Part A Introduction				
Program: Certificate		**Class: B.Sc. 1 st year**	**Year : 2021**	**Session: 2021-22**
Subject: Botany				
1	**Course Code**	**S1-BOTA1T**		
2	**Course Title**	**Applied Botany (Paper-1)**		
3	**Course Type (Core Course/Elective/Generic Elective/Vocational/ .....)**	**Core Course**		
4	**Pre-requisite (if any)**	To study this course, a student must have had the subject Biology/ Life Sciences/ Agriculture in class/12th		
5	**Course Learning outcomes (CLO)**	**By** the end of this course the student should have: • Understood the significance and role of botany. • Learnt the basic aspects of applied botany. • Gained knowledge about employment opportunities in field of botany • Gained knowledge about start-up opportunities in the field of botany • Learnt about opportunities of social services • Gain knowledge about best health practices		
6	Credit **Value**	**04 Credits**		
7	**Total Marks**	Max. Marks: 25+75 Min. Passing Marks:33		

Part B- Content of the Course

Total No. of Lectures- 60 Hours Tutorials- 00 Practical -00 (04 hours per week): L-T-P:

Unit	Topics	No. of Lectures
1	**1.1 Introduction,** objectives and importance of Applied botany 1.2 History and evolution of botany 1.3 Relation of plants to man and relation with other services 1.4 Various disciplines of botany and theirapplications to human welfare	12
II	1.1 Definition and types of pollution and pollutants **1.2 Phytoremediation:** Air, water, soil, noise and thermal pollutants (Any 5 plants with botanical name, family) and their role in pollution control. 1.3Bioremediation: definition and types	12
III	1.1 Ancient agricultural practices. **1.2Modern agriculture practices:** Polyhouse, Drip irrigation, hydroponics, computer-based agriculture,	12

	terrace farming, 1.30rganic farming: Introduction, objective and brief technique 1.4 Horticulture: Definition and role in human welfare 1.5Forestry: Definition, branches and role in human welfare 1.6 Silviculture: Definition and management practices	
IV	1.1 Role of Botany in Rural development 1.2 Ethnobotany: Introduction and importance 1.3 Ethnomedicine: Definition and examples. (Local name, Botanical name, family and importance of Neem, Aloe, Clove, Ginger, Tulsi, Turmeric, Giloy, Emblica, Ashwagandha, Arandi) 1.4 Ethno-fibres: Definition and examples (Local name, Botanical name, family and importance of. Jut Coconut, elephant grass, cotton) 1.5 Ethno-food crops: Definition and examples (Local name, Botanical name, family and importance of Garadu,Singada, Kutaki, Sama, Kodo, Bathua, Sehjan, Jowar, Makka, Bajra, Jau)	12
V	1.1Plant tissue culture: Definition, types and Importance. 1.2DNA Recombinant technique: Introduction. tools and importance 1.3Role of recombination in present era 1.4Bioinformatics: Definition, concept and tools 1.5Introduction of bioinformatics software: Basic idea of BLAST and FASTA Importance of bioinformatics	12

Keywords/Tags:Applied Botany, History of Botany, Evolution of Botany, Botany in human welfare, : Pollution. Pollutants, Phytoremediation, Bioremediation, Hydroponics, polyhouse, Terrace farming, Organic farming, Horticulture, Silviculture, Ethnobotany, Ethnomedicine, Ethnofibers, Ethno-food crops, Bioinformatics, BLAST, FASTA, Recombinant DNA, Plant tissue culture

Part C-Learning Resources

Text Books, Reference Books, Other resources

Suggested Readings:

1. LevetinE. and Mcmahon K. "Plants and Society" McGraw Hill Education. 2007
2. MaitiR.,Rodriguez H. G. and Thakur A. S. "Applied Botany" American Academic Press. 2017
3. Negi S. S. "Forest Botany"M/s Bishen Singh Mafendra Pal Singh. 2012.
4. Agrahari R. P. "Environmental Ecology, Biodiversity, Climate Change and Disaster Management McGraw Hill Education. 2020

2. Suggestive digital platforms web links		
Suggested equivalent online courses:		
Part D-Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks : 100 Continuous Comprehensive Evaluation (CCE) : 25marks University Exam (UE) 75 marks		
Internal Assessment : Continuous Comprehensive Evaluation (CCE):25 •	Class Test Assignment/Presentation	15 10 Total =25
External Assessment : University Exam Section: 75 Time : 02.00 Hours	Section(A) : Three Very Short Questions (50 Words Each) Section **(B)** : Four Short Questions (200 Words Each) Section (C) : Two Long Questions (500 Words Each)	03 x 03 = 09 04 x 09 = 36 02 x 15 = 30 Total 75

Part A Introduction			
Program: Certificate	**Class: B.Sc. Piyear**	**Year: 2021**	**Session: 2021-22**
Subject: Botany			

1	**Course Code**	**S1-BOTA1P**
2	**Course Title**	**Applied Botany Practical (paper, I)**
3	**Course Type (Core Course/Elective/Generic Elective/Vocational/.....)**	**Core Course**
4	**Pre-requisite (if any)**	**To study this course, a student must have had the subject Botany, Biology, Life Science in class/12th/.**
5	**Course Learning outcomes (CLO)**	**On completion of this course, learners will be able to:** **By the end** of this course the student should have knowledge of practical skill related with ethnobotany, tissue culture, application of bioinformatics software and tools of recombinant DNA technology.
6	**Credit Value**	**2 Credits**
7	**Total Marks**	Max. Marks: 25+75 Min. Passing Marks:33

Part B- Content of the Course

Total No. of Lectures-Tutorials-Practical (in hours per week):
L-T-P:

Unit	Topics	No. of Lectures
I	1. Identification of ethnomedicinal plants 2. Preparation of soil health card of any agricultural field 3. Study of vermicompost and composting of kitchen waste 4. Use of BLAST and FASTA 5. Prepare the list of important air, water and soil pollutants of local areas **6. Plant tissue culture technique:** sterilization, inoculation, culture media, acclimatization and hardening, 7. Preparation of list of ethnomedicinal, food, fibre plant locally available **8. Tools of recombinant DNA technology:** Restriction. enzymes, plasmid vectors, other enzymes 9. Study of global warming, acid rain and water	**30**

	quality (pH and Conductivity), 10. Study of local plants grown around agricultural field 11. * Practical can be decided on theory basis according to availability. 12. * Case and field study can be designed accordingly.	

Keywords/Tags:

Part C-Learning Resources

Text Books, Reference Books, Other resources

Suggested Readings:

I Levetin E. and Mcmahon K. "Plants and Society" Mc Graw Hill Education. 2007

2. Maiti R., Rodriguez H. G. and Thakur A. S. "Applied Botany" American Academic Press. 2017

3. Negi S. S. "Forest Botany" M/s Bishen Singh Mafendra Pal Singh. 2012.

4. Agrahari R. P. "Environmental Ecology, Biodiversity, Climate Change and Disaster Management" Mc Graw Hill Education. 2020

5. Sharma D. K. "Biodiversity Conservation: Current Status and Future Strategies" Write and Print Publication. 2017

6. Singh J. "Biodiversity Environment and Sustainability" MD Publications Pvt Ltd/ 2008

. 7. Gupta P. K. "Molecular Biology and Genetic Engineering" Rastogi Publications. 2005

Sharma V., Munjal A. and Shankar A. "Bioinformatics" Rastogi Publications. 2008.

Suggestive digital platforms web links

Suggested equivalent online courses:

Part D-Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Internal Assessment	Marks	External Assessment	Marks
Class Interaction /Quiz	10	Viva Voce on Practical	15
Attendance	5	Practical Record File	10
Assignments (Charts/ Model Seminar / Rural Service/ Technology Dissemination/ Report of Excursion/ Lab Visits/ Survey / Industrial visit)	10	Table work / Experiments	50
TOTAL	25		75

Part A Introduction				
Program: Certificate		Class: BSc-I	Year:2021	Session:2021-22
Subject: Botany				
1	Course Code	**S1-BOTA2T**		
2	Course Title	Basic Botany Paper - II		
3	Course Type (Core Course/Elective/Generic Elective/Vocational/.....)	Core Course		
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: 25+75 Min. Passing Marks:33		
Part B- Content of the Course				
Total No. of Lectures- 60Tutorials- 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

	2Bryophytes : 2.1General characteristics, Ecology. 2.2Range of thallus organization, morphology, anatomy(internal and external features) and reproduction of any one Bryophyte. 2.3Economic 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.		

