

CIRCULAR

In supersession to the above referred Circular, the updated approved Syllabus of the **Bachelor of Science in Botany** Programme approved by the Standing Committee of the Academic Council in its meeting held on 06th, 07th and 21st March 2024 is enclosed.

The Dean/ Vice-Deans of the School of Biological Sciences and Biotechnology and Principals of the Affiliated Colleges offering the **Bachelor of Science in Botany** Programme are requested to take note of the above and bring the contents of the Circular to the notice of all concerned.

ASHWIN VYAS LAWANDE
Digitally signed by ASHWIN VYAS LAWANDE
Date: 2024.05.15 14:30:46 +05'30'

(Ashwin Lawande)
Assistant Registrar – Academic-PG

To,

The Principals of Affiliated Colleges offering the Bachelor of Science in Botany 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 #@$%&* Fundamentals of Botany (3T+1P)	BOT-111 Plants in Everyday Life (4T)	BOT-131 Kitchen Gardening (3) OR BOT-132 Ecosystem Diversity (3)	(2)	BOT-141 Nursery and Gardening (1T+2P)					
II				(2)						BOT-161 Floriculture (1+3)
III	BOT-200 @%* Diversity of Microbes and Non-flowering plants (3T+1P) BOT-201 #$& Plant Physiology (3T+1P)	BOT-211 Algal Plant-Animal Interactions (3T+1P) OR BOT-212 Soil and Water Analysis (3T+1P)	BOT-231 Plant Propagation Methods (3T)	(2)	BOT-241 Herbal Technology (1T+2P)					

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.	**2 hours**
	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).	**4 hours**
	Familiarizing the students to identify plants based on morphology of plant parts. Identify common wild plants using live plants/ herbarium/photographs etc.	**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*).	**2 hours**
	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*).	**3 hours**
	Module 2: Plant resources and utilization-I (including brief description of plants and/or plant parts used).	
	a. **Cereals**: Rice, Wheat, Maize	**2 hours**
	b. **Millets:** Ragi, Jowar and Bajra	**2 hours**
	c. **Legumes**: Bengal gram, Green gram, Red gram, Black gram and Cowpea.	**2 hours**
	d. **Cash crops:** Cashew, Sugarcane and Cocoa.	**2 hours**
	e. **Plantation crops:** Coconut, Banana, Mango and Jackfruit.	**3 hours**
	f. **Edible oils:** Groundnut, Coconut, Soyabean and Palm Oil.	**2 hours**
	g. **Starch and tuber crops:** Potato, Sweet potato and Yam	**1 hour**
	h. **Vegetable crops**: Red amaranth, Radish, Lady's finger, Teren,	**1 hour**

	Kudduki, Ankur and Taikhilo.	
	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*).	**2 hours**
	b. **Beverages:** Tea and Coffee (including processing).	**2 hours**
	c. **Eco-friendly use of plant parts**: Banana fresh leaves, Arecanut spathe, Kumyo leaves (*Carea arborea*), Jackfruit leaves and Bamboo culm.	**2 hours**
	d. **Oils:** Eucalyptus, Rose and Orange peel (including methods of extraction)	**2 hours**
	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)	**4 hours**
	f. **Timber:** Teak (Sailo), Rose wood (Shisham), Matti and Bamboo.	**2 hours**
	g. **Rubber:** *Hevea brasiliensis* (including demonstration of rubber extraction process)	**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.	**3 hours**
	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).	**3 hours**
	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*.	**2 hours**
	Preparation of plant based holi colours.	**1 hour**
	Paper making from plants: Paper industry and paper manufacturing; Raw materials, Processing and kinds of paper, paper Industry in India.	**3 hours**
	Method of making of handmade paper with demonstration/video.	**1 hour**
	Demonstration on preparation of herbal formulation/herbal tea.	**1 hour**
	Field visit in the campus to identify the plants of economic importance and report preparation.	**1 hour**
Pedagogy:	Lectures/ Tutorials/Assignments/Presentation / Demonstration/Field visit/Team based learning.	

References/ Readings:	**1. Billings S and Collingwood S** (2013). The Big book of home remedies. Lulu.com publisher. **2. Buckley, C** (2020). Plant Magic: Herbalism in Real Life. Roost Books Publishers, New York. **3. Chrispeels, MJ and Sadava, DE** (1994). Plants, Genes and Agriculture. Jones & Bartlett Publishers. **4. Fuller, KW and Gallon, JA** (1985). Plant Products and New Technology. Clarendon Press, Oxford, New York. **5. Hill, AF** (1952). Economic Botany: A Textbook of Useful Plants and Plant Products. McGraw Hill Publishing Company Ltd., New Delhi. **6. Kochhar, SL** (2012). Economic Botany in the Tropics. MacMillan India Ltd., New Delhi. **7. Purohit, SS and Vyas, SP** (2008). Medicinal Plant Cultivation: A Scientific Approach. Agrobios, India. **8. Rao, RS** (1985-1986). Flora of Goa, Diu, Daman & Nagar-Haveli. 2 Volumes. Botanical Survey of India. **9. Shailesh, R** (2019). Everyday Ayurveda: The complete book of Ayurvedic home remedies. Notion Press, India. **10. Sambamurty AVSS and Subramanyam NS** (1989). A Textbook of Economic Botany. Wiley Eastern Ltd., New Delhi. **11. Sen, S (**2009). Economic Botany. NCBA Publishers, New Delhi. **12. Sharma, OP** (1996). Hill's Economic Botany. Tata McGraw Hill Publishing Company Ltd., New Delhi. **13. Simpson BB and Conner-Ogorzaly M** (1986). Economic Botany - Plants in Our World. McGraw Hill, New York. **14. Singh V, Pande PC and Jain DK** (2009). A Text Book of Economic Botany. Rastogi Publications, Uttar Pradesh. **15. Trivedi, PC** (2006). Medicinal Plants: Ethnobotanical Approach. Agrobios, India. **16. 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. **17. 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 hours**
	2. Preparation of layout sketches of any 2 types of gardens.	**4 hours**
	3. Familiarization with various tools, implements and plant supports.	**2 hours**
	4. Identification and description of any 2 plants used for avenues, hedges, flower beds, lawns, ornamental shrubs, rock garden, water garden and indoor garden.	**4 hours**
	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 hours**
	6. Treatment of seeds of coriander or other suitable seeds to break dormancy and to find germination percentage of treated seeds.	**2 hours**
	7. Propagation of plants by cutting, layering, budding, grafting, runners, suckers, corms, bulbs, bulbils and tubers.	**6 hours**
	8. Preparation of a coir stick/coir basket.	**2 hours**
	9. Preparation of a garden in window boxes, troughs and trays (any 2).	**4 hours**

	10. Preparation of a terrarium.	**2 hours**
	11. Preparation/creation of a vertical garden and its after care.	**4 hours**
	12. Preparation of potting medium and cultivation of different types of potted plants (foliage, succulent, anthurium and orchid).	**4 hours**
	13. Demonstration of cultivation of house plants and after care of upright and climbing plants.	**4 hours**
	14. Cultivation of any 3 vegetables in the College Botanical Garden (red amaranth, cluster beans, cucurbits, chillies, lady's finger, ginger and tomato).	**6 hours**
	15. Preparation of compost.	**4 hours**
	16. Field visit to a plant nursery or landscape garden.	**4 hours**
Pedagogy:	Lectures, practical, field visits, participatory learning, seminars, assignments etc.	
References/ Readings:	1. **Acquaah, G** (2019). Horticulture: Principles and Practices (4th edition). India: Pearson India Education Services Pvt. Ltd. 2. **Agrawal, PK** (1993). Hand Book of Seed Technology. Department of Agriculture and Cooperation, National Seed Corporation Ltd., New Delhi. 3. **Alphonso, N** (2004). Home Gardening. Agriculture Officers' Association, Panaji – Goa. 4. **Bose, TK and Mukherjee, D** (1972). Gardening in India. Oxford & IBH Publishing Co., New Delhi. 5. **Courtier, J and Clarke, G** (1997). Indoor plants: The Essential Guide to Choosing and Caring for Houseplants. Reader's Digest, New York. 6. **Edmond, JB, Musser, AM and Andrews, FS** (1957). Fundamentals of Horticulture. McGraw Hill Book Co., New Delhi. 7. **Janick, J** (1979). Horticultural Science (3rd edition). W.H. Freeman & Co., San Francisco, USA. 8. **Kumar, N** (1997). Introduction to Horticulture. Rajalakshmi Publications, Nagercoil. 9. **Randhawa, GS and Mukhopadhyay, A** (1986). Floriculture in India. Allied Publishers Limited, New Delhi. 10. **Rao, KM** (2005). Textbook of Horticulture (2nd edition). MacMillan India Limited, New Delhi. 11. **Rao, PS** (2016). Vegetable Crops Production. Sonali Publications, New Delhi. 12. **Sandhu, MK** (1989). Plant Propagation. Wiley Eastern Ltd., Bangalore. 13. **Stevenson, V** (1984). Plants and Flowers in the Home. Treasure Press, London. 14. **Trivedi, PP** (1987). Home Gardening. Indian Council of Agricultural Research, New Delhi. 15. **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.

ATMANIRBHAR BHARAT
SWAYAMPURNA GOA

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(Accredited by NAAC)

GU/Acad –PG/BoS -NEP/2024/111 Date: 17.05.2024

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

CIRCULAR

In supersession to the above referred Circular, the Syllabus of Semester III to VIII of the **Bachelor of Science in Mathematics** Programme approved by the Standing Committee of the Academic Council in its meeting held on 06th, 07th and 21st March 2024 is enclosed. The syllabus of Semester I and II approved earlier is also attached.

The Dean/ Vice-Deans of the School of Physical and Applied Sciences and Principals of the Affiliated Colleges offering the **Bachelor of Science in Mathematics** programme are requested to take note of the above and bring the contents of the Circular to the notice of all concerned.

ASHWIN VYAS LAWANDE
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Date: 2024.05.17 11:07:58 +05'30'

(Ashwin Lawande)
Assistant Registrar – Academic-PG

To,

The Principals of Affiliated Colleges offering the Bachelor of Science in Mathematics 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.

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

Name of the Programme : **B.Sc. Mathematics**
Course Code : **MAT-141**
Title of the Course : **Numerical Analysis using Python/SageMath**
Number of Credits : **3 (1L+2P)**
Effective from AY : **2023-24**

Prerequisites for the Course	Basic 12^{th} standard mathematics.	
Course Objectives:	To make students aware of numerical methods that can be employed to obtain good approximate numerical solutions to problems that may not be able to be solved in a closed form and to effectively use software in these computations.	
Content		**No. of Hours**
Unit I	**Elementary Error Analysis:** Numbers: Exact and Approximate; Significant digits; Errors: Absolute, Relative and Percentage errors; Examples. **Solution of Algebraic and transcendental Equations:** Bisection Method; Regula – Falsi Method; Secant Method; Newton – Raphson Method; Special Cases of Newton – Raphson Method like finding q^{th} root of a positive real number 'd' and finding reciprocal of a positive real number 'd' without using division; Bairstow's Method; Remarks on convergence. **(PROBLEMS IN THIS UNIT TO BE DONE IN PRACTICAL)**	05
Unit II	**Calculus of Finite Differences:** Operators Δ, ∇, & E; Difference Tables; Properties of Δ, ∇, & E; Fundamental Theorem of Difference Calculus; Expression of any value of a function in terms of leading term and leading differences of a difference table. **Interpolation and Extrapolation:** Newton's Forward and Backward Interpolation formulae; Central difference Interpolation formula; Lagrange's Interpolation formula; Newton's Divided Difference formula. **(PROBLEMS IN THIS UNIT TO BE DONE IN PRACTICAL)**	05
Unit III	**Numerical Differentiation and Integration:** Differentiation formulae for equidistant arguments; General quadrature formula for equidistant ordinates (Newton – Cotes Formula or Gauss Legendre quadrature formulae); Trapezoidal rule and its Geometrical interpretation; Simpson's one – third rule; Simpson's three – eighth rule; Weddle's rule. **Method of Least Squares:** Fitting of straight line, Fitting of quadratic curve; Fitting of an exponential curve.	05

	(PROBLEMS IN THIS UNIT TO BE DONE IN PRACTICAL)	
Practical	**Out of the 60 total hours for practical, around 30 hours may be dedicated for manual problem solving.** **The remaining time of around 30 hours shall be utilized for executing the following computations using Python/SageMath:** 1. Finding roots of equations using Bisection method. 2. Finding roots of equations using Regula – Falsi method. 3. Finding roots of equations using Secant method. 4. Finding roots of equations using Newton – Raphson method and Finding q^{th} roots and reciprocals of equations using Newton – Raphson method. 5. Finding roots of polynomials using Bairstow's method. 6. Interpolating data using Newton – Gregory's Forward Difference Interpolation Formula. 7. Interpolating data using Newton – Gregory's Backward Difference Interpolation Formula. 8. Interpolating data using Central Difference Interpolation Formula. 9. Interpolating data using Newton's Divided Difference Interpolation Formula. 10. Interpolating data using Lagrange Interpolation Formula. 11. Computing the first and second order numerical derivative. 12. Calculating the numerical integral using Trapezoidal rule. 13. Calculating the numerical integral using Simpson's $1/3^{rd}$ and $3/8^{th}$ rule. 14. Fitting a straight line to a given data. 15. Fitting quadratic and exponential curves to a given data.	**60**
Pedagogy	Lectures/Practical/Self study. Visualizations using software, wherever possible, is encouraged.	
References/Readings	1) B. S. Grewal: *Numerical Methods in Engineering and Science with Programs in C & C++*, Khanna Publishers, 2010. (**Principal Text**) 2) A. N. Kamthane, and A. A. Kamthane: *Programming and Problem Solving with Python*, McGraw Hill Education, 2017. 3) P. P. Gupta, G. S. Malik, and J. P. Chauhan: *Calculus of Finite Differences & Numerical Analysis*, Krishna Prakashan Media, 2015. 4) S. S. Sastry: *Introductory Methods* of *Numerical Analysis,* Prentice Hall India Pvt. Ltd., 2012.	

	5) SAGE Documentation.
Course Outcomes	The student will be able to, 1. Find the roots of algebraic and transcendental equations. 2. Apply Interpolation to solve real life problems. 3. Make use of the techniques of numerical differentiation and integration. 4. Determine the best line/quadratic curve/exponential curve to fit the give data. 5. Utilize Python/SageMath software to aid mathematical pursuits.

Name of the Programme : **B.Sc. Mathematics**
Course Code : **MAT-142**
Title of the Course : **Statistical Methods Using R/SPSS/PSPP**
Number of Credits : **3 (1L+2P)**
Effective from AY : **2023-24**

Prerequisites for the Course	NIL	
Course Objectives	To make students aware of various statistical methods that can be employed in data analysis, hypothesis testing and research.	
Content		**No. of Hours**
Unit I	**Introduction – Meaning and Scope**: Definition of Statistics; Importance and scope of Statistics; Limitations of Statistics. **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. Graphical representation of various measures of location and dispersion: Bar Graphs, Histograms, Frequency polygons, Ogives, Pie Charts. **Correlation and Regression Analysis**: Introduction; Karl Pearson's coefficient of Correlation; Spearman's Rank correlation; Bivariate Linear Regression Analysis. **(PROBLEMS IN THIS UNIT TO BE DONE IN PRACTICAL)**	**05**
Unit II	**Theory of Probability**: Introduction; Mathematical probability; Statistical probability; Axiomatic probability; Addition theorem of probability; Multiplication theorem of probability; Pair wise and mutual independence; Total probability theorem; Bayes' theorem. **Random Variables**: Random variable; Probability distribution of a Discrete Random Variable; Probability distribution of a Continuous Random Variable; Mathematical Expectations. **Theoretical Distributions**: Binomial distribution; Poisson Distribution; Normal Distribution. **(PROBLEMS IN THIS UNIT TO BE DONE IN PRACTICAL)**	**05**
Unit III	**Testing of Hypothesis**: Interval Estimation; Testing of Hypothesis.	

	Large sample tests: Introduction; Sampling of Attributes; Sampling of Variables. **Parametric tests**: Student's t distribution (Independent and Paired 't' test); One Way and Two Way ANOVA. **Non-Parametric tests**: Chi Square test; Mann-Whitney test; Kruskal Wallis test. **(PROBLEMS IN THIS UNIT TO BE DONE IN PRACTICAL)**	**05**
Practical	**Out of the 60 total hours for practical, 40 hours may be dedicated for manual problem solving.** **The remaining 20 hours shall be utilized for executing the following computations using R/SPSS/PSPP:** 1. Importing data from CSV or Excel file. Data entry in R/SPSS/PSPP. 2. Finding measures of central tendency, namely, mean, median and mode. 3. Finding measures of dispersion, namely, range, quartile deviation, mean deviation and standard deviation. 4. Graphical representations and their interpretations. 5. Analyzing correlation and regression. 6. Testing of hypothesis for single mean and difference of means using independent t- test and paired t-test. 7. Testing of hypothesis for more than two means using ANOVA. 8. Testing of hypothesis regarding independence of attributes using Chi square test. 9. Testing the hypothesis stating that the k independent samples have been drawn from the populations which have identical distributions using Kruskal Wallis test. 10. Working with questionnaires for understanding the collected data and their analysis.	**60**
Pedagogy	Lectures/Practical/Case 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. Calculate measures of central tendencies and variations.	

	2. Interpret correlation and regression. 3. Solve problems in Probability theory. 4. Demonstrate and Infer based on various statistical tests using statistical software.

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(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 VYAS LAWANDE
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Date: 2023.06.30 10:18:38 +05'30'

(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.

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.	

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.	

Name of the Programme: UG General Education Programmes
Course Code: VAC-112
Title of the Course: Green Energy Systems
Number of Credits: 02
Effective from AY: 2023-24

Pre-requisites for the Course	Nil	
Course Objectives:	1. To demonstrate the importance of solar energy collection and storage. 2. To understand the principles of wind energy and biomass energy. 3. To gain knowledge on geothermal and ocean energy. 4. To gain knowledge on geothermal and ocean energy. 5. To understand the concepts of green manufacturing systems.	
Content:	**Unit I Solar, Wind and Biomass Energy** Solar (10 hours) **SOLAR RADIATION**: Role and potential of new and renewable sources, the solar energy option, Environmental impact of solar power, structure of the sun, the solar constant, sun-earth relationships, coordinate systems and coordinates of the sun, extra-terrestrial and terrestrial solar radiation, solar radiation on titled surface, instruments for measuring solar radiation and sun shine, solar radiation data, numerical problems. Photo voltaic energy conversion – types of PV cells. **SOLAR ENERGY COLLECTION:** Flat plate and concentrating collectors, classification of concentrating collectors, orientation. SOLAR ENERGY STORAGE AND APPLICATIONS: Different methods, sensible, latent heat and stratified storage, solar ponds, solar applications- solar heating/cooling technique, solar distillation and drying, solar cookers, central power tower concept and solar chimney. Wind and Biomas (5 hours) **WIND ENERGY**: Sources and potentials, horizontal and vertical axis windmills, performance characteristics, betz criteria, types of winds, wind data measurement. **BIO-MASS**: Principles of bio-conversion, anaerobic/aerobic digestion, types of bio-gas digesters, gas yield, utilization for cooking, bio fuels, I.C. engine operation and economic aspects.	**15 hours**
	Unit II **Geothermal And Ocean Energy, Energy Efecient Systems, And Green Manufacturing Systems** GEOTHERMAL ENERGY: Resources, types of wells, methods of harnessing the energy. OCEAN ENERGY: OTEC, Principles of utilization, setting of OTEC plants, thermodynamic cycles. Tidal and wave energy: Potential and conversion techniques. (A) ELECTRICAL SYSTEMS: Energy efficient motors, energy efficient lighting and control, selection of luminaire, variable voltage variable frequency drives (adjustable speed drives), controls for HVAC (heating, ventilation, and air conditioning), demand site management.	**15 Hours**

	(B) MECHANICAL SYSTEMS: Fuel cells- principle, thermodynamic aspects, selection of fuels & working of various types of fuel cells, environmentally friendly and Energy efficient compressors and pumps. Environmental impact of the current manufacturing practices and systems, benefits of green manufacturing systems, selection of recyclable and environment friendly materials in manufacturing, design and implementation of efficient and sustainable green production systems with examples like environmentally friendly machining, vegetable based cutting fluids, alternate casting and joining techniques, zero waste manufacturing.	
Pedagogy:	Lectures/Experiential Learning	
References/ Readings:	1. Sukhatme S.P. and Nayak J.K. *Solar Energy – Principles of Thermal Collection and Storage*, Tata McGraw Hill,1984. 2. Khan B.H ,*Non-Conventional Energy Resources*, Tata McGraw Hill, New Delhi, 2006. 3. Paulo Davim J. , *Green Manufacturing Processes and Systems*, Springer 2013. 4. K.S Jagadeesh, B.V Venkata Rama Reddy and K.S Nanjunda Rao *Alternative Building Materials and Technologies* 2nd edition,New Age International,2017. 5. D.Yogi Goswami, Frank Krieth & John F Kreider *Principles of Solar Engineering*,4th edition,Taylor & Francis, 2022.	
Course Outcomes	Students will, 1. Explain the importance of solar energy collection and storage 2. Apply the principles of wind energy and biomass energy. 3. Analyse knowledge on geothermal and ocean energy. 4. Learn about energy efficient systems. 5. Discuss the concepts of green manufacturing systems	

Name of the Programme: UG General Education Programmes
Course Code: VAC-116
Title of the Course : Life Skills
Number of Credits: 02
Effective from AY: 2023-24

Pre-requisite	Nil

Objectives:	1. To introduce the students to life skills 2. To understand the connection between emotional, social and thinking skills 3. To train the students in conducting life skills workshop with various stakeholders 4. To develop critical and creative thinking skills	
Content:	**Module 1: Need and Importance of Life Skills Education** a. Introduction to the Concept of Life Skills b. Benefits and application of Life Skills. c. Matching Life Skills with one's behaviour. d. Components of Life Skills (Social- Thinking-Emotional) e. Understanding oneself in the world around: Discovering and Understanding the Inner-Self, Exploring One's Self Identity, Staying in tune with Self, Self Esteem. f. Managing one's emotions/ feelings- Identifying common emotions. **Module 2: Social Skills** a. Interpersonal Relationships- Web of Relationships, Family and Friendships, Healthy Relationships, Resistance to Peer Pressure, Transactions with people around us (Negotiation), Assertiveness. b. Effective Communication- Verbal and Non-Verbal communication (body language) Talking, Hearing vs Listening, Clarity and Optimal communication. c. Empathy- Understanding of other people's circumstances, Extending support to others. d. Coping with Stress- Sources of stress, Coping Strategies.	15 hours 15 hours
Pedagogy:	Lectures/power point presentation/assignments/ games/ films and discussion/ group readings and discussions/ presentations/	
References/ Readings:	1. Central Board of Secondary Education (2010). Teacher's manual on Life Skills for classes – IXX [Manual], Delhi 2. Cottrell, S. (2005). Critical thinking skills: Developing effective analysis and argument. New York: Palgrave Macmillan Ltd. 3. Karen, D. G., & Eastwood A. (2008). (8thEdn.), Psychology for living- adjustment, growth and behaviour today, New Delhi: Pearson Education Inc. 4. McGregor, D. (2007). Developing thinking; developing learning - A guide to thinking skills in education. New York, USA: Open University Press.	
Course Outcomes:	1. Students will be introduced to important Life Skills: Emotional, Social, Critical thinking, and Creative thinking. 2. Students will understand the connection between emotional, social and thinking skills. 3. Students will be able to understand the use of these skills and be able to use them in their own personal lives as well as in the helping profession. 4. Students will develop their critical and creative thinking skills.	

ATMANIRBHAR BHARAT
SWAYAMPURNA GOA

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GU/Acad –PG/BoS -NEP/2024/120 Date: 20.05.2024

Ref: GU/Acad –PG/BoS -NEP/2023/102/6 dated 19.06.2023

CIRCULAR

In supersession to the above referred Circular, the Syllabus of Semester III to VIII of the **Bachelor of Arts in English** Programme approved by the Standing Committee of the Academic Council in its meeting held on 06th, 07th and 21st March 2024 is enclosed. The syllabus of Semester I and II approved earlier is also attached.

The Dean/ Vice-Deans of the Shenoi Goembab School, of Languages and Literature and Principals of the Affiliated Colleges offering the **Bachelor of Arts in English** Programme are requested to take note of the above and bring the contents of the Circular to the notice of all concerned.

ASHWIN VYAS LAWANDE
Digitally signed by ASHWIN VYAS LAWANDE
Date: 2024.05.20 17:40:05 +05'30'

(Ashwin Lawande)
Assistant Registrar – Academic-PG

To,
The Principals of Affiliated Colleges offering the Bachelor of Arts in English Programme.

Copy to:
1. The Director, Directorate of Higher Education, Govt. of Goa
2. The Dean, Shenoi Goembab School of Languages and Literature, Goa University.
3. The Vice-Deans, Shenoi Goembab School of Languages and Literature, 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.

Programme Structure for Semester I to VIII Under Graduate Programme- English										
Semester	Major	Minor	MC	AEC	SEC	I	D	VAC	Total Credits	Exit
I	ENG-100 Introduction to English Literature (4)	ENG-111 Science Fiction in English (4)	ENG-131 Culture Study through Film: India (3) OR ENG-132 Advanced Writing Skills in English (3)	ENG-151 Communicative English: Spoken and written (2)	ENG-141 Soft Skills (3) OR ENG-142 Creative Writing in English (3) (DELETED)					
II		ENG-111 Science Fiction in English (4) ENG-112 Detective Fiction in English (4) (DELETED)	ENG-133 Travel Narratives of India (3) OR ENG-134 Culture Study through Film: America (3)	ENG-152 Digital Content Creation in English (2)	OR ENG-143 English for Competitive Exams (3)					ENG-161 Hotel Front Office Operations (4)

Name of the Programme : **B.A. 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	
		No. of Hours
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.	**15**
	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**
Pedagogy:	Topics to be taught using interactive teaching and the workshop method.	
References/Readings:	1. Beebe, S. A., & Beebe, S. J. *Public Speaking: An audience centered approach*. 8th ed, 2012 2. Hancock, Mark. *English Pronunciation in Use*. Cambridge UP, 2003 onwards. 3. Krishna Mohan and N. P. Singh. *Speaking English Effectively*. Macmillan India Ltd ISBN: 0333925521	

	4. Lougheed, Lin. *Business Correspondence: A Guide to Everyday Writing*. Longman, 2003. 5. Murphy, Raymond. *Murphy's English Grammar*. Cambridge UP. 6. Vyas Manish A., Yogesh L. Patel. *Tasks for the English Classroom*. Macmillan, 2012. 7. 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: 1. Elicit and show respect for the views of others as well as be culturally sensitive. 2. Display emotional stability and self-confidence. 3. Apply critical thinking skills through decision-making and problem-solving. 4. 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 : **B.A. English**
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	
		No. of Hours
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.)	**15**
	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**
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:	1. Frazel, Midge. *Digital Storytelling: Guide for Educators,* International Society for Technology in Education, 2010. 2. Hindle, Tim. *Making Presentations.* Dorling Kindersley Publishers, 1999. 3. Raina, Roshan Lal et al. *Professional Communication*. Himalaya Publishing House, 2012/ later editions 4. Reynolds, Garr. *Presentation Zen: Simple Ideas on Presentation Design and Delivery.* 2nd edition, Voices that Matter, 2011. 5. 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: 1. Create and deliver individual presentations using a variety of digital software 2. Compose and present a digital story 3. Identify and distinguish between different genres of writing 4. Write a book/ film review 5. Interpret graphic data to arrive at an informed conclusion

Name of the Programme : **B.Sc. Computer Science**
Course Code : **CSC-131**
Title of the Course : **Emerging Trends in Computer**
Number of Credits : **3T**
Effective from AY : **2023-24**

Pre-requisites for the Course:	NIL	
Course Objectives:	This course will – 1. enable students to explore current breakthrough technologies in the areas of Artificial Intelligence (AI), Big data and Business Intelligence, IOT, Blockchain that have emerged over the past few years. 2. prepare the students to use technology in their respective professional preparations.	
Content:		**No. of Hours**
	Unit 1: Artificial Intelligence & Business Intelligence (BI) and Big data AI Concept, Scope of AI, Components of AI, Types of AI, Machine Learning (ML) and Natural Language Processing (NLP), Applications of AI, the state of art AI today BI- Definition, Importance, Benefits of Business Intelligence, How BI process works, Stages of Business Intelligence. Big data – Definition, Characteristics, Challenges with Big Data, Traditional Business Intelligence (BI) versus Big Data. Big Data Applications in Business	**15**
	Unit2: Internet of Things (IoT) and Embedded Systems Definition, Characteristics of Embedded System, Real time systems, Real time tasks. Processor basics: General Processors in Computer Vs Embedded Processors, Microcontrollers, Microcontroller Properties, Components of Microcontrollers, Components of Embedded Systems, Introduction to embedded processor Definition, Characteristics of IoT, Trends in Adoption of IoT, IoT Devices, IoT Devices Vs Computers, Societal Benefits of IoT, Technical Building Blocks. IoT functional blocks, IoT enabling technologies, IoT levels and deployment templates, Applications in IoT.	**15**
	Unit 3: Cloud Computing & Blockchain and Cryptocurrency Importance of Cloud Computing, Characteristics, Pros and Cons of Cloud Computing, Migrating into the Cloud, Seven-step model of migration into a Cloud, Trends in Computing. Cloud Service Models: SaaS, PaaS, IaaS, Storage, Cloud Architecture: Cloud Computing Logical Architecture, Developing Holistic Cloud	**15**

	Computing Reference Model, Cloud System Architecture, Cloud Deployment Models. Introduction to Blockchain Technology and its Importance, Evolution of the Blockchain Technology, Elements of a Blockchain A basic crypto currency, Creation of coins, Payments and double spending, Bitcoin –Digital Signatures as Identities – eWallets – Personal Crypto security - Bitcoin Mining	
Pedagogy:	PowerPoint, YouTube Videos	
References/ Readings:	Main Reading: 1. Stuart Russel and Peter Norvig (2015), "*Artificial Intelligence: A Modern Approach*", 3rd Edition, Pearson 2. V.K Jain (2018), "*Big Data and Hadoop*", 2nd Edition, Khanna Publishing 3. Tejaswini N and Yathish R(2019), "*Blockchain for Beginners: The Art of Decentralization & Cryptography*", 1st Edition, Shroff/X-team 4. Cuno Pfister(2011), "*Getting Started with the Internet of Things*", 1st Edition, Make Community 5. ArsheepBahga, Vijay MAdisetti(2015), "Internet of Things: A Hands-On Approach", 1st Edition, Orient Blackswan Private Limited - New Delhi 6. Anandamurugan, T.Priyaa, M.C. Arvind Babu(2017), "Cloud Computing", 1st Edition, Laxmi Publications Pvt. Ltd.	
Course Outcomes:	At the end of the course, students will be able to: 1. Remember different emerging technologies 2. Define emerging trends in Computer Science 3. Select appropriate technology for a given task 4. Identify necessary inputs for applications of emerging technologies	

Name of the Programme : **B.Sc. Computer Science**
Course Code : **CSC-132**
Title of the Course : **Computer Applications**
Number of Credits : **3T**
Effective from AY : **2023-24**

Pre-requisites for the Course:	Nil	
Course Objectives:	1. To provide an understanding of essential Information Technology concepts 2. To familiarize and learn use of various types of IT tools	
Content:		**No. of Hours**
	Unit 1: (Computer Basics) Introduction to computers – Definition, Characteristics, Classification of computers, Components of a Computer System –Hardware Components - Central Processing Unit, Input devices, Output devices, Computer Memory. Categories of Software - System Software and Application Software, Operating Systems - definition and functions. Data - Definition, Types, Data Representation, Types of Number system- Binary, Octal, Hexadecimal Conversion between number bases	**8**
	Unit 2: (Word Processor) Word processing concepts: Use of Templates, Working with word document: Editing text, Find and replace text. Formatting- Text, Paragraphs, Styles, Columns. Bullets and numbering, Tabs, Indent, Page Formatting. Design Themes, Page Background. Page setup Insert: Tables, Illustrations, Links, Comments, Header and Footer, Symbols. Tables: Inserting, filling and formatting a table, Changing cell width and height, Alignment of Text in cell, Delete / Insertion of Row, Column and Merging & Splitting of Cells, Border and Shading. Referencing- Captions, Footnotes and Endnotes Citations and Bibliography, Reference Tables and Indexes, Bookmarks and Cross-References.	**10**
	Unit 3: Spreadsheets Spreadsheet concepts: Managing worksheets; Formatting, Conditional formatting, Entering data, Editing, Handling operators in formula, Project involving multiple spreadsheets, Organizing Charts and graphs, Generally used Spreadsheet functions: Mathematical, Statistical, Financial, Logical, Date and Time, Lookup and reference, Database, and Text functions, Summarizing data using filter. Pivot tables to analyze data. Using What-If Scenario Manager, Goal Seek. Printing a worksheet-working with page breaks, adding headers	**10**

	or footers, choosing what to print.	
	Unit 4: Presentation Software Creating a presentation, creating a Presentation Using a Template, Creating a Blank Presentation, Inserting & Editing Text on Slides, Inserting and Deleting Slides in a Presentation, Saving a Presentation, Manipulating Slides, Inserting Table, Adding ClipArt Pictures, Inserting Other Objects, Resizing and Scaling an Object, Creating & using Master Slide, Presentation of Slides, Choosing a Set Up for Presentation, Running a Slide Show, Transition and Slide Timings, Automating a Slide Show, Providing Aesthetics to Slides & Printing, Enhancing Text Presentation, Working with Color and Line Style, Adding Movie and Sound, Adding Headers, Footers and Notes, Printing Slides and Handouts.	**10**
	Unit 5: User Generated Content Blogs and Wikis. Online Data Capture Tools: Types of data capture form templates (Personal, Work and Education). Question Formats for data capture (short answer, paragraph, multiple choice, check- box, drop-down, linear-scale, multiple choice grid). Data form design (Add new question, add section, add title/description/image/video). Data form distribution techniques (Send via email, publish on social media, send as link). Response management (Print responses, Export to spreadsheet, View analysis, Include analysis in word processing reports)	**7**
Pedagogy:	PowerPoint, Tutorials	
References/ Readings:	Main Reading: 1. Dennis Curtin, Kim Foley, Kunal Sen, Cathy Morin(2017), "*Information Technology The breaking wave*", Indian Edition, McGraw-hillEducation Additional Reading: 1. ITL Education Solutions Limited(2012), "*Introduction to Information Technology*", second edition, Pearson Education India. 2. Satish Jain, Shashank Jain, Shashi Singh & M. Geetha Iyer (2010), *"O" Level made simple "Introduction to ICT resources"*, BPB publication. 3. Pradeep K. Sinha and Priti Sinha(2004), "*Computer fundamentals*", 4th Edition, BPB publications	
Course Outcomes:	At the end of the course the learner will be able to: 1. Understand the essential of Information Technology Concepts 2. Develop practical skills in data capture, analysis and presentation, report formatting 3. Use a range of current, standard, Office Productivity software applications 4. Apply the basic concepts of a word processing package, electronic spreadsheet and PowerPoint tool	