Part A Introduction			
	Class: BSc-I Year [II SEM]	Year: 2022	Session:2022-23
Subject: Botany			
1	Course Code	S1-BOTA2T	
2	Course Title	Basic Botany	
3	Course Type (Core Course/Elective/Generic Elective/Vocational/.....)	Major	
4	Pre-requisite (if any)	To study this course, a student must have had the subject botany in class/12th/ certificate/diploma.	
5	Course Learning outcomes (CLO)	• This course will help the student to understand the diversity of plants and evolutionary process in plant kingdoms. • It gives an accounts of plant adaptations from aquatic condition to colonize terrestrial habitat. • The changes in morphological, anatomical and reproductive structures that propel plant evolution can be investigated. • The economic importance and significance of plants in nature will be understood. • They will be acquainted with locally prevalent microbial diseases of plants and humans	
6	Credit Value	4 Credits	
7	Total Marks	Max. Marks: 40+60 Min. Passing Marks:35	
Part B- Content of the Course			
Total No. of Lectures- 60 Tutorials- 0 Practical =0 (theory 4 hours per week): L-T-P:			

Unit	Topics	No. of Lectures
I	1.1 History of Botany and Indian Contributions. 1.2Morphological Characteristics of lower and higher) plants(Angiosperms. 1.3Types of leaves. Inflorescence, Flowers and Fruits. 1.4 Structure of Plant cell and cell organelles, Prokaryotic and Eukaryotic Cells, types of Cell division. 1.5 Microscope structure and function of light microscope (magnification and resolving power), 1.6 Various types of Microscopes: Bright field, Phase Contrast, SEM and TEM.	12
II	1. Algae 1.1General characteristics 1.2Range of thallus organization, reproduction. 1.3Types of life-cycles in algae 1.4 Role of algae in nature and its economic importance.	12

	2.Bryophytes : 2.1General characteristics, Ecology. 2.2Range of thallus organization, morphology, anatomy(internal and external features) and reproduction of any one Bryophyte. 2.3 Economic importance of Bryophytes	
III	**1Pteridophytes** **1.1General** characteristics and morphology. 1.2Stelar organization and reproduction. 1.3Heterospory and seed habit. 1.4Economical importance 2.Gymnosperms 2.1General description and their distribution. 2.2Economical importance of Gymnosperms. 3.Paleobotany 3.1Indian contribution in Paleobotany. 3.2Brief knowledge of Fossils and Geological time scale.	12
IV	1Fungi **1.1** General characteristics and cell wall composition. 1.2 Mode of nutrition 1.3 Types of reproduction 1.4 Economic importance 1.5Parasexuality and Mycorrhiza 2. Lichens: Brief knowledge and their significance.	12
V	1Microbes **1.1Brief** outline of various types of Microbes 1.2Archaebacteria, Eubacteria, Cyanobacteria, Mycoplasma, Actinomycetes and Virus. 1.3 Beneficial and harmful roles.	12

Keywords/Tags: History of Botany, Palebotany, Prokaryotes, Eukaryotes, Algae, Bryophyta, Pteridophyta, Gymnosperms, Fungi , Mycorrhiza, Lichens, Bacteria, Virus

Part C-Learning Resources

Text Books, Reference Books, Other resources

Suggested **Readings:**

I	Oladele Ogunseitan, Microbial Diversity: Form and Function in Prokaryotes, Wiley Blackwel1,2008.
2.	Pelczar, M.J et al., Microbiology, Tata McGraw-Hill Co, New Delhi,5th edition, 2001.
3.	Presscott, L. Harley, J. and Klein, **D.,** Microbiology, Tata McGraw- Hill Co. New Delhi,6th edn., 2005.
4.	Fritsch F.E., The Structure & Reproduction of Algae, Vol. I & Vol. 11., CambridgeUniversity Press, Cambridge, U.K. 1945.
5.	Smith, G.M., Cryptogamic Botany, Vol. I: Algae, Fungi, & Lichens, McGraw-Hill Book Co., New York, 1955.
6.	IanMorris,An Introduction to the Algae, Hutchinson, London, 1967.

Part A Introduction			
Program: Certificate	**Class: BSc-I Year [II SEM]**	**Year: 2022**	**Session: 2022-23**
Subject : Botany P r a c t i c a l			

1	**Course Code**	S1-BOTA2P	
2	**Course Title**	**Basic Botany Practical**	
3	**Course Type (Core Course/Elective/Generic Elective/Vocational/.....)**	Major	
4	**Pre-requisite (if any)**	To study this course, a student must have had the subject of Biology/ Life science/Agriculture in class 12th.	
5	**Course Learning outcomes (CLO)**	• **Students will learn** to carry out practical work in the laboratory, • Interpreting plant morphology and anatomy of various groups of lower and higher plants. • Students will be able to identify the major groups of microorganisms.	
6	**Credit Value**	**2** **Credits**	
7	**Total Marks**	Max. Marks: 40+60 Min. Passing Marks:35	
Part B- Content of the Course			
Total No. of Practical- 30 Hours Tutorials- 00 - Practical (2 hours per week): L-T-P:			

Unit	Topics	No. of Practical
I to V	1. Study of various types of leaves , inflorescence, Flowers and fruits. 2. Understanding various parts of Microscope(simple and compound microscope) 3. Study of plant cells (e.g. Onion etc.) 4. Study of permanent slides of Mitosis and meiosis 5. Study of Electron Micrographs of Cell and organelles from Internet, You -Tube. 6. Identification of various algae from specimens, slides and temporary mounts of water from nearby areas like, *Noslo•, Os•illato•ia, Volvox, Spirokira, Oedogonium, Chard* and specimens and pictographs of marine algae like *Ectoccupu.s., Sargassinn, Polysiphonia.* 7. Study and identification of some Bryophytes like *Riccia, Marchaniia, Anthoceros, F1117C1•ia and* Field visit. 8. Study of some fossils (specimens and slides) 9. Study of some Pteridophytes like *Ly•opodium, Sellaginella, Equisenun, Marselia* andstudy of any one fern	**30**

Part A Introduction			
Program- CERTIFICATE	**Class- B.Sc. Year-First[II SEM]**	**Session 2022**	**Session- 2022-2023**
Subject – Chemistry			
	Course Code	**S1-CHEM2T**	
	Course Title	**Analytical Chemistry**	
	Course Type	Major	
	Pre-requisite (if any)	To study this course students must have had the subject Chemistry in class +2 or equivalent.	
	Course Learning Outcomes (CLO)	By the this course students will learn the following aspects of Chemistry: 1. Basic concepts of Mathematics for Chemists. 2. Fundamentals of analytical chemistry and steps involved in analysis. 3. Basic Knowledge of Computer for chemists. 4. Basic Concepts of Chemical equilibrium. 5. Principles of Chromatography and chromatographic techniques. 6. Various techniques of Spectroscopic Analysis.	
	Credit Value	4	
	Total marks	Maximum Marks: CCE-40 University Exam (UE)-60	Minimum Passing Marks:35