Suggested equivalent online courses:		
Part D Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks : 100 Continuous Comprehensive Evaluation (CCE) : 25marks University Exam (UE) 75 marks		
Internal Assessment : Continuous Comprehensive Evaluation (CCE):25	Class Test Assignment/Presentation Total	15 10 25
External Assessment : University Exam Section: 75 Time : 02.00 Hours	Section(A) : Three Very Short Questions (50 Words Each) Section **(B)** Four Short Questions (200 Words Each) Section **(C)** Two Long Questions (500 Words Each)	03 x 03 = 09 04 x 09 = 36 02 x 15 = 30 Total 75

Part A Introduction				
Program: Certificate		**Class: l st year**	**Year: 2021**	**Session: 2021-22**
Subject : Botany P r a c t i c a l				
1	**Course Code**	**S1-BOTA2P**		
2	**Course Title**	**Basic Botany Practical (Paper/II)**		
3	**Course Type (Core Course/Elective/Generic Elective/Vocational/.....)**	**Core Course**		
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: 25+75 Min. Passing Marks:33		

Part B- Content of the Course

OTotal No. of Practical- 30 HoursTutorials- 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, F1117Cl•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**

	10. Section cutting of Pteridophytes and Gymnosperms: Stem, root and leaves 11. Specimen study of Pteridophytes and Gymnosperms Cones 12. Study of fugal structures and preparation of temporary mounts of *Mucor, Rhizopus, Asperigillus, Yeast, Pencillium, Alternaria, Albugo, Helimenthosporium.* 13. Permanent slides of Puccinia on host. 14. Study of various fungal plant diseases 15. Observation of symptoms of virus and bacteria on plants. 16. Gram staining techniques	

Keywords/Tags: Microscope, Algae, Bryophyta, Pteridophyta, Gymnosperm Fungi

Part C-Learning Resources

Text Books, Reference Books, Other resources

Suggested Readings:

1. Bendre Ashok and Ashok Kumar , A Textbook of Practical Botany, vol. 1, Rastogi Pub., Meerut, 1984.
2. Pandey B.PModern Practical Botany,., vol. I, S. Chand and Co. Ltd., N. Delhi, 17th edn., 1999.
3. Singh M.P., Chaudhary S.B. and Sahu H. BA Textbook of Practical Botany,Daya Pub. House, N. Delhi, 2005.
4. Shahezad, Aki I Mohd., Practical Botany, Shanti Prakashan, Gwalior, 2016.
5. Elizabeth Margaret and Angela GPractical manual of Botany, vol.1, New Age (Pub.) Ltd., Delhi, 2007.

Suggestive digital platforms web links --

Suggested equivalent online courses: ---

Part D-Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Internal Assessment	Marks	External Assessment	Marks
Class Interaction /Quiz	10	Viva Voce on Practical	15
Attendance	5	Practical Record File	10
Assignments (Charts/ Model Seminar / Rural Service/ Technology Dissemination/ Report of / Lab Visits/ Survey / Industrial visit)	10	Table work / Experiments	50
TOTAL	25		75

Any remarks/ suggestions: Practical may be adjusted accordingly by the teachers.

Part A Introduction			
Programm- CERTIFICATE	**Class-B.Sc**	**Year- First**	**Session- 2021-2022**

Subject - Chemistry			
	Course Code	**S1-CHEM1T**	
	Course Title	**Fundamentals of Chemistry (Paper-1)**	
	Course Type	Core Course	
	Pre-requisite (if any) Course Learning Outcomes (CLO)	By the end of this course students will learn the following aspects of Chemistry. 1. Ancient Indian chemical techniques. 2. Various theories and principles applied to reveal atomic structure. 3. Significance of quantum numbers. 4. Concept of periodic properties of elements. 5. Theories related to chemical bonding. 6. Acid-base concepts, ph, buffer. 7. Factors responsible for reactivity of chemical kinetics. 8. Properties of electrolytes.	
	Credit Value	4	
	Total Marks	Maximum Marks: CCE - 25 University Exam (CE) - 25	Minimum Passing Marks: 33

Part B Content of the course

Total No. of Lectures- Tutorials-Practical (in hours per week):

L-T-P: 60-0-30

Unit	Topic	No. of Lectures
1	(a) Chemical techniques in ancient India: General Introduction (b) Contribution of ancient Indian scientists in chemistry e.g. metallurgy, dyes, pigments, cosmetics, Ayurveda, Charak Sanhita. **Atomic Structure:** (i) Review of Bohr's theory and its limitations. Atomic spectrum of Hydrogen. Dual nature of particles and waves, de Broglie's equation, Heisenberg's Uncertainty principle and its significance. (ii) Quantum numbers and their significance. Rules for filling electrons in various orbital , Pauli's Exclusion Principle, Hund's rule of maximum multiplicity, Aufbau principle and its limitation. Variation of orbital energy with atomic number. Electronic configurations if the atoms. Stability of half filled and completely filled orbital's, concepts of exchange energy. Relative energies of atomic orbital's, Anomalous electronic configurations. ***Keywords/Tags:*** *Metallurgy, Dyes, Cosmetics, Charak Sanhita Hydrogen spectrum, Hund's rule, Aufbau principle*.	**2+4**

2	**Elementary idea of the following properties of the elements with references to s & p-block elements in periodic table.** • Effective nuclear number (EAN), shielding or screening effect, Slater rules, variation of effective nuclear cgarfe ibn periodic table,	**6**

	• Atomic radii (van der Waals) • Ionic and crystal radii. • Covalent radii (octahedral and tetrahedral) Detailed discussion of the dollwing properties of the elements, with reference to s & o-blocks. • Ionization energy-Successive ionization energy and factors affecting ionization energy. Applications of ionization energy. • Electro negativity-Pauling's /Mulliken's electronegativity scales. Variation of electronegativity with bond order. partial charge. Hybridization ***Keywords/Tags:*** *EAN, Atomic radii, Ionic Radii, Crystal Radii, Ionization Energy.*	

3	**Chemical Bonding** i. Ionic Binding: General characteristics of ionic bonding. Ionic bonding & Energy: Lattice & solvation energies and their importance in the context of stability and solubility of ionic compounds. Statement of Born-Lande equation for calculation of lattice energy, Madelung constant, Born-Haber cycle and its applications. Covalent charcater in ionic compounds, polarizing power and polarizability. Fajan's rules. ii. Covalent bonding: Lewis structure, Valence Bond theory (Heitler-London approach). Hybridization-Concept, types (SP, SP^2, SP^3, dSP^2, d^2SP^3) with suitable examples of inorganic and organicmolecules. Ionic character in covalent compounds – dipole moment and percentage ionic character. Valence shell electron pair repulsion theory (VSEPR) theory: Assumptions, need of theory, application of theory to	**20**

	explain geometries or shapes of some inorganic molecules and ions on the basis of VSEPR and hybrization with suitable examples of linear, trigonal planar, square planar, tetrahedral, trigonal bipyramidal and octahdral arrangements such as: NH_3, H_2O, SF_4, CIF_3, PCl_5, SF_6, ClF_5, XEF_4. **Molecular orbital (MO) concept of bonding** The approximations of the theory, Linear combination of atomic orbitals (LCAO) (elementary pictorial approach) Rules for the LCAO method, bonding and antibonding MOs. Characteristics for s-s, s-p and p-p combinations of atomic orbitals, nonbonding combination of orbitals. MO diagrams of homonuclear diatomic molecules: H_2, Li_2, Be_2, B_2, C_2, N_2, O_2, F_2, and their ions. Molecular orbitals of heteronuclear diotomic molecules: CO, NO, CN, HF. **Bond parameters:** Definition and factors affecting – bond orders, bind lengths, bond angles. ***Keywords/Tags:*** *Ionic Bonding, Covalent Bonding, Hybrigization, VSEPR Theory, LCAO, MO Diagrams, Bond Parameters.*	

4	**Acid-Base concept** Arrhenius concept, Bronsted-Lowry's concept, conjugate acids and bases, relative strength of acids, Lewis concept. pH, buffer solutions. Acid-base neutralisation curves, Handerson equation. Strength of organic acids and bases: Comparative study with emphasis on factors affecting pK values. Indicator, choice of indicators.	**4**

	Keywords/Tags: *Acid-Base Concept, Bronsted-Lowry's Concept, Conjugate Acids And Bases, pH, Buffers Solution, Indicator.*	

5	**(a) Fundamentals of Organic Chemistry** Structure, shape and reactivity of organic molecules: Physical Effects. Electronic Displacements: Inductive Effects, Electromeric Effect, Resonance and Hyperconjugation. Cleavage of Bonds: Homolysis and Heterolysis. Reactive Intermediates: Carbocations, Carbanions and free radicals. Nucleophiles and electrophiles. **(b) Stereochemistry of Organic compounds:** Concepts of isomerism. **Geometrical isomerism.** Determination of configuration of geometric isomers. E & Z system of nomenclature, geometric isomerism in oximes and alicyclic compounds. **Optical isomerism:** Elements of symmetry, molecular chirality, enantimoers & their properties, stereogeniccentre, optical activity of enantionmers. Concept of chirality (up to two carbon atoms): chiral and achiral molecules with two stereogeniccentres, dieastereomers, threo and erythroisomers, meso iosmer, resolution of enantiomers, inversion, retension and racemization. Relative and absolute configuration, sequence rules, D & L and R & S systems of nomenclature. **Conformations and Conformational analysis** Conformations of ethane, butane and cyclohexane, Interconversion of Wedge Formula, Newman, Sawhorse and Fischer representations. ***Keywords/Tags:*** *Electronic Displacements, Nucleaphiles, Electrophiles, Isomerism, Molecular Chirality, Enantiomers,* *Sequence Rules, Conformation.*	**12**

6	**Chemical Kinetics:** Rate of reaction, Definition and difference of order and molecularity. Derivation of rate constants for first, second, third and zero order reactions and examples. Derivation for half-life period. Methods to determine the order of reactions. Arrhenius equations, concept of activation energy. **Ionic Equilibria:** Strong, moderate and weak electrolysis, degree of ionization, factors affecting degree of ionization, ionization constant and ionic product of water. Common ion effects. Salt hydrolysis- calculation of hydrolysis constant, degree of hydrolysis and pH for different salts. Solubility and solubility product of sparingly soluble salts-applications of solubility product. ***Keywords/Tags:*** *Order of Reaction, Molecularity of Reaction, Arrhenius Equation, Activation Energy, Electrolytes, Salt Hydrolysis, Solubility Product.*	**12**

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

Text Books:

1. Lee, J.D., Concise Inorganic Chemistry, ELBS,1991
2. Khera, H.S., Gurtu, J.N., Singh, J., Chemistry For B.Sc. 1st Year, Pragati prakashan.
3. Bariyar, A.& Goyal, S., B.Sc. Chemistry Combined, (In Hindi) Krishna Educational Publishers Year:2019.
4. Puri, B.R., Pathania, M.S., Sharma, L.R., Principles of Physical Chemistry. Vishal Publishing Co. 2020.
5. Gurtu, J.N., Gurtu A., Advanced Physical Chemistry, Pragati Prakashan, Meerut, ISBN:9789386633347, 9386633345; Edition: IV, 2017
6. Day, M.C. and Selbin, J. Theoretical Inorganic Chemistry, ACS Publications 1962.
7. Bahl, A. & Bahl, B.S. Advanced Organic Chemistry, S. Chand, 2010.
8. Kalsi, P.S., Stereochemistry Confirmation and Mechanism, new Age International, 2005.
9. Finar, L.L., Organic Chemistry (Vol. 1&11). E.L.B.S.
10. Morrison, R.T. & Boyd, R.N., Organic Chemistry, Pearson, 2010.
11. Clayden, J., Greeves, N., Warren, S., Wothers, P., Organic Chemistry, Oxford University Press, 2nd Edition, 2012.
12. Atkins' Physical Chemistry, 10th Edition, Oxford University Press, 2014.

Reference Books:

Reference Books:

1. Prakash, S., Founders of Sciences in Ancient India, published by The research Institute of Ancient Scientific Studies, New Delhi. 1965 (OCoLC)594302452.
2. Acharya Prafulla Chandra Ray – A Collection of Writings, Volume IIIA : A History of Hindu Chemistry (Volume-I), Edition : Prof. Anil Bhattacharyya, Publisher : University of Calcutta, Online information: https://www.caluniv.ac.in/news/APCR%20Publication/acharya-prafulla.htm l
3. Chemistry in India, in Traditional & Practice of India, Textbook for Class XI, Module 2, Central Board of Secondary Education.
4. Subbarayappa, B.V., Chemistry and Chemical Techniques in India, Centre for Studies in Civilizations, 2004 ISBN 818758601X.
5. Huheey, J.E., Keiter, E.A., Keiter, R.L. & Medhi, O.K., Inorganic Chemistry: principles of Structure and Reactivity, Pearson Education India, 2006.
6. Douglas, B.E., McDaniel, D.H. & Alexander, J.J., Concepts and Models in Inorganic Chemistry, john Wiley & Sons, 1994.
7. Graham Solomon, T.W., Fryhle, C.b. & Dnyder, S.A. Organic Chemistry, John Wiley & Sons, 12th Edition, 2016.
8. McMurry, J.E. Fundamentals of Organic Chemistry, 7th Ed. Cengage Learning New Delhi (1988).
9. Sykes, p., A Guidebook to Mechanism in Organic Chemistry, Orient Longman, New Delhi (1988).
10. Barrow, G.M. Physical Chemistry, Tat McGraw-Hill(2007).

Suggested equivalent online courses:

(all URLs accessed in May 2021)

- MOOC: https://alison.com/course/fundamentals-of-chemistry
- NPTEL: https://nptel.ac.in/course/104/106/1041061196/; https://nptel.ac.in/course/104/101/104101121
- MIT: https://ocw.mit.edu/courses/chemistry/5-12-organic-chemistry-i-spring-2005/ syllabus/

Web sources

(all URLs accessed in May 2021)

https://www.sydney.edu.au/science/chemistry/~george/1108/ShapesOfMolecules.p df

https://artsandculture.google.com/exhibit/rasashala-ancient-indian-alchemical-lab- national-council-of-science-museums/KwJCaPIRF0y-KO?hl=en

https://sanskrit.uohyd.ac.in/events.new/Ancient-Indian-chemistry.pdf

https://insa.nic.in/writereaddata/UpLoadedFiles/IJHS/Vol01_1_1_PRAY.pdf

https://asi.nic.in/Ancient_India/Ancient_India_Volume_9/article_8.pdf

https://ddceutkal.ac.in/Syllabus/MA_history/paper_23.pdf

https://vvm.org.in/study_material/ENG%20%Indian%20Contributions%20to%20S cience.pdf

https://www.pgurus.com/chemistry-in-ancient-india/ https://en.wikipedia.org/wiki/History_of_chemistry

	Part D- Assessment and Evaluation	
	Suggested Continuous Evaluation Methods: Continuous Internal Evaluation Shall be Based on Allotted Assignment and Class Tests. The marks shall be as follow.	**Marks**
	Assessment and presentation of assignment	**04**
	Class Test-I (Objective Questions)	**04**
	Class Test-II (Descriptive Questions)	**04**
	Class Test-I (Objective Questions)	**04**
	Class Test-II (DescriptiveQuestions)	**04**
	Overall performance throughout the Year (includes Attendance, Behavior, Discipline, Participation in Different Activities)	**05**
	Total	**25**

Elaboration: Assessment Theory

External Assessment

Theory Paper	Section A	3 Very short question (50 words each)	03×03=09
	Section B	4 short question (200 words each)	04×09=36
	Section C	4 Long question (500 words each)	02× 15=30
		Total	**75**
Grand Total			**100**

PRACTICAL				
Program-Certificate		Class- B.Sc.	Year-First	Session-2021-2022
Subject –Chemistry				
1	**Course Code**	**S1-CHEM1P**		
	Course Title	**Qualitative& Quantitative Chemical analysis (Paper-I)**		
2	**Course Type**	Core Course		
3	**Course Learning Outcomes(CLO)**	By the end of this course students will learn the following aspects of Laboratory exercises in Chemistry: 1. Importance of chemical safety and lab safety while performing experiments in laboratory 2. Qualitative inorganic analysis 3. Elements analysis of organic compounds (non-instrumental) 4. Qualitative identification of functional group of organic compounds. 5. Techniques of pH measurements 6. Preparation of buffer solutions		
4	**Credit Value**	2		
	Total Marks	Maximum Marks: University Exam (UE)-75, CCE-25	Minimum Passing Marks:33	

	External Assessment	Marks
1	**Experiments to be performed in laboratory**	**50**

	Qualitative inorganic analysis **20 Marks** Identification of simple inorganic mixture (5 radicals) with two/three acidic and two/three basic radicals (including typical combinations), special emphasis on learning theoretical concept of strong, moderate and weak electrolytes, ionic product, common ion effect. Solubility and solubility product. **Qualitative organic analysis** **7+8 Marks** 1. Detection of hetero-elements (N, S, Cl, Br, I) in organic compounds	

2. Functional group tests for alcohol, aldehyde, carboxylic acid, carbohydrate, phenols, nitro, amine and amide.

Quantitative analysis of acid, alkali and buffer solutions **15 Marks**

Ionic Equilibria

1. Measurement of pH of different solutions of acids and alkalies using pH-meter (may use aerated drinks, fruits juices, shampoos and soaps)

   Note- use dilute solution of soaps and shampoos to prevent damage to the glass electrode.

2. Measurement of the pH of buffer solutions and comparison of the values with theoretical values.
3. Preparation of buffer solution and determination of their pH and buffer capacity:
   (i) Sodium acetate-acetic acid
   (ii) Ammonium chloride-ammonium hydroxide

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

Text Books:

1. Goswami A.K., Mehta, A., Khanam Rehanan, O.R.S., UGCPractical Chemistry VOL., I, Pragati Prakashan,2015
2. Goyal, S., B.Sc. Chemistry Practical, Krishna Publication,2017.
3. Vogel, A.I., A Textbook of Quantitative Inorganic Analysis, ELBS.
4. Svehla, G., Vogel's Quantitative Inorganic Analysis, PearsonEducation, 2012.
5. Mendham, J., Vogel's Quantitative Chemical Analysis, Pearson,2009.

6. Vogel, A.I., Tatchell, A.R., Furnis, B.S., Hannaford, A.J. & Smith, P.W.G., Textbook of Practical Organic Chemistry, Prentice –Hall, 5th edition, 1996.
7. Mann, F.G., & Saunders, B.C., Practical Organic Chemistry, Pearson Education (2009)
8. Khosla, B.S., Garg, V.C., & Gulati, A., Senior Practical Physical Chemistry, R. Chand & Co.: New Delhi (2011).

References:

9. Mann, F.G. & Saunders, B.C., Practical Organic Chemistry Orient-Longman, 1960.
10. Furniss, B.S., Hannaford, A.J., Smith, P.W.G., Tatchell, A.R., Practical Organic Chemistry, 5th Ed., Pearson (2012)
11. Ahluwalia, V.K., & Saunders, B.C., Practical Organic Chemistry Preparation and Quantitative Analysis, University Press(2000).
12. Prof. Robert H. Hill Jr., David C. Finster, Laboratory Safety for Chemistry: Students, 2nd Edition Wiley ISBN:978-1-119-02766-9 May 2016.
13. Prudent Practices in the Laboratory: Handling and Management of Chemical Hazards, Updated Version, ISBN 978-0-309-13864-2| DOI 10.17226/12654, The National Academies Press, Washington D.C.

Suggestive digital platforms web links:
https://ntpel.ac.in/courses/104/105/104105102/

Suggested equivalent online courses:

1. https://www.youtube.com/watch?v=EhyemWlIuXQ
2. http://amrita.obals.edu.in/?sub=73&brch=7&sim=31&cnt=1
3. http://amrita.olabs.edu.in/?sub=73&brch=7&sim=180&cnt=1
4. http://www.rbmcollege.ac.in/sites/default/files/files/reading%20materia l/inorganic-qualitative-analysis-pdf.
5. https://courses.lumenlearning.com/boundlesschemistry/chapter/qualita tive-chemical-analysis/
6. https://chem.libretexts.org/Bookshelves/Analytical_Chemistry/ Supplemental_Modules_(Analytical_Chemistry)/Qualitative_A nalysis
7. Https://courses.lumenlearning.com/boundlesschemistry/chapte r/buffer-solutions/
8. https://bio.libretexts.org/Bookshelves/Biotechnology/Lab_Man ual%3A_Introduction_to_Biotechnology/01%3A_Techniques/1 .07%3A_pH_and_Buffers
9. https://chem.libretexts.org/Ancillary_Materials/Laboratory_E xpriments/Wet_Lab_Experiements/General_Chemistry_Labs/ Online_Chemistry_Lab_Manual/Chem_12_Experiments/05%3 A_pH_Measurement_and_Its_Applications_(Experiment)
10. https://www.mt.com/mt_ext_files/Editorial/Generic/I/Guides_t o_Electrochemical_Analysis_0x000248ff00025c9a00093c4a_file s/guideph.pdf
11. https://web.cortland.edu/sternfeld/ph.pdf
12. https://webhost.bridgew.edu/c2king/CHEM142/Lab/7_Buffers %20and%20Properties.pdf

Part D- Assessment and Evaluation			
Suggested Continuous Evaluation Methods:			
Internal Assessment	**Marks**	**External Assessment**	**Marks**
Class Interaction **Chemical and Lab Safety** 1. Toxicity of the compoundsused in chemistry laboratory. 2. Safety symbol on labels of pack of chemicals and its meaning 3. What is MSDS sheets? Find out MSDS sheets of some hazardous chemicals ($K_2Cr_2O_7$), Benzene, cadmium nitrate, sodium metal, etc) 4. Precautions in handling and storage of Hazardous substances like concentrated acids, ammonia, organic solvents, etc. *Notes: description to be written in practical record.*	**10**	**Viva Voce on Practical**	**15**
Attendance	**5**	**Practical Record File**	**10**

Assignments (Chart/Model Seminar/Rural Service/Technology Dissemination/Report of Excursion/ Lab Visit/Survey/Industrial visit)	**10**	**Table work/Experiments**	**50**

TOTAL	**25**		**75**

<table>
<tr><th colspan="5">Part A Introduction</th></tr>
<tr><td colspan="2">Program- CERTIFICATE</td><td>Class- B.Sc.</td><td>Year- First</td><td>Session- 2021-2022</td></tr>
<tr><td colspan="5">Subject – Chemistry</td></tr>
<tr><td></td><td>Course Code</td><td colspan="3">S1-CHEM2T</td></tr>
<tr><td></td><td>Course Title</td><td colspan="3">Analytical Chemistry (Paper II)</td></tr>
<tr><td></td><td>Course Type</td><td colspan="3">Core Course</td></tr>
<tr><td></td><td>Pre-requisite (if any)</td><td colspan="3">To study this course students must have had the subject Chemistry in class +2 or equivalent.</td></tr>
<tr><td></td><td>Course Learning Outcomes (CLO)</td><td colspan="3">By the this course students will learn thefollowing aspects of Chemistry:
1. Basic concepts of Mathematics for Chemists.
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.</td></tr>
<tr><td></td><td>Credit Value</td><td colspan="3">4</td></tr>
<tr><td></td><td>Total marks</td><td>Maximum Marks: CCE-25, University Exam (UE)-75</td><td colspan="2">Minimum Passing Marks:33</td></tr>
</table>

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**	**10**

	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.*	
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.*	**10**

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-**	**10**

	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, YugbodhPublications, Raipur.

Reference Books:

1. Mitra Surbhi, Handbook of Computer Science & IT, Arihant, 2018.
2. Harris, D.C. Quantitative ChemicalAnalysis, 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.

Suggested equivalent online courses:
MOOC: https://www.edx.org/course/basic-analytical-chemistry

NPTEL: https://nptel.as.in/courses/104/105/104105084/

Web sources

1. https://www.freebookcentre.net/Chemistry/Analytical-Chemistry-Books.html
2. https://nptel.springer.com/journal/216

	Part D- Assessment and Evaluation	

	Suggested Continuous Evaluation Methods: Continuous Internal Evaluation Shall be Based on Allotted Assignment and class Tests. The marks shall be as follows:	**Marks**
	Assessment and presentation of assignment	**04**
	Class Test-I (Objective Questions)	**04**
	Class Text-II (Descriptive Questions)	**04**
	Class Test-I (Objective Questions)	**04**
	Class Test-II (Descriptive Questions)	**04**
	Overall performance throughout the year (includes Attendance Behavior Discipline Participation in Different Activities)	**05**
	Total	**25**
Elaboration: Assessment Theory		
External Assessment		
Theory Paper		**75**
Grand Total		**100**

PRACTICAL			
Program- CERTIFICATE	Class- B.Sc.	Year- First	Session: 2021-2022
Subject – Chemistry			
1	Course Code	**S1-CHEM2P**	
	Course Title	**Analytical Processes and Techniques (paper-II)**	

2	Course Type	Core Course	
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)-75, CCE-25	Minimum Passing Marks: 33

	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-BeerLaw • 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**

Part C- Learning resources
Text Books, References Books, OtherResources

References:

1. Skoog, D.A. and Leary, J.J.: Instrumental Methods of Analysis, Saunders College Publications, New York, 1992.
2. Vogel's textbook of quantitative chemical analysis, 7th edition.
3. Goswami A.K., Mehta Anita, Khanam Rehnaa, ORS., UGC Practical Chemistry VOL. I, Pragati Prakashan, 2015.
4. Goyal Sudha, B.Sc. Chemistry Practical, Krishna Publication, 2017.
5. Tandon, M.N., unified Rasayan Vigyan, Shivlal Agarwal & Company, 2018.

Suggestive digital platforms web links:

1. https://www.youtube.com/watch?v=OAImRDzuTh8
2. http://amrita.olabs.edu.in/?sub=73&brch=8&sim=133&cnt=1
3. http://chemcollective.org/vlabs
4. http://mas-iiiith.vlabs.ac.in/exp6/Quiz.html
5. https://chem/libretexts.org/Ancillary_Materials/Laboratory_Experiments/Wet_Lab_Experiemtnts/General_Chemistry_Labs/Online_Chemistry_Lab_Manual/Chem_9_Experiments/02%3A_Paper_Chromatography_of_Gel_Ink_Pens-(Experiment)
6. https://edu.rsc.org/experiment/leaf-chromatography/389/article
7. https://edu.rsc.org/experiments/chromatography-of-sweets/455.arti cle
8. http://swe.mit.edu/outreach/virtual_resources/paper_chromatograp hy.pdf
9. http://www.chem.latech.edu/-deddy/chem104/104Standard.htm
10. https://www.chem.purdue.edu/course/chm224/Miscelleneous/Mod el_report_Expt2-revised_2009.pdf

	11. https:www.webpages.uidaho.edu/ifcheng/Chem%20253/labsExper iments%203.pdf 12. http://faculty.ccbcmd.edu/c-cyau/122%2007%20Acid-base%20titration%20AUG%2013.pdf 13. https://labbalances.net/blog/guide-to-calibration-weights 14. https://cdn2.hubspot.net/hubfs/2203666/Beamex_White_Papers/Beamex%20White%20Paper%20-%20Weighing%20scale%20calibration%20ENG.pdf?_hssc=107807261.6.1518193235316&_hsfp=2102249448&hsCtaTracking=8918cffa-b755-4f72-b4b1-24c1fa8d 1a6d%7C12eb2e3f-4b62-43eb-baf0-2da2a5d102b6	

Part D-Assessment and Evaluation			
Suggested Continuous Evaluation Methods:			
Internal Assessment	**Marks**	**External Assessment**	**Marks**
Class Interaction on- • Common glassware and lab wares for solution preparation and analysis. • Numerical problems related to solution preparation. • Any other discussion. *Note: description to be written in practical record.*	**10**	**Viva Voce on Practical**	**15**
Attendance	**5**	**Practical Record File**	**10**

Assignment (Charts/Model Seminar/Rural Service/Technology Dissemination/Report of Excursion/Lab Visits/Survey/Industrial visit)	**10**	**Table work/Experiments**	**50**
TOTAL	**25**		**75**

PART -A Introduction			
Program :Certificate	**Class: B.Sc.**	**Year :**	**Session:**

			I Year	**2021-2022**
Subject : Computer Science				
1.	**Course Code**	**S1-COSC1T**		
2.	**Course Title**	**Computer System Architecture (Paper 1)**		
3.	**Course Type (Core Course/Elective/Generic Elective/Vocational)**	**Core Course**		
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. Understands the basic structure ,operation and characteristics of digital computer .** **2. Be able to design simple combinational digital circuits based on given parameters .** **3. Familiarity with working of arithmetic and logic units as well as the concept of pipelining .** **4. Know about hierarchical memory system including cache memories and virtual memory .** **5. Undersatand concept and advantage of parallelism,threading ,multiprocessor and multicore processor .** **6. Know the contributions of Indians in the field of computer architecture and related technologies.**		
6.	**Credit value**	**Theory-4 Credits**		
7	**Total Marks**	**Max .Marks : 25+75**	**Min. Passing Marks :33**	

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	**Fundamentals of Digital Electronics:Data types ,Complements , Fixed –Points Representation, floating point representation , Binary and other Codes ,Error Detection Codes.** **Logic Gates : Boolean Algebra ,Map Simplification ,Combinational Circuits ,Sequential Circuits ,Simple Combinational Circuits design**	**10**

	problems . **Circuits: Adder- Subtractor , Multiplexer , Demultiplexer, Decoders, Encoders ,Flip Flops ,Registers ,Counters.**	
II	**Basic Computer Organization:Instruction Codes, Computer Register, Computer Instructions, Timing &control , Instruction Cycles, Memory Reference Instruction ,Input- out put& Interrupts, Complete Computer description & design of basic computer.**	**10**
III	**Instructions :Instruction formats ,Addressing modes,Instruction codes, Machine language, Assembly language .** **Register Transfer and micro operations :Register Transfer Language ,Register Transfer ,Bus and Memory Transfer ,Arithmetic Micro Operations ,logics Micro Operations ,Shift Micro Operations.**	**10**
IV	**Processor and Control Units : Hardwired vs. Micro Programmed Control Units ,General Register Organization ,Stack Organization, Instruction Formats ,Data Transfer & Manipulation , Program control ,Introductory concepts of RISC,CISC, advantages of both .** **Pipelining –Concept of pipe lining ,Introduction to Pipelined data path and control –Handling data hazard & Control hazards.**	**10**
V	**Memory and I/O System –Peripheral Devise ,I/O Interface ,Data Transfer Scheme- Program Control ,Interrupt ,DMA Transfer I/O Processor .** **Memory Hierarchy ,Processor Vs Memory Speed , Memories ,main memory , Auxiliary memory ,Cache Memory , Associated Memory, Interleaving ,Virtual Memory ,Memory management.**	**10**
VI	**Parallelism – Meaning ,Types of Parallelism ,Introduction to Instruction level Parallelism , Parallelism ,Parallel processing challenge ,applications.** **Flynn's Classification –Introduction to SISD,SIMD.MISD,MIMD.** **Hardware Multithreading -Introduction ,types, advantages and applications .** **Multicore Processors – Introduction ,advantages ,difference from multiprocessors .**	**8**
VII	**Indian contribution to the field – Contributions of reputed scientists of indian origin like – Dr. VinodDham – Father of Intel Pentium Processor ,Dr. Ajay Bhat- Co –Investor of USB Technology,Dr. VinodKhosla –co founder of Sun Microsystems,Dr. Vijay P Bhatkar – architect of India's national initiative in supercomputing ,and many others .** **Parallel Computing project of India –PARAM, ANUPAM,FLOSOLVER ,CHIPPS etc.Other relevant contributors and contributions .**	**2**

Keywords /Tags : Digital Electronics,Logic gates ,circuits ,Instruction formats ,Addressing modes , Parallelism ,Pipelining ,Memory Hierarchy, Multicore, Multithreading ,SISD,SIMD,MISD,MIMD,PARAM,

ANUPAM,FLOSOLVER,CHIPPS

PART C: Learning Recourses

Textbooks, References Books, Other Recourses

Suggested Readings :

- **M.Morris Mano, "Computer System Architecture " PHI**
- **Heuring Jordan ,"Computer System Design & Architecture" (A.W.L.)**
- **William Stalling ," Computer Organization & Architecture " , Pearson Education Asia.**
- **V.CarlHamacher ," Computer Organization " TMH**
- **Tannenbaun ,"Structured Computer Organization " PHI.**

Suggested Digital Platforms ,Web links :

1. **https://www.youtube.com/watch?v=4TzMyXmzlL8M**
2. **https://nptel.ac.in/course/106/106/106106166/**
3. **https://nptel.ac.in/course/106/106/106106134/**

Suggested equivalent online course

http://nptel.ac.in/courses/106/105/106105163/

Part D : Assessment and Evaluation

Internal Assessment: Continuous Comprehensive Evaluation (CCE):25 Marks Shall be based on allotted assignment and Class Tests.The marks shall be as follows :		**External Assessment: University Exam (UE) :75 Marks Time : 02.00 Hours**	
Assessments and presentation of assignment	**10 Marks**	**Section (A) : Three Very Short Questions (50Word) OR Nine MCQ Questions**	**03x03=9 Marks Or 09x01= 9 Marks**
Class Test I (Objective Questions)	**05 Marks**		
Class Test II (Descriptive Questions)	**05 Marks**	**Section (B) : Four Short Questions (200 Word)**	**04x09=36 Marks**
Class Test III(Based on solving circuit design problems)	**05 Marks**	**Section (C) : Two Long Questions (500 Word)**	**02x15=30 Marks**
Total	**25 Marks**	**Total**	**75 Marks**

Any remarks /Suggestions : Learning in the course should be emphasized more on practical aspects and real world problems and their solutions.

PART A : Introduction

Program :Certificate		Class: B.Sc.	Year : I Year	Session: 2021-2022
Subject : Computer Science				
1.	**Course Code**	**S1-COSC1P**		
2.	**Course Title**	**Computer Architecture Lab (Paper I)**		
3.	**Course Type (Core Course/Elective/Generic Elective/Vocational)**	**Core Course**		
4.	**Pre-Requisite (if any)**	**To study a student 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-** **1. Realization of the basic logic and Universal gates .** **2. Verifying the behavior of logic gates using truth table.** **3. Implement Binary to Gray,Gray to Binary code conversion .** **4. Design half and full adder using basic gates .** **5. Design and construct flip flops and verify the excitation tables .**		
6.	**Credit value**	**Practical -2 Credits**		
7	**Total Marks**	**Max .Marks : 25+75**	**Min. Passing Marks :33**	
PART B:Content Of the Course				
No. of Lab Practical's(in hours per week): 2Hrs. Per week				
Total No. of Labs =30 hours				
Suggested list of Practicals				

	List of Practical 1. **To study basic gates (AND ,OR, NOT) and verify their truth table.** 2. **To convert a given binary number to Gray code using IC 7486 .** 3. **To study and verify NAND as Universal gates using IC 7400 .** 4. **To study half adder suing basic gates and verify its truth table .** 5. **To study full adder suing basic gates and verify its truth table .** 6. **To realize basic gates (AND ,OR, NOT) from Universal gates (NAND and NOR).** 7. **To verify truth table of 4-bit adder using IC 7483.** 8. **To design and construct RS flip Flop using gates and verify the truth table .** 9. **To design and construct JK flip Flop using gates and verify the truth table .** 10. **To verify DeMorgan'sTheorem .**	

Keyword /Tags: Digital Electronics ,Logic gates ,AND ,OR,NOT ,IC 7486,IC 7400,NAND ,NOR,IC 7483, Circuit , Flip Flop , Demorgan's Theorem

Part C: Learning Recourses

Textbooks, References Books, Other Recourses

Suggested Readings :

- **M.Morris Mano, "Computer System Architecture " PHI**
- **Heuring Jordan ,"Computer System Design & Architecture" (A.W.L.)**
- **William Stalling ," Computer Organization & Architecture " , Pearson Education Asia.**
- **V.CarlHamacher ," Computer Organization " TMH**
- **Tannenbaun ,"Structured Computer Organization " PHI.**

Suggested Digital Platforms ,Web links :

1. **https://www.youtube.com/watch?v=4TzMyXmzlL8M**
2. **https://nptel.ac.in/course/106/106/106106166/**
3. **https://nptel.ac.in/course/106/106/106106134/**

Suggested Equivalent online course

http://nptel.ac.in/course/106/105/106105163

Part D : Assessment and Evaluation (theory)

Internal Assessments : Continuous Compressive Evaluation (CCE) :25 Marks		**External Assessments : University Exam(UE):75 Marks Time :02.00 Hours**	
Internal Assessment	**Marks**	**External Assessment**	**Marks**
Hands –on Lab Practice	**5 Marks**	**Practical Record File**	**10 Marks**
Lab Test Practical list & Internal Viva	**12 Marks**	**Viva Voce on Practical**	**15 Marks**
Assignments(Charts/Seminar/Rural	**8 Marks**	**Table Work /Experiments**	**50 Marks**

Service/Technology Dissemination/Report of Excursion/ Lab Visits/Survey/Industrial Visit)			
Total	**25**	**Total**	**75**
Any remarks /Suggestions : Learning in the course should be emphasized more on practical aspects and real world problems and their solutions			

PART A : Introduction			
Program :Certificate	**Class: B.Sc.**	**Year : I Year**	**Session : 2021-2022**
Subject : Computer Science			

1.	**Course Code**	**S1-COSC2T**
2.	**Course Title**	**Programming Methodology & Data Structure (Paper I1)**
3.	**Course Type (Core Course/Elective /Generic Elective/Vocational)**	**Core Course**
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 : 25+75**	**Min. Passing Marks :33**

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-**	**10**

	Dimentional Arrays.	
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.** **.**	**2**
Keywords /Tags :Programming, C++,Data Structure, Expressions, Control,File Handling, Arrays, Stack, Queue, Linked List, Tree, Graphs, Structure, Union, Search,Algorithm.		

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,2nd 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**

Suggested equivalent online course
http://nptel.ac.in/courses/106/105/106105151/ **http://nptel.ac.in/courses/106/106/106106133/**

Part D : Assessment and Evaluation			
Internal Assessment: Continuous Comprehensive Evaluation (CCE):25 Marks **Shall be based on allotted assignment and Class** **Tests.The marks shall be as follows :**		**External Assessment: University Exam (UE) :75 Marks** **Time : 02.00 Hours**	
Assessments and presentation of assignment	**10 Marks**	**Section (A) : Three Very Short Questions (50Word)** **OR Nine MCQ Questions**	**03x03=9 Marks** **Or** **09x01= 9 Marks**
Class Test I (Objective Questions)	**05 Marks**		
Class Test II (Descriptive Questions)	**05 Marks**	**Section (B) : Four Short Questions (200 Word)**	**04x09=36 Marks**

Class Test III(Based on solving circuit design problems)	**05 Marks**	**Section (C) : Two Long Questions (500 Word)**	**02x15=30 Marks**
Total	**25 Marks**	**Total**	**75 Marks**
Any remarks /Suggestions :Focus of the course /teaching should be on developing ability of the student in analyzing a problem, building the logic and efficient code for the problem .			

PART A : Introduction			
Program :Certificate	**Class: B.Sc.**	**Year : I Year**	**Session: 2021-2022**
Subject : Computer Science			

1.	**Course Code**	**S1-COSC2P**	
2.	**Course Title**	**Office Tools & Programming MethodologyLab (Paper 2)**	
3.	**Course Type (Core Course/Elective/Generic Elective/Vocational)**	**Core Course**	
4.	**Pre-Requisite (if any)**	**To study a student 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-** **1. Develop simple algorithms and flow Chart to solve a 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 recursive techniques, pointers and searching methods in programming.** **5. Possess ability to choose a data Structure to suitably model any data used in computer applications.** **6. Implementation of algorithms for searching and sorting .**	
6.	**Credit value**	**Practical -2 Credits**	
7	**Total Marks**	**Max .Marks : 25+75**	**Min. Passing Marks :33**

PART B:Content Of the Course		
No. of Lab Practical's(in hours per week):2Hrs. Per week		
Total No. of Labs =30 Hours		
Suggested list of Practical's		
	List of Practical **I. Office Tools .** **Using a Text Editor Tool** **1. Create a documents and apply different Editing options .** **2. Create Banner for your college .** **3. Design a Greeting card using word art for different festivals.** **4. Design your Bio Data and use page borders and shading .** **5. Create a documents and insert header and footer,apgetitle,date,time ,apply various page formatting feature etc.** **6. Implement Mail Merge.** **7. Insert a table into a document and try different formatting options for the table .** **Using a spreadsheet Tool** **1. Design your class Time Table .** **2. Prepare a Mark Sheet of your class result .** **3. Prepare a salary slip of an employee of an organization.** **4. Prepare a bar chart & pie chart for analysis of election result.** **5. Prepare a generic Bill of a Super Market.** **6. Work on the following exercise on answer book;** **a. Copy an existing Sheet** **b. Rename the old Sheet** **c. Insert a new Sheet into an existing Workbook** **d. Delete the renamed sheet.** **7. Prepare an attendance sheet of 10 students for any 6 subjects of your syllabus.calculate their total attendance,total percentages of attendance of each students and average of attendance.** **8. Create a worksheet of students list of any 4 facilities and perform following database function on it.** **a. Sort data by Name** **b. Filter data by Class** **c. Subtotal of students by class** **Using a Presentation Tool**	**30 Hours**

	1. Design a presentation of your institute using auto content wizard, design template and blank presentation. **2. Design a presentation illustrating insertion of pictures, Word Art and Clipart .** **3. Design a presentation, learn how to save it in different formats, copying and opening an existing presentation.** **4. Design a presentation illustrating insertion of movie, animation and sound.** **5. Illustrate use of custom animation and slide transition (using different effects).** **6. Design a presentation using charts and tables of the marks obtained in class.** **II. Given a problem statements ,students are required to formulate problem,developflowchart/Algoriyhm,write code in C++,execute and test it. Students should be given assignments on following :** **1. A. To learn elementary technique involving arithmetic operators and mathematical expressions, appropriate use of selection (if, switch, conditional operators)and control structures.** **B.Learn how to use functions and parameter passing in functions ,writing recursive programs.** **2. Write a program to swap the contents of two variables.** **3. Write a program for finding the roots of a quadratic education.** **4. Write a program to find area of a circle,reactangle,square using switch case.** **5. Write a program to check whether a given number is even or odd.** **6. Write a program to print table of any number.** **7. Write a program to print Fibonacci series.** **8. Write a program to find factorial of given number.** **9. Write a program to convert decimal (integer) number in to equivalent binary number.** **10. Write a program to check given string is palindrome or not.** **11. Write a program to perform multiplications of two matrices.** **12. Write a program to print digits of entered number in reverse order .** **13. Write a program to print sum of two matrices .** **14. Write a program to print multiplication of two matrices.** **15. Write a program to generate even/odd series from 1 to 100.** **16. Write a program whether a given number is prime or not.** **17. Write a program for call by value and call by reference.** **18. Write a program to generate a series**	

	1+1/1!+2/2!+3/3!.....+n/n! . **19. Write a program to create a pyramid structure** ***** ****** ******* ******** **20. Write a program to create a pyramid structure** **1** **12** **123** **1234** **21. Write a program to check entered number is Armstrong or not.** **22. Write program for traversing an Array.** **23. Write a program to input N numbers, add them and find average.** **24. Write a program to find largest element from an array.** **25. Write a program for linear search.** **26. Write a program for binary search.** **27. Write a program for bubble sort.** **28. Write a program for selection sort.**	

Keyword /Tags: Digital Electronics ,Logic gates ,AND ,OR,NOT ,IC 7486,IC 7400,NAND ,NOR,IC 7483, Circuit , Flip Flop , Demorgan's Theorem

Part C: Learning Recourses

Textbooks, References Books, Other Recourses

Suggested Readings :

- **M.Morris Mano, "Computer System Architecture " PHI**
- **Heuring Jordan ,"Computer System Design & Architecture" (A.W.L.)**
- **William Stalling ," Computer Organization & Architecture " , Pearson Education Asia.**
- **V.CarlHamacher ," Computer Organization " TMH**
- **Tannenbaun ,"Structured Computer Organization " PHI.**

Suggested Digital Platforms ,Web links :

4. **https://www.youtube.com/watch?v=4TzMyXmzlL8M**
5. **https://nptel.ac.in/course/106/106/106106166/**
6. **https://nptel.ac.in/course/106/106/106106134/**

Suggested Equivalent online course

http://nptel.ac.in/course/106/105/106105163

Part D : Assessment and Evaluation (theory)

Internal Assessments : Continuous Compressive Evaluation (CCE) :25 Marks		**External Assessments : University Exam(UE):75 Marks Time :02.00 Hours**	
Internal Assessment	**Marks**	**External Assessment**	**Marks**
Hands –on Lab Practice	**5 Marks**	**Practical Record File**	**10 Marks**
Lab Test Practical list &	**12 Marks**	**Viva Voce on Practical**	**15 Marks**

Internal Viva			
Assignments(Charts/Seminar/Rural Service/Technology Dissemination/Report of Excursion/ Lab Visits/Survey/Industrial Visit)	**8 Marks**	**Table Work /Experiments**	**50 Marks**
Total	**25**	**Total**	**75**
Any remarks /Suggestions :Focus of the course /Teaching should be on developing ability of the students in analyzing a problem, building the logic and efficient code for the problem.			

Part A- Introduction			
Program: Certificate	**Class**: B.Sc. I Year	**Year**: 2021	**Session**: 2021-2022
Subject: Mathematics			
Course Code	**S1-MATH1T**		
Course Title	**Algebra, Vector Analysis and Geometry(Paper-1)**		
Course Type (Core/Elective/ Generic Elective/Vocational/...)	Core course		
Pre-requisite (if any)	To study this course, a student must have had the subject Mathematics in 12 class.		
Course Learning	The course will enable the students to:		

Outcomes (CLO)	1. Recognize consistent and inconsistent of a system of linear equations by the reducing echelon form of the augmented matrix. using the rank of matrix. 2. To find the Eigen values and corresponding Eigen vectors for a square matrix. 3. Using the knowledge of vector calculus in geometry. 4. Enhance the knowledge of three dimensional geometrical figures (cone and cylinder etc).	
Credit Value	**6**	
Total Marks	**Max. Marks: 25+75**	**Min. Marks: 33**

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: Later Classical Period (500 -1250) 1.1.2 A brief biography of Varahamihira and Aryabhatta 1.2 Rank of a Matrix 1.3 Echelon and Normal form of a matrix 1.4 Characteristic equations of a matrix 1.4.1 Eigen-values 1.4.2 Eigen-vectors	**15**
2	2.1 Cayley Hamilton theorem 2.2 Application of Cayley Hamilton theorem to find the inverse of amatrix. 2.3 Application of matrix to solve a system of linear equations 2.4 Theorems on consistency and inconsistency of a system of linear equations 2.5 Solving linear equations up to three unknowns	**18**
3	3.1 Scalar and Vector products of three and four vectors 3.2 Reciprocal vectors 3.3 Vector differentiation 3.3. 1 Rules of differentiation 3.3.2 Derivatives of Triple Products 3.4 Gradient, Divergence and Curl 3.5 Directional derivatives	**18**

	3.6 Vector Identities 3.7 Vector Equations	
4	4.1 Vector Integration 4.2 Gauss theorem (without proof) and problems based on it 4.3 Green theorem (without proof) and problems based on it 4.4 Stoke theorem (without proof) and problems based on it	**15**
5	5.1 General equation of second degree 5.2 Tracing of conics 5.3 System of conics 5.4 Cone 5.4.1 Equation of cone with given base 5.4.2 Generators of cone 5.4.3 Condition for three mutually perpendicular generators 5.4.4 Right circular cone 5.5 Cylinder 5.5.1 Equation of cylinder and its properties 5.5.2 Right Circular Cylinder 5.5.3 Enveloping Cylinder	**24**

Keywords/Tags:
Indian Mathematics, Rank of a Matrix, Scalar and Vector Products, Vector Differentiation, Vector Identities, Vector Integration, General Equation of Second Degree, Tracing of Conics, System of Conics, Equation of Cone, Equation of Cylinder.

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

Suggested Readings:

Text Books:

1. K. B. Datta: Matrix and Linear Algebra, Prentice Hall of India Pvt. Ltd., New Delhi 2000.
2. Shanti Narayan: A Text Book of Vector Calculus, S. Chand & Co., New Delhi, 1987.
3. S. L. Loney: The Elements of Coordinate Geometry part-1, New Age International (p) Ltd. Publishers, New Delhi. 2016.
4. P. K. Jain and Khalil Ahmad: A text book of Analytical Geometry of Three Dimensions, Willey Eastern Ltd, 1999.
5. Gerard G. Emch, R. Sridharan, M. D. Srinivas: Contributions to the History of Indian Mathematics, Hindustan Book Agency, vol.3, 2005.

Reference Books:

1. Chandrika Prasad: A Text Book on Algebra and Theory of Equations, Pothishala Pvt.**,** Ltd., Allahabad, 2017.
2. N. Jocobson: Basic Algebra Vol. I and II, W. H. Freeman, 2009.
3. I. S. Luther and I. B. S. Passi: Algebra Vol. I & II, Narosa Publishing House, 1997.
4. N. Saran and S. N. Nigam: Introduction to Vector Analysis, Pothishala Pvt. Ltd., Allahabad, 1990.
5. Murray R. Spiegel: Vector Analysis, Schaum Publishing Company, New York, 2017.
6. Gorakh Prasad and H. C. Gupta: Text Book on Coordinate Geometry, Pothishala Pvt.Ltd., Allahabad, 2000.
7. P. K. Jain and Khalil Ahmad: A text book of Analytical Geometry of Two Dimensions Macmillan Indian Ltd., 1994.
8. S. L. Loney: The Elements of Coordinate Geometry Part-2, Macmillan, 1923.
9. N. Saran and D. N. Gupta: Three Dimensional Coordinate Geometry, Pothishala Pvt. Ltd., Allahabad, 1994.
10. R. J. T. Bell: Elementary Treatise on Coordinate Geometry of Three Dimensions, Macmillan India Ltd., 1994.
11. Bibhutibhusan Datta and Avadhesh Narayan Singh: History of Hindu Mathematics, Asia Publishing House,1962.

Suggested Digital Platforms Web links:

https://epgp.inflibnet.ac.in
hnps://freevideolectures.com/university/iit-roorkee
https://www.highereducation.mp.gov.in/?page=xhzlQmpZwkylQo2b%2Fy5G7w%3D%3D
https://www.bhojvirtualuniversity.com

Suggested Equivalent online courses:

https://nptel.ac.in/courses/111l05l22/
https://nptel.ac.in/courses/1111071 l2/
https://nptel.ac.in/courses/111/101/111101080/

Part D-Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:100 marks
Continuous Comprehensive Evaluation (CCE): 25 marks
University Exam (UE): 75 marks

Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	15 10 **Total: 25 marks**
External Assessment: University Exam Section:75 Time : 02.00 Hours	**Section(A)** : Three Very Short Questions (50 Words Each) **Section (B):** Four Short Questions (200 Words Each) **Section (C**): Two Long Questions (500 Words Each)	$03 \times 03 = 09$ $04 \times 09 = 36$ $02 \times 15 = 30$ **Total = 75**

Part A- Introduction			
Program: Certificate	**Class**: B.Sc. I Year	**Year**: 2021	**Session**: 2021-2022
Subject: Mathematics			
Course Code	**S1-MATH2T**		
Course Title	**Calculus and Differential Equations (Paper-2)**		
Course Type (Core/Elective/ Generic Elective/Vocational/...)	Core course		
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: 25+75**	**Min. Marks: 33**

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 l.2.l Leibnitz Theorem 1.2.2 Maclaurin's series Expansion 1.2.3 Taylor's series Expansion	**18**
	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 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	**18**

	3.4.2 For Polar coordinates 3.5 Rectification 3.5.1 For Cartesian coordinates 3.5.2 For Polar coordinates	
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.

Suggested Digital Platforms Web links:

https://epgp.inflibnet.ac.in
hnps://freevideolectures.com/university/iit-roorkee
https://www.highereducation.mp.gov.in/?page=xhzlQmpZwkylQo2b%2Fy5G7w%3D%3D
https://www.bhojvirtualuniversity.com

Suggested Equivalent online courses:

https://nptel.ac.in/courses/111l05l22/
https://nptel.ac.in/courses/1111071 l2/
https://nptel.ac.in/courses/111/101/111101080/

Part D-Assessment and Evaluation		
Suggested Continuous Evaluation Methods: Maximum Marks:100 marks Continuous Comprehensive Evaluation (CCE): 25 marks University Exam (UE): 75 marks		
Internal Assessment: Continuous Comprehensive Evaluation (CCE)	Class Test Assignment/Presentation	 15 10 **Total: 25 marks**
External Assessment: University Exam Section:75 Time : 02.00 Hours	**Section(A)** : Three Very Short Questions (50 Words Each) **Section (B):** Four Short Questions (200 Words Each) **Section (C**): Two Long Questions (500 Words Each)	03 × 03 = 09 04 × 09 = 36 02 × 15 = 30 **Total = 75**

	Part A Introduction

Program Certificate Course		**Class: B.SC.**	**Year : FIRST Year**	**Session :2021-2022 onwards**
	Subject : Microbiology			
1	**Course Code**		**S1-MBIO1T**	
2	**Course Title**		**General Microbiology and Cell Structure(Paper-I)**	
3	**Course Type**		**Core Course**	
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 Microbiology, a student vshall have understanding of.** • **Indian traditional knowledge and historical background of Microbiology.** • **Structure and transmission of viruses.** • **Cell structure and cell organization of bacteria.** • **Different kinds of unicellular prokaryotic and eukaryotic microorganisms based on specific characteristics.** • **General characteristics of important Eubacteria.**	
6	**Credit Value**		**4**	
7	**Total Marks**	**Maximum Marks:25+75**	**Minimum Passing Marks: 33**	
	Part B- Content of the Course			
	Total no of Lectures –60 **Lectures- Tutorials- practical (in hours per week) L-T-P:4-0-0**			
Unit	**Topics**			**No. of Lectures**

I	**The MicrobialWorld** **1.1 Indian traditional knowledge and global historical background of Microbiology.** **1.2 Theory of Biogenesis, Germ theory of disease, Fermentation.** **1.3 Significance of Microbiology-** **(a) Branches of microbiology** **(b) Thrust area of microbiology- Genetic engineering and Biotechnology.** **1.4 Contribution of following scientists in the field of microbiology-** **Louis Pasteur, Robert Koch, Edward Jenner, Alexander Fleming, Joseph Lister, serge N. Winogradsky, Marti us beijernik, Dmitri Ivanowsky, and Hans Christian Gram.** **Keywords: History of Microbiology, Renowned microbiologists, Genetic Engineering, Biotechnology.**	**15**
II	**2. Acellular and Prokaryotic Microorganisms** **2.1 Virus- General characters of following viruses- Bacteriophage (T4 phage) , plant viruses (TMV), Prions and Viroid.** **2.2 Whittaker's System- of Five kingdom Classification: Mon era, Protista, fungi, Plantae and Animal a.** **2.3 Carl Weser's Three Domain system of classification:** **Achaea andEubacteria.** **2.4 Bacteria- Study of Spirochete, Rickettsia, Chlamydia, Mycoplasma, and Actinomycetes.** **2.5 Cyanobacteria- Study of anabaenas and spiraling.** **Keywords: Prokaryotes, Whittaker, Carl Whose** **, Bacteria, cyanobacteria.**	**15**

III	**Eukaryotic Microorganisms** **3.1 Basic Knowledge of Eukaryotic organisms and their evolutionary pattern.** **3.2 Fungi- Study of Saccharomyces cerevisiae, Mucor, Aspergillus, Rhizopus and Penicillium.** **3.3 Protozoa- Study of Euglena, Trypanosome, Leishmania, Amoeba, Entamoeba and Plasmodium.** **Key words: Eukaryotes, Fungi, Protozoa**	**15**
IV	**4. Introduction to Microbial Cell Structure** **4.1 Study of Bacteria- Size, shape, and arrangement of bacterial cells.** **4.2 Structures External to plasma Membrane- Glyo calyx, capsule slime layer, flagella, stalk, protean and cell wall of Gram + v e and Gram –v e bacteria..** **4.3 Structures internal to cell wall- Cell membrane, cytoplasm, cytoplasmic inclusions, genome, spores and cysts.** **4.4 Reproduction in bacteria- Binary fission, budding and fragmentation.** **Keywords: Bacterial cells, Gram positive Bacteria, Gram negative Bacteria, Binary fission.**	**15**
	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 Microorganisms, 12th edition, Pearson Benjamin Cummings, San Francisco (2009).** 5. **Sum Bali, Gaeta and Mathura, R.S., "Principles of Microbiology" M.C. Grew Hill edition.(2017)**	

6. **AgathaNarayan, R. and Picnicker, C.K.S., "Text book of microbiology", 6th edition Oriental Longman Publication, U.S.A (2000).**
7. **Dubiety, R.C., And Maheshwari, D.K., "Text book of microbiology". S. Chand & Company Ltd., New Delhi.(2008).**
8. **Sharma, P.D., "Microbiology". Kasogi Publications, Meerut. (2014).**
9. **Singh, R.P., "Applied Microbiology". Kalian Publishers, New Delhi. (2007)**
10. **Shimmy, Q.J., "Microbiology"-I". Kailās Sadden, Bhopal.**

Suggested equivalent online courses:

1. **https://www.com.mooc-list.com/course/small-and-mighty-introduction-microbiology-futurelearn**
2. **https://www.mooc-list.com/course/microbiology-saylororg**
3. **https://www.mooc-list.com/course/bacteria-and-chronic-infections-coursera**
4. **https://www.coursera.org/lecture/bacterial/-infections/1-1-introduction-to-bacteria-by-bioinformaticstician-phd-peder-worning-HZ64m**
5. **https://www.openstax.org/books/microbiology/pages/1-3-types-of-microorganisms**
6. **https://openstax.org/books/microbiology/pages/4-1-prokaryotic-habitats-relationships-and-microbiomