<table>
<tr><td colspan="6" align="center">Part A Introduction</td></tr>
<tr><td colspan="2">Program: Certificate</td><td colspan="2">Class: BSc-I Year [II SEM]</td><td>Year: 2022</td><td>Session:2022-23</td></tr>
<tr><td colspan="6" align="center">Subject: Botany</td></tr>
</table>

1	Course Code	S1-BOTA2T
2	Course Title	Basic Botany
3	Course Type (Core Course/Elective/Generic Elective/Vocational/.....)	Minor
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

<table>
<tr><td colspan="3" align="center">Part B- Content of the Course</td></tr>
<tr><td colspan="3" align="center">Total No. of Lectures- 60   Tutorials- 0 Practical =0 (theory 4 hours per week): L-T-P:</td></tr>
</table>

Unit	Topics	No. of Lectures
1	**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

II	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
III	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

<div align="center">

Part C-Learning Resources

Text Books, Reference Books, Other resources

</div>

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 Practical			

1	Course Code	S1-BOTA2P	
2	Course Title	**Basic Botany Practical**	
3	Course Type (Core Course/Elective/Generic Elective/Vocational/.....)	Minor	
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 III	1)Section cutting of Pteridophytes and Gymnosperms: Stem, root and leaves
	2)Specimen study of Pteridophytes and Gymnosperms Cones
	3)Study of fugal structures and preparation of temporary mounts of Mucor, Rhizopus, Asperigillus, Yeast, Pencillium, Alternaria, Albugo, Helimenthosporium
	    4. Permanent slides of Puccinia on host.
	    5.Study of various fungal plant diseases
	    6.Observation of symptoms of virus and bacteria on plants.
	    7.Gram staining techniques
		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	Minor
	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 thefollowing aspects of Chemistry: 1. Basic concepts of Mathematics forChemists. 2. Fundamentals of analytical chemistry andsteps 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

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	**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
2	**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.*	
3	**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 organiccompounds. *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	Minor	
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	**Quantitative Analysis by Colorimetry** • Verification of Lambert-Beer Law • Determination of concentration of coloured compounds (e.g., $CuSO_4$, $KMnO_4$)	**10**
2	**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: **2022-20223**
Subject : **Computer Science**				
1.	Course Code	S1-COSC2T		
2.	Course Title	**Programming Methodology & Data Structure**		
3.	Course Type (Core Course/Elective/Generic Elective/Vocational)	Minor		
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
1	**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
II	**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
111	**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/...)	Minor		
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 Integration of Transcendental Functions
	1.2 Introduction to Double and Triple Integral
	1.3 Reduction formulae
	1.4 Quadrature
	    3.4.1 For Cartesian coordinates
	    3.4.2 For Polar coordinates
	1.5 Rectification
	    3.5.1 For Cartesian coordinates
	    3.5.2 For Polar coordinates
		18

	2.1 Linear Differential Equations 2.1.1 Linear equation	

| 2 | 2.1.2 Equations reducible to the linear form
2.1.3 Change of variables
2.2 Exact Differential equations
2.3 First order and higher degree Differential equations
    2.3.1 Equations solvable for x, y and p
    2.3.2 Equations homogenous in x and y
    2.3.3 Clairaut's equation
    2.3.4 Singular solutions
    2.3.5 Geometrical meaning of Differential equations
    2.3.6 Orthogonal trajectories | 18 |

| 3 | 3.1 Linear Differential equation with constant coefficients
3.2 Homogeneous linear ordinary Differential equations
3.3 Linear Differential equations of second order
3.4 Transformation of equations by changing the Dependent/Independent variables
3.5 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, 2016.
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, 1961.
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

PART A INTRODUCTION

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	**Sterilization and culture medium** 1.1 **Physical methods of sterilization:** Dry heat, moist heat, radiation, filtration, and incineration. 1.2 **Chemical methods of sterilization-** Phenol and phenolic compounds, Alcohol, Halogens, and detergents. 1.3 **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.			
II	**Isolation, Cultivation and preservation** 2.1 **Natural microbial population-** Pure culture 2.2 **Isolation of microbial population-** From air, water,			

and soil.

2.3 **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.

2.4 **Maintenance and preservation** for short term and long term.

2.5 **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	Minor	
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	Isolation of fungi from water, soil and air by serial dilution agar plating method.	3
2	Isolation of microorganisms by pour plate method.	3
3	Isolation of microorganisms by streak plate method	3
4	Isolation of microorganisms by spread plate method.	3
5	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/...)	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 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
I	**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). **Keywords/Tags:**Conservative force field, Gravitational potential, Gravitational self-energy, Central force, reduced mass, Scattering.	12
II	**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	Verification of laws of the parallel/perpendicular axes of momentof inertia.	
2	Determination of modulus of rigidity of material of a wire with thehelp of Maxwell's needle.	
3	Determination of Young's Modulus of a material of a rod usingCantilever method.	
4	Determination of modulus of rigidity of material of a wire with thehelp of torsional pendulum.	
5	Determination of force constant of a spring.	
6	Determination of Poisson's ratio of rubber.	
7	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**			MINOR
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	**1. Developmental Biology:** **1.1** Fertilization **1.2** Embryonic development of frog up to the formation of three layers	11

	1.3 Fate map construction in frog. **1.4** Metamorphosis of Tale pole Larva. **1.5** Partheno genesis. **Keywords**: Fertilization, frog embryology, tadpole, metamorphosis, parthenogenesis.	
II	**2.Embryonic Development of Chick:** **2.1** Structure of hen's egg. **2.2** Embryonic development of chick embryo unto the formation primitive streak. **2.3** Fate map construction in chick. 2.4 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**	MINOR
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	Squash preparation of Grasshopper testis to understand the stage of Meiosis	9
2	Try pan Blue exclusion test of cell viability	3
3	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)