Unit	Topic	No. of Lectures

Part B – Content of the course

Total No. of Lectures-Tutorials-Practical (In hours per week): L-T-P: 90-0-30

Unit	Topic	No. of Lectures
1	**Mathematics for Chemists** Straight line equation, Logarithmic relation, curve sketching, linear graphs & calculation of slopes. Differentiation, differentiation of functions like k_x, e^x, x^n, sinx, logx, maxima & minima, partial differentiation. Integration of some useful relevant functions. *Keywords/Tags: Linear graphs, Logarithmic Relation, Differentiation, Integration.*	10
2	**Basic Analytical Chemistry:** Introduction to Analytical Chemistry and its interdisciplinary nature. Concept of sampling. Importance of accuracy, precision and sources of error in analytical measurement . Presentation of experimental data and results, from the point of view of significant figures, statistical terms: mean, mean deviation, median standard deviation, Numerical Problems. **Calculations used in Analytical Chemistry** **Some Important units of measurements-** SI Units, distinction between mass and weight, mole, milli mole and Numerical Problems. **Solution and their concentrations-** Concept of Molarity, molality adn normality, Expressing the concerntration in parts poer million (ppm), parts per billion (ppb), Numerical Problems. **Chemical Stoichiometry-** Empirical and Molecular Formulas, Stoichiometric Calculations, Numerical Problems. *Keywords/Tags: Accuracy, Precision, SI units, Units of Concentration, Chemical stoichiometry.*	10
3	**Computer for chemists** Introduction to computer, Introduction to operating systems like- DOS, Windows, Linux and Ubuntu. **Use of computer programs** Running of standard programs & packages such as MS-word, MS-excel, PowerPoint, Execution of linear regression x-y Plot. Use of software's for drawing structures and molecular formulae. Keywords/Tags: Operating systems, MS-word, MS-excel, PowerPoint.	10
4	**Chemical Equilibrium:** Equilibrium constant and free energy, concept of chemical potential, Thermodynamic derivation of law of chemical equilibrium. Temperature dependence of equilibrium constant; Van't Hoff reaction isochore, Van's Hoff reaction isotherm. Le-Chetelier's principle and itsapplications. *Keywords/Tags: Chemical Equilibrium, Equilibrium constant,* *Free Energy, ChemicalPotential.*	10

| 5 | **Chromatography:**
 Introduction, Principle and Classification. Mechanism of separation: adsorption, partition & ion-exchange.
 Development of chromatograms: frontal, elution and displacement methods. Paper Chromatography (ascending, descending and circular), Thin layer Chromatography (TLC) and Column Chromatography (CC), Gas Chromatography (GC) and High Pressure Liquid Chromatography (HPLC), types of column and column selection, applications, limitations.
 Principle and Application of:
 • Flash chromatography,
 • Ion-exchange chromatography and
 • Chiral chromatography.

 Keywords/Tags: Chromatography, Ion Exchange, Column Selection, Adsorption. | |
| 6 | **Spectrum techniques of analysis**
 Basic of absorption spectroscopy: Electromagnetic radiation, Spectral range. Absorption, Absorptivity, Molar Absorptivity, Fundamental Laws of Absorption, Lambert-Beer Law and its limitations.

 Constitution & working of photometer, spectrometer, colorimeter.

 Ultraviolet (UV) absorption spectroscopy-
 Presentation and analysis of UV spectra, Types of electronic transistions, Effect of conjuction. Concept of chromphore and auxochrome. Bathochromic, hypsochromic, Hyperchromic and hypochromic shifts. UV spectra of conjugated polyenes and enones.

 Infra-red (IR) absorption spectroscopy-
 Molecular vibrations, Hooke's law, selection rules, intensity and position of IR bands, Measurement of IR spectrum, finger print region, characteristic absorption of various functional groups and interpretation of IR spectra of simple organic compounds.
 Keywords/Tags: Hypsochromic, Hypochromic, Absorption, Spectrum | |

Part C- Learning resources
Text Books, Reference Books, Other Resources

Text Books

1. Gaur,S., Computer for Chemists, Neel Kamal Prakashan,2017.

2. Khopkar, S.M. Basic Concept of Analytical Chemistry, New Age, Internations Publisher, 2009.

3. Kaur H, Analytical Chemistry, Pragati Prakashan(2008).

4. Gupta, Alka L., Analytical Chemistry , Pragati Prakashan (2020).

5. Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.

6. Kaur H, Instrumental Methods of Chemical Analysis, Pragati Prakashan, 2018.

7. Sharma B.K., Chromatography, Krishna Prakashan,2019.

8. Sharma Y.R., Elementry Organic Spectroscopy, S Chand, 2013.

9. Singh, DR Saxena, G., Singh, B., Inorganic Chemicals, Shivlal Aggrawal & Company, Agra.

10. Srivastava, S.S., Gehlot, A.S., Chemistry, Ratan Prakashan Temple, Indore.

11. Soni, PL, Organic Chemistry, Sultan Chand and Sons, Delhi.

12. Singh, R.K.P., Modern Chemistry, Sahitya Bhavan, Agra.

13. Agnihotri, PK, Sahu, D

14. P., Pillai, A., Sahu, M., Yugbodh Chemistry, Yugbodh Publications, Raipur.

Reference Books:

1. Mitra Surbhi, Handbook of Computer Science & IT, Arihant, 2018.

2. Harris, D.C. Quantitative Chemical Analysis, 6th Ed., Freeman (2007).

3. Christian, Gary D; Analytical Chemistry, 6th Ed. John Wiley & Sons, New York, 2004.

4. Barrow, G.M. Physical Chemistry, Tata McGraw-Hill (2007)

5. Atkins' Physical Chemistry,   10th Edition, Oxford University Press 2014.

6. Gurtu J.N. Gurtu A, Advanced Physical Chemistry, Pragati Prakashan, Meerut, ISBN:9789386633347, 9386633345; Edition: IV, 2017.

7. Atkins, P.W. & Paula, J. Physical Chemistry, Oxford Press, 2016.

8. Finar, I.L. Organic Chemistry (Vol. I & II), E.L.B.S.

9. Morrison, R.T. & Boyd, R.N. Organic Chemistry, Pearson, 2010.

10. Banwell, Molecular Spectroscopy, 2017.

11. Silverstien Robert, Spectrometric Identification of Organic Compounds, Wiley, 2014.

12. Dyer J.R., Applications of Absorption Spectroscopy of Organic Compounds, 2009.

PRACTICAL				
Program-CERTIFICATE	Class- B.Sc. I Year[II SEM]		Year- 2022	Session: 2022-2023
Subject – Chemistry				
1	Course Code	**S1-CHEM2P**		
	Course Title	**Analytical Processes and Techniques**		
2	Course Type	Major		
3	Course Learning Outcomes (CLO)	**By the end of this course students will learn the following aspects of Laboratory exercises in Chemistry:** 1. Concepts and analytical methods in Chemistry. 2. Preparation of solutions of different concentrations. 3. Standardization of the solution. 4. Identification of Organic compounds by chromatographic techniques. 5. Analysis by Spectral Techniques.		
4	Credit Value	2		
Total Marks	Maximum Marks: University Exam (UE)-60 CCE-40		Minimum Passing Marks: 35	

	External Assessment	Marks
	Experiments to be performed in laboratory	**50**
1	**Basic analytical exercises** ● Calibration of different weights and glass apparatus (measuring cylinder, burette, pipette, volumetric flasks). ● Preparation of solutions of different morality/normality by weighing and dilution.	10
2	**Quantitative Analysis** ● **Titrimetric Analysis** ● Standardization of NaOH with Oxalic acid. ● Determination of carbonate and hydroxide presentin mixture. ● Determination of carbonate and bicarbonate present in a mixture. ● Determination of free alkali present indifferent soaps/detergents.	20
3	**Quantitative Analysis by Colorimetry** ● Verification of Lambert-Beer Law ● Determination of concentration of coloured compounds (e.g., $CuSO_4$, $KMnO_4$)	10
4	**Qualitative Analysis** ● Systematic identification of organic compound by qualitative analysis. ● Chromatography: Identification by determination of the R_f values of the given organic/ inorganic compounds by paper/thin layer chromatography. *Keywords/Tags: Analytical, Authentication, Molarity/ Normality, Standardization, Colorimetry, Qualitative Analysis*	10

Program :**Certificate**		Class: **B.Sc I Year [II SEM].**	**Year : 2022**	Session: **2022-2023**
Subject : **Computer Science**				
1.	Course Code	**S1-COSC2T**		
2.	Course Title	**Programming Methodology & Data Structure**		
3.	Course Type (Core Course/Elective/Generic Elective/Vocational)	Major		
4.	Pre-Requisite (if any)	To study this course ,a students must have had the subject Physics/Maths in 12th class .		
5.	Course Learning Outcomes(CLO)	On the Completion of this course ,learners will be able to: 1. Develop simple algorithm and flow chart to solve the problem with programming using top down design principles . 2. Writing efficient and well structured computer algorithms/programs . 3. Learn to formulate iterative solutions and array processing algorithms for problems . 4. Use the recursive technique ,pointers and searching methods in programming . 5. Will be familiar with fundamental data structure ,their implementation ; become accustomed to the description of algorithm in both functional and procedural styles . 6. Have knowledge of complexity of basic operations like insert ,delete ,search on these data structure . 7. Posses ability to choose a data structure to suitably model any data used in computer applications . 8. Design programs using various data structure including hash table ,Binary and general search Tree ,heaps ,Graphs etc. 9. Asses efficiency tradeoffs among different data structure implementations. 10. Implement and know the applications of algorithms for searching and sorting etc. 11. Know the contributions of Indian in the field of programming data structures.		
6.	Credit value	**Theory-4 Credits**		

7	Total Marks	Max .Marks : **40+60**	Min. Passing Marks :**35**

| Part B:Content Of the Course | | | |

No. of Lectures (in hours per week): **2 Hours per week**

Total No. of Lectures: 60 **HRS.**

Module	Topics	No. of Lectures
I	**Introduction to Programming** :Program concepts ,Characteristics of programming, Stages in program Development, Algorithms, Notations ,Design ,Flow chart, Types of programming Methodologies . **Inroduction to C++ Programming** :Basic Program Structure in the C++,Data types,Variable,Constatnts ,Opearators and basic I/O . **Variable:**Declaring ,defining and initializing variables, scope of variables ,using named constants ,Keywords,Casting of data types ,Opearators(Arithmetic,Logical and Bitwise),Using comments in programs,Character I/O (getc,getchr,putc,putchr etc.),Formatted and console I/O(printf(),scanf(),cin,cout),using basic header files (stdio.h,iostream.h,conio.h etc.). **Simple Expressions in C++** : (Including unary operator Eepressions,Binary operator expressions), understanding operator precedence in expressions .	8
II	**Iterativestatements :**while ,do-while and for loops,use break and continue loops,Using nested Statements (Conditional as well as Iterative). **Functions**:Top-Down design,Pre-defined functions, Programmer defined functions,local variable and global variables,Functionas with default Arguments ,Call by Value and Call by References, Parameters, Recursions. **Introduction to Arrays**: Declaration and Referring Arrays,Arrays in Memory,Initializing Array. Arrays in Functions,Multi-Dimentional Arrays.	10

III	**Structures :**Member Accessing ,Pointers to Structure ,Structureand Functions ,Array of Structure . **Unions :**Declaration and Initialization. **Strings:**Reading and Writing Strings,Arrays of Strings,Strings and Structures, Standard String and Structure, Standard String library Functions. **Searching Algorithms:**LinearSearch,Binary Search . **File Handling :**Use of Files for data input and output ,merging and copying files **.**	8
IV	**Data Structure** :Basic Concepts, Linear and non linear data structure . **Algorithm Specification** –Introduction,recursivealgorithms,Data Abstraction, Performance Analysis. **Linked List**: Singly Linked List, Operations, Concatenating,Circularly linked list ,Doubly linked list –Operations. **Array:** Representation of single,Two Dimensional arrays, sparse matrices-array and linked Representation. **Stacks:**Operations array and linked implementations,applications infix to postfix conversion, postfix expression evaluation, Recursion Implementation.	12
V	**Queue** –Definition, operation,array and linked implementations . Circular Queue- insertion and deletion operations ,Dequeue (Double ended Queue) ,priority Queue-Implementation. **Trees :** Binary Tree Representation –Properties of Binary Tree ,Binary Tree Representation,-Arrayand Linked Representation, Binary Tree Traversal,Threaded Binary Tree. **Heap:** Definition,Insertion,Deletion.	10
VI	**Graphs** – Graph ADT, Graph Representation Graph Traversals, searching. **Hashing** - Introduction, Hash tables, Hash functions, Overflow Handling **Sorting Methods –** Comparison Sorting Methods. **Search Tree-**Binary Search Tree,Avl Tree –definition and Examples.	10
VII	**Indian contribution to the field –** Innovation in India, Origin of Julia Programming Language, Indian Engineers who designed new programming Languages, open sourselanguages ,Dr. Sanjay Sahni-Computer Scientist- pioneer of Data Structures, other relevant contributors and contributions. Keyword /Tags: Digital Electronics ,Logic gates ,AND ,OR,NOT ,IC 7486,IC 7400,NAND ,NOR,IC 7483, Circuit , Flip Flop , Demorgan's Theorem .	2
	PART C: Learning Recourses	
	Textbooks, References Books, Other Recourses	

Suggested Readings :

- Lipschutz: Schaun's outline series Data Structure ,Tata Mcgraw Hill
- Problem Solving and Program Design in C,J.R.Hanly and E.B.Koffman ,Pearson.2015
- E.Balaguruswamy,"C++TMH Publication ISBN O-07-462038-X.
- HerbertzShield,"C++ the complete References" TMH Publication.
- R.Lafore, 'Object Oriented Programming C++.
- N. Dale and C .Weems ,Programming and Problem solving with C++ :brief edition,Jones& Bartlett learnig.
- Adam Drozdek," Data structure and Algorithms in C++",Third edition Cengage Learning.
- SartajSahani, Data Structure ,Algorithms and Applications with C++ ,McGraw Hill.
- Robert L. Kruse," Data Structure and Program Design inC++',Pearson.
- D.S. Malik,Data Structure using C++,Second Edition ,Cengage Learning.
- M.A. Weiss ,Data structure and Algorithms Analysis in C,2nd edition ,Pearson.
- M.A. Weiss,Data structure and Algorithm Analysis in C,2^{nd}edition,Pearson.

Suggested Digital Platforms ,Web links :

1. https://www.youtube.com/watch?v=BC1S40yzssA
2. https://www.youtube.com/watch?v=vLnPwxZdW4Y&vl=en
3. https://www.youtube.com/watch?v=Umm1ZQ5ltZw
4. https://www.youtube.com/watch?v=AT141CXuMKI&list=PLdo5W4Nhv31bbkJzrsKfMpo_grxuLI8LU

Part A- Introduction			
Program: Certificate	**Class**: B.Sc. I Year[II SEM]	**Year**: 2022	**Session**: 2022-2023
Subject: Mathematics			
Course Code	S1-MATH2T		
Course Title	**Calculus and Differential Equations**		
Course Type (Core/Elective/ Generic Elective/Vocational/...)	Major		
Pre-requisite (if any)	To study this course, a student must have had the subject Mathematics in 12 class.		
Course Learning Outcomes (CLO)	The course will enable the students to: 1. Sketch curves in a plane using its Mathematical properties in the different coordinate systems of reference. 2. Using the derivatives in Optimization, Social sciences, Physics and Life sciences etc. 3. Formulate the Differential equations for various Mathematical models. 4. Using techniques to solve and analyze various Mathematical models.		
Credit Value	6		
Total Marks	**Max. Marks: 40+60**		**Min. Marks: 35**

Part B- Content of the Course		
Total numbers of Lectures(in hours per week): 3 hours per week		
Total Lectures: 90 hours		
Unit	**Topics**	**Numbers of Lectures**

1	1.1 Historical background:
	    1.1.1 Development of Indian Mathematics ancient and early classical period (Till 500 Cen.)
	    1.1.2 A brief biography of Bhaskaracharya (with special reference to Lilavati and Madhava)
	1.2 Successive Differentiation
	    1.2.1 Leibnitz Theorem
	    1.2.2 Maclaurin's series Expansion
	    1.2.3 Taylor's series Expansion
	1.3 Partial Differentiation
	    1.3.1 Partial Derivatives of higher order
	    1.3.2 Euler's theorem on homogeneous functions
	1.4 Asymptotes
	    1.4.1 Asymptotes of algebraic curves
		18

	1.4.2 Condition for Existence of Asymptotes 1.4.3 Parallel Asymptotes 1.4.4 Asymptotes of polar curves	

2	2.1 Curvature '
	    2.1.1 Formula for radius of Curvature
	    2.1.2 Curvature at origin
	    2.1.3 Centre of Curvature
	2.2 Concavity and Convexity
	    2.2.1 Concavity and Convexity of curves
	    2.2.2 Point of inflexion
	    2.2.3 Singular point
	    2.2.4 Multiple points
	2.3 Tracing of curves
	    2.3.1 Curves represented by Cartesian equation
	    2.3.2 Curves represented by Polar equation
		18

3	3.1 Integration of Transcendental Functions
	3.2 Introduction to Double and Triple Integral
	3.3 Reduction formulae
	3.4 Quadrature
	    3.4.1 For Cartesian coordinates
	    3.4.2 For Polar coordinates
	3.5 Rectification
	    3.5.1 For Cartesian coordinates
	    3.5.2 For Polar coordinates
		18

4	4.1 Linear Differential Equations
	    4.1.1 Linear equation
	    4.1.2 Equations reducible to the linear form
	    4.1.3 Change of variables
	4.2 Exact Differential equations
	4.3 First order and higher degree Differential equations
	    4.3.1 Equations solvable for x, y and p
	    4.3.2 Equations homogenous in x and y
	    4.3.3 Clairaut's equation
	    4.3.4 Singular solutions
	    4.3.5 Geometrical meaning of Differential equations
	    4.3.6 Orthogonal trajectories
		18

5	5.1 Linear Differential equation with constant coefficients 5.2 Homogeneous linear ordinary Differential equations 5.3 Linear Differential equations of second order 5.4 Transformation of equations by changing the Dependent/Independent variables 5.5 Method of Variation of parameters	**18**

Keywords/Tags:
Indian Mathematics, Successive Differentiation, Partial Differentiation, Asymptotes, Curvature, Tracing of Curves, Quadrature, Rectification, Linear Differential Equations, Method of Variation of Parameters.

Part C-Learning Resources
Text Books, Reference Books, Other resources

Suggested Readings:

Text Books:

1. Gorakh Prasad: Differential Calculus, Pothishala Pvt. Ltd. Allahabad, 20l6.
2. Gorakh Prasad: Integral Calculus, Pothishala Private Lld.. Allahabad, 2015.
3. M. D. Raisinghania: Ordinary and Partial Differential equations. S Chand & Co Ltd., 2017.
4. Gerard G. Emch, R.Sridharan and M. D. Srinivas: Contributions to the History of lndian Mathematics, Hindustan Book Agency, vol. 3, 2005.
5. Madhya Pradesh hindi granth academy books.

Reference Books:

1. N. Piskunov: Differential and Integral Calculus, CBS Publishers,1996.
2. G. F. Simmons: Differential Equations, Tata McGraw Hill, 1972.
3. E. A. Codington: An introduction to ordinary differential Equation, Prentice Hall of India, 196l.
4. D. A. Murray: Introductory Course in Differential Equations, Orient Longman   (india), 1967.
5. H. T. H Piaggio: Elementary Treatise on Differential Equations and their Application, C. B.S. Publisher & Distributors Delhi, 1985.
6. Bibhutibhusan Datta and Avadhesh Narayan Singh: History of Hindu Mathematics, Asia Publishing House,1962.

Program Certificate Course	Class: B.SC.I Year [II SEM]	Year : FIRST Year	Session :2022-2023	
		Subject : Microbiology		
1	**Course Code**		S1-MBIO2T	
2	**Course Title**		**Microbial Techniques**	
3	**Course Type**		Major	
4	**Pre- requisite (if any)**		To Study this course a student must have had the subject	
5	**Course Learning outcomes (CLO)**		After completing this course in Microbiology ,a student shall have understanding of- • Recall the basic lab glassware to be used in the laboratory. • Summarize different methods of sterilization and isolation of pure cultures. • Understand the working of different kinds of instruments and microscopes. • Apply serial dilution technique to isolate the bacteria. • Practice different methods to culture bacteria in the laboratory • Illustrate a method to differentiate between gram positive and gram negative bacteria.	
6	**Credit Value**		4	
7	**Total Marks**	Maximum Marks:40+60		Minimum Passing Marks: 35

Part B- Content of the Course
Total no of Lectures –60 Lectures- Tutorials- practical (in hours per week) L-T-P:4-0-0 Total No. of Lectures: 15

Unit	Topics		No. of Lectures
I	**MICROSCOPY AND STAINING** **1.1 MICROSCOPY-** PRINCIPLES AND APPLICATION OF SIMPLE AND COMPOUND Bright- field microscopy, phase- contrast microscopy, transmission electron microscopy and scanning electron microscopy. **1.2 Preparation for light microscope Examination-** wet mount and hanging – drop techniques preparation for simmer and fixation **1.3 Staining-** principles of staining, negative staining, simple staining, differential staining (Gram and acid fast staining), flagella staining capsule and endospore staining,		15

		mount,Hnging drop method, Bacterial staining.		
II		**Instruments** Electronic Balance, autoclave, centrifuge ,colony counter, deep freezer, homogenizer, hot air oven,incubator,laminar air flow, magnetic stirrer, P h meter, spectrophotometer, vortex mixture, water bath, water distiller chromatography chamber anaerobic chamber and electrophoresis apparatus.	15	
III		**Sterilization and culture medium** 3.1 **Physical methods of sterilization:** Dry heat, moist heat, radiation, filtration, and incineration. 3.2 **Chemical methods of sterilization-** Phenol and phenolic compounds, Alcohol, Halogens, and detergents. 3.3 **Types of culture media-** Natural, synthetic, complex, enriched, and selective. Anaerobic (Trio glycol ate broth, Robertson's media,) broth culture of aerobic bacteria. **Keywords:** Physical sterilization, Chemical sterilization, microbial culture media.		
IV		**Isolation, Cultivation and preservation** 4.1 **Natural microbial population-** Pure culture 4.2 **Isolation of microbial population-** From air, water, and soil. 4.3 **Methods for isolation:** Streak plate, pour plate and spread plate. Serial dilution and micromanipulator methods. Cultivation on liquid and solid media, Isolation of micro organisms on potato slice and bread. 4.4 **Maintenance and preservation** for short term and long term. 4.5 **Cultivation** OF Anaerobic bacteria, and accessing non-cultivable microorganisms. **Key words:** Pure culture, isolation of microbes, preservation of culture.		
		Part C-Learning Resources		
		Text books, Reference Books, Other resources		
		Suggested Reading: 1. Pelzer, M.J., , E.C.S and Krieg, N.R. "Microbiology" Tata McGraw- Hill, New DELHI,(2001) 2. Tortuga G.J, Finke Br, Case "Microbiology". An Introduction, 9th edition Pearson		

	Education (2008)
	3. Willey J.M., Sherwood L.M., Wool verton C.J.,"PRESCOTT'S Microbiology", 9th edition (2013)
	4. Madigan, M.T., Marino, J.M., Dunlap, P.V. AND Clark D.P., "Brock Biology of

Part A Introduction			
Program Certificate Course	**Class: B.SC. I Year[II SEM]**	**Year:2022**	**Session :2022-2023 onwards**

Subject : Microbiology		
1	**Course Code**	**S1-MBIO2P**
2	**Course Title**	**Microbial Tools and Techniques Practical**
3	**Course Type**	**Major**
4	**Pre- requisite (if any)**	To Study this course a student must have had the subject
5	**Course Learning outcomes (CLO)**	**On completion of this course, learners will be able to understand:** • Basic Knowledge of glassware, microscopes and different kinds of instruments used in the microbiology laboratory. • Basic media preparation technique, autoclaving, cleaning and sterilization of glassware. • Preparation of liquid and solid culture media. • Isolation of microorganisms by different plating methods.
6	**Credit Value**	**2**
7	**Total Marks**	Maximum Marks:40+60 Minimum Passing Marks: 35

Part B – Content of the Course

Total No. of Lectures:30
Lectures – Tutorial – Practical (In hours per week): L-T-P: 0-0-2

S. No.	Name of the Exercise	No. of Lab Hours
1.	Demonstration and briefing about principles and working of basic instruments.	**4**
2.	Basic media preparation technique, autoclaving, cleaning and sterilization of glass ware.	6
3	Preparation of liquid culture media- Peptone water, nutrient broth	2
4.	Preparation of solid culture media – Nutrient agar (agar slant/ agar plate)	2
5.	Isolation of microbes from water , soil and air by serial dilution agar plating method.	3
6.	Isolation of fungi from water, soil and air by serial dilution agar plating method.	3
7.	Isolation of microorganisms by pour plate method.	3
8.	Isolation of microorganisms by streak plate method	3
9.	Isolation of microorganisms by spread plate method.	3
10.	Any other experiment may be designed on the basis of theoretical aspects.	1

Keywords: Basic instruments, Culture media, pour plate, streak plate, spread plate.

Part- C Learning Resources

Text Books, References, and other Resources Books

1.Cappuccino ,J and Sherman, N., "Microbiology : A Laboratory Manual ", 9th edition .Pearson Eduction Limited .(2010).

2.Dubey , R.C. and Maheswari, D.K. , "Practical Microbiology" ,.S. Chand &Co.Ltd.,New Delhi

3.M. Gopoal Reddy , M., Reddy m.n. Saigopal , D.V.R. and Mallaiah K.V.," Laboratory Experiments in Microbiology", Himaliya Publishing House , Mumbai (2007).

4.Aneja , K.R., " Laboratory Manual of Microbiology and Biotechnology.2:Edition", Meditech Scientific International .(2018).

5.Patel, Rakesh J and Patel Kiran, R., " Experiments MicrobiologyVol. I and Vol. II" ,. AdityaPrakashan Ahmadabad. (2009).

6. Varghese, Naveen and Joy , V," Microbiology   LaboratoryManual " ED.1, Aromatic and Medicinal Plants Research Station, Odakkali, Ernakulam, Kerala. (2014).

7.Shammi, Q.J. " Microbiology-Tools and Techniques", KailashPustaksadan ISBN 978-81-89900-38-0 (In hindi also)

8.Grainger. John , Hurst Janet and Burdass. Dariel , "Basic Practical Microbiology: A Manual".The Society for General Microbiology.(2001).

Suggested Digital Platform /Web Links:
1.   https://www.mooc-list.com/course/introduction-practical-Microbiology-futurelearn
2.   https://study.com/articles/List_of_Free_Online_ Microbiology_Courses_and_Training_Options.html

Part A- Introduction			
Program:Certificate	**Class**:B.Sc.IYear[II SEM]	**Year**: 2022	**Session**: 2022-2023
Subject: Physics			
Course Code	**S1-PHYS2T**		
. Course Title	**Mechanics and General Properties of Matter**		
Course Type (Core/Elective/ Generic Elective/Vocational/...)	Major		
Pre-requisite (if any)	To study this course, a student must have had the subject Physics in 12" class.		
Course Learning Outcomes (CLO)	. 1. The course would empower the students to develop the idea about the behavior of physical bodies. 2. It will provide the basic concepts related to the motion of all the objects around us in daily life. 3. The students would be able to build foundation to various applied field in science and technology especially in the field of mechanical engineering. 4. The students will acquire the knowledge of basic mathematical methods to solve the various problems in physics. 5. The students will be able to understand the relativistic effect and the relation between energy and mass.		
Credit Value	4		
Total Marks	Max. Marks: 40+60		Minimum passingMarks:35

Part B- Content of the Course		
Total numbers of Lectures(in hours):60		
Unit	**Topics**	**Numbers of Lectures**
1	**Historical background and Mathematical Physics** 1. **Historical background:** 1.1. A brief historical background of mathematics and mechanics in the context of India and Indian culture. 1.2. A brief biography of Varahamihira and Vikram Sarabhai with their major contribution to science and society. 2. **Mathematical Physics:** 2.1. Scalar and vector fields, Gradient of a scalar field and its physical significance. 2.2. Vector integral: line integral, surface integral and volume integral, Divergence of a vector field and its physical significance, Gauss divergence theorem. 2.3. Curl of a vector field and its physical significance, Stokes and Green's theorem, Numerical problems based on the above topics. **Keywords/Tags:** Scalar field, Vector field, Vector integral, Gradient, Divergence, Curl.	**12**
II	**Mechanics of Rigid and deformable bodies** 1. **Rigid body mechanics:** 1.1. System of particles and concept of rigid body, Torque, centre of mass: position of the centre of mass, Motion of the centre of mass, Conservation of linear & angular momentum with examples, Single stage and multistage rocket. 1.2. Rotatory motion and concept of moment of inertia, Theorems on moment of inertia: theorem of addition, theorem of perpendicular axis, theorem of parallel axis, Calculation of moment of inertia of rectangular lamina, disc, solid cylinder, solid sphere. 2. **Mechanics of deformable bodies:** 2.1. Hooks law, Young's modulus, Bulk modulus, Modulus of rigidity and Poisson's ratio, Relationship between various elastic moduli. 2.2. Possible values of Poisson's ratio, Finding Poisson's ratio of rubber in the laboratory, Torsion of a cylinder, Strain energy of twisted cylinder. 2.3. Finding the modulus of rigidity of the material of a wire by Barton's method, Torsional pendulum and Maxwell's needle, Searl'smethod to find Y, η and σ of the material of a wire, Bending of beam, Cantilever, Beam supported at its ends and loaded in the middle. **Keywords/Tags:** Rigid body, Centre of mass, Moment of Inertia, Poisson's	**12**

	ratio.	
III	**Fluid mechanics** **1. Surface Tension:** 1.1. Inter-molecular forces and potential energy curve, force of cohesion and adhesion. 1.2. Surface tension, Explanation of surface tension on the basis of intermolecular forces, Surface energy, Effect of temperature and Impurities on surface tension, Dally life application of surface tension. 1.3. Angle of contact, The pressure difference between the two sided of a curved liquid surface, Excess pressure inside a soap bubble, Capillarity, determination of surface tension of a liquid capillary rise method, Jaeger's method. **2. Viscosity:** 2.1. Ideal and viscous fluid, Streamline and turbulent flow, Equation of continuity, Rotational and Irrational flow, Energy of a flowing fluid, Euler's equation of motion of a non-viscous fluid and its physical significance. 2.2. Bernoulli's theorem and its applications (Velocity of efflux, shapes of wings of airplane, Magnus effect, Filter pump, Bunsen's burner) 2.3. Viscous flow of a fluid, Flow of liquid through a capillary tube, Derivation of Polseuille's formula and limitations, Stocks formula, Motion of a spherical body falling In a viscous fluid. **Keywords/Tags:** Inter-molecular force, Surface tension, Angle of contact, Capillarity, Viscosity, Euler's equation, Polseulle's formula	12
IV	**Gravitational potential and central forces** **1. Gravitational potential:** 1.1. Conservative and non-conservative force field, Conservation of energy in motion under the conservative and non-conservative forces, Potential energy. 1.2. Conservative force, Conservation of energy, Gravitational potential and gravitational potential energy, Gravitational potential and intensity of gravitational field due to uniform spherical shell and a uniform sold sphere. 1.3. Gravitational self-energy, Gravitational self-energy of a uniform spherical shell and a uniform solid sphere. **2 Central forces:** 2.1. Motion under Central forces, Conservative ve characteristics of central forces. 2.2. The motion of a two particles system in Central force, Concept of reduced mass, Reduced mass of positronium and hydrogen. 2.3. Motion of particles in an inverse-square central force, Motion of celestial bodies and derivation of Kepler's laws, 2.4. Elastic and inelastic scattering (elementary idea).	12

	Keywords/Tags: Conservative force field, Gravitational potential, Gravitational self-energy, Central force, reduced mass, Scattering.	
v	**Relativistic Mechanics and Astrophysics** **1. Relativistic Mechanics:** 1.1. Frame of references, Galilean transformation, and Michelson Morley experiment. 1.2. Postulates of special theory of relativity, Lorentz Transformation, Simultaneity and order of events, Length contraction, Time dilation, Relativistic transformation of velocities, Variation of mass with velocity. 1.3. Mass-energy. Equivalence and its experimental verification. **2. Astrophysics:** 2.1. Introduction to the Universe, Properties of the Sun,Concept of Astronomical Distance. 2.2. Life cycle of stars, Chandrasekhar Limit, H-R diagram, Red giant star, White dwarf star, Neutron star, Black hole, 2.3. Big Bang Theory (elementary Idea). **Keywords/Tags**: Transformation, Mass-energy equivalence, Astronomical distance, Chandrasekhar limit, Black hole.	**12**

Part C-Learning Resources
Text Books, Reference Books, Other resources
Suggested Readings: 1. Spiegel M. R., "Vector Anal ysis: Schaum Outline Series", McGraw Hill Education, 2017. 2 Mathur D. S., "Mechanics", S. Chand, 2012. 3. Ghatak A. K., Goyal I.C. and Chua S.J., "Mathematical Physics", Laxmi Publications Private Limited, 2017 4. Mathur D. S., "Properties of Matter", Shyamlal Charitable Trust, New Delhi. 5. Sears and Zeemansky, "University Physics", Pearson Education.
Suggested equivalent online courses: 1. htips//nptel.ac.in/courses/115/103/115103036/ Mathematical Physics by Dr. SaurabhBasu, Department of Physics, Indian Institute of Technology Guwahati 2. https://nptel.ac.in/courses/115/106/115106090/ Mechanics, Heat, Oscillations and Waves by Prof. V. Balakrishnan, Department of Physics, Indian Institute of Technology, Madras

.

Part A- Introduction			
Program: Certificate	**Class**: B.Sc. I Year [II SEM]	**Year**: 2022	**Session**: 2022-23
Subject: Physics			
Course Code		S1-PHYS2P	
. Course Title		**Mechanics and General Properties of Matter Lab**	
. Course Type Core/Elective/ Generic Elective/Vocational/...		Minor	
Pre-requisite (if any		To study this course, a student must have had the subject Physics in 12" class.	
Course Learning Outcomes (CLO)		1. The students would acquire basic practicalknowledge related to mechanics through theexperiments. 2. Students will be familiar with variousmeasurement devices by which they can measurevarious physical quantities with accuracy. 3. The students will develop the concept related tothe mechanics and properties of matter.	
Credit Value		2	
Total Marks		Max. Marks: 40+60	Min passing Marks :35

Part B- Content of the Course		
Total numbers of Lectures(in hours):60		
Sr.No	**List of experiments**	**Number of Practical (in hours)**
1	Determination of Young's modulus, modulus of rigidity andPoisson's ratio of material of a wire using Searle's method.	30
2	Determination of Young's modulus of material of a metallic barby bending of beam method.	
3	Determination of acceleration due to gravity (g) using Bar pendulum.	
4	Determination of acceleration due to gravity (g) using Kater'sreversible pendulum.	
5	Determination of modulus of rigidity of a rod with the help ofBarton's apparatus.	
6	Determination of coefficient of viscosity of liquid usingPoiseuille's method.	

7	Determination of the moment of inertia of a flywheel about its axisof rotation
8	Determination of the moment of inertia of a given body (irregularbody) with the help of inertia table.
9	Verification of laws of the parallel/perpendicular axes of momentof inertia.
10	Determination of modulus of rigidity of material of a wire with thehelp of Maxwell's needle.
11	Determination of Young's Modulus of a material of a rod usingCantilever method.
12	Determination of modulus of rigidity of material of a wire with thehelp of torsional pendulum.
13	Determination of force constant of a spring.
14	Determination of Poisson's ratio of rubber.
15	Determination of surface tension of a liquid by Jaeger's method.

Part C-Learning Resources
Text Books, Reference Books, Other resources
Suggested Readings: 1. PrakashI. &Ramakrishna, "A Text Book of Practical Physlcs", KitabMahal, 2011, 11/e. 2. Squlres G. L, "Practical Physics", CambridgeUniversity Press, 2015, 4/e. 3. Flint B. L. and Workshop H. T., "Advanced Practical Physics for 2015, students", 4/e Asia Publishing House, 197. 4. Chattopadhyay D. &Rakshit P. C., "An Advanced Course in Practical Physics", NewCentral Book Agency. **Suggestive digital platforms web links** 1. https//www.vlab.co.in/broad-area-physical-sciences 2. https.//storage.aoogleapis.com/unique courses/online.html

Part A Introduction			
Program Certificate Course	**Class: B.SC.I Year[II SEM]**	**Year : 2022**	**Session :2022-2023**
	Subject : ZOOLOGY		
1	**Course Code**		S1-ZOOL2T
2	**Course Title**		**Cell biology, reproductive biology and developmental biology**
3	**Course Type**		MAJOR
4	**Pre- requisite (if any)**		To study this course a student must have had the subject Biology in class 12th.
5	**Course Learning outcomes (CLO)**		After completing this course in ZOOLOGY, a student shall have understanding of. • Develop deeper understanding of what life is and how it functions at cellular level. • Understand the nature and basic concepts of cell biology, Reproductive and Developmental biology. • Understand structure and functions of cell membrane, and cellular organelles. • Understand the importance of latest reproductive trends, reproductive techniques to be applied for human welfare. • Understand the general patterns and sequential developmental stages during embryogenesis;& understand how the developmental processes lead to establishment of body plan of multicellular organisms. • Understand the the evolutionary development of various animals.
6	**Credit Value**		4
7	**Total Marks**	Maximum Marks:40+60	Minimum Passing Marks: 35
	Part B- Content of the Course		
	Total no of Lectures –60 organisms **Lectures- Tutorials- practical (in hours per week) L-T-P:4-0-0**		
Unit	**Topics**		**No. of Lectures**

I	**Cell biology:** **1.1** Concept of prokaryotic and eukaryotic cell, difference between prokaryotic and eukaryotic cells. **1.2** Structure and functions of plasma membrane **1.3** Structure and functions of Golgi body, Mitochondria, Endoplasmic reticulum, ribosomes and lysosomes. **1.4** Structure and functions of Nucleus. **1.5** Structure and functions of Chromosomes and special types of chromosomes- Lamp brush and Polygenes chromosomes. **1.6** Cell cycle, Mitotic & Meiotic cell division and their significance. **Keywords:** Prokaryote, Eukaryote, cell organelles, chromosomes, cell cycle.	13
II	## 2. **Reproductive Biology:** **1.1** Structure of Male reproductive system of Lupus. **1.2** Structure of Female reproductive system of Lupus. **1.3** Histology of testis, and Ovary of Lupus. 1.4 Gametogenesis- Spermatogenesis and oogenesis, difference between spermatogenesis and oogenesis. 1.5 Types of Eggs- based on amount and distribution of yolk with examples. **Keywords**: Reproductive system, Gametogenesis, sperms, eggs.	13
III	**Recent assisted Reproductive Techniques (ART):** **3.1** Stem cell- Types and their uses. **3.2** Gene bank, sperm bank, superovulation, cryopreservation. **3.3** In Vitro Fertilization (IVF) and Embryo Transfer (ET), Zygote. **3.4** Placentation- Types, examples and functions. **3.5 Placenta** Banking- placenta preservation benefits. **Key words:** Gene bank, sperm bank, superovulation, IVF, ET.	15
IV	**4. Developmental Biology:** **4.1** Fertilization **4.2** Embryonic development of frog up to the formation of three layers **4.3** Fate map construction in frog. **4.4** Metamorphosis of Tale pole Larva. **4.5** Partheno genesis. **Keywords**: Fertilization, frog embryology, tadpole, metamorphosis, parthenogenesis.	11
V.	**Embryonic Development of Chick:** **5.1** Structure of hen's egg. **5.2** Embryonic development of chick embryo unto the formation primitive streak. **5.3** Fate map construction in chick. 5.4 Extra embryonic membranes of chick, formation and functions. **Keywords/tags: Hens egg, chick embryology, fate map, chick embryo membranes.**	

Part C-Learning Resources

Text books, Reference Books, Other resources

Suggested Reading:
1. Arm gam, ''A TEXT BOOK OF EMBRYOLOGY'', Sara's publications 2005.
2. Babinski, BI, ''an Introduction to Embryology.'' CEng age learning 2012.
3. De Roberti's, EDP De Roberti's, EMF, ''Cell and molecular biology,''8th edition, Williams &Wilkins, Philadelphia, 2006.
4. Gupta, PK, ''CELL BIOLOGY, Genetics and evolution'', Rastogi publications 2013
5. Heffner, L, ''Human reproduction at a glance,'' BWL Publications, 2013.
6. Larsen, Human Embryology,'' Churchill livingstone, 2001.
7. Powar, CB, ''CELL BIOLOGY'' Himalya publishing House,2010.
8. Rastogi, VB, ''Animal Distribution aqnd developmental biology .'' KNRNPublication, 2020.
9. Rastogi, VB ,'' Introduction to Cytology,'' KNRN Publications, 1988.
10. Sastry, KV, ''ENDOCRINOLOGY and Reproductive Biology'', rastogi p[ublication 2018
11. VERMA and AGRAWAL,'' A text Book of cytology,''S Chand & co. 1999
12. VERMA, PS, AGARWAL, VK ''Chordate Embryology,''S. Chand & co.2000.
13. Pardesi, K and Dubey A, Cell & developmental Biology,'' Akhand publishing house, New Delhi,
14. https://wwwacademic.oup.com
15. https://www.medineplus.gov
16. https://www.neni.nlm.nih.gov
17. https://www.zoologylearningpoint.wordpress.com
18. https://zoologyresources.com

Suggested equivalent online courses:
1. Sway am online courses
   https://storage.googleapis.com/uniquecourses/onlinehtml
2. National Digital Library https://ndl.iitkgp.ac.in
3. E- PG Pataskala (MHRD) PORTAL,(HTTPS://EPGP.INFLIBNET.AC.IN)
4. Science Direct Open Access Content
   (https://www.sciencedirect.com/book/9781843342038/openaccess)

Part A Introduction
PRACTICAL SYLLABUS

Program Certificate Course	Class: B.SC.I Year[II SEM]	Year : 2022	Session :2022-2023	
Subject: ZOOLOGY			
1	**Course Code**	S1-ZOOL2P		
2	**Course Title**	**CYTOLOGY, REPRODUCTIVE BIOLOGY & EMBROLOGY (Paper2)**		
3	**Course Type**	MAJOR		
4	**Pre- requisite (if any)**	To Study this course a student must have had the subject		
5	**Course Learning outcomes (CLO)**	**On completion of this course, learners will be able to understand:** - The different stages of mitotic and meiotic cell division and special types of chromosomes. - Different stages of embryology. - Through squash preparations understand the stage of cell division and structure of polygene chromosomes. - Enhance collaborative learning and communication skills through practical sessions, team work group discussion assignments & projects.		
6	**Credit Value**	**2**		
7	**Total Marks**	Maximum Marks:40+60	Minimum Passing Marks: 35	

Part B – Content of the Course

Total No. of Lectures:30
Lectures – Tutorial – Practical (In hours per week): L–T–P: 0-0-2

Unit	TOPICS	No. of Lab Hours
1.	Spotting related to the cytology a. Prokaryotes and Eukaryotes cell b. Stages of mitotic cell division c. Stages of meiotic cell division d. Lamp brush chromosomes.	**13**
2.	Spotting related to Reproductive biology & Embryology a. T.S. Testis of Mammal b. T.S. Ovary of Mammal c. Development stages of frog Embryology d. Developmental stages of Chick embryology.	13
3	Squash preparation of onion root tip to understand the stages ofMitotis	8
4.	Squash preparation of Grasshopper testis to understand the stage of Meiosis	9
5.	Try pan Blue exclusion test of cell viability	3
6.	Squash preparation of salivary gland chromosomes from Chironomus larva/Drosophila	9

KEYWORDS: stages of cell division, stages of embryonic development squash preparation.

Part- C Learning Resources

Text Books, References, and other Resources Books
Suggested reading: 1.   Biffa, MM, Knight J. ''Experiments in practical development biology'', first edition Cambridge university press,2011   2.   Chai Tanya, KV'' Cell & molecular biology: a lab manual'', PHI, 2013.   3.   KELLER, LR Evans, JH, KELLER TCS ''experimental developmental biology'', academic press, 1998   4.   TIGUNAYAT, MM,''A manual of practical Zoology; biodiversity cell biology, Genetics& development biology' 'scientific publishers,2019   5.   Virtual Labs (https://www.vlab.co.in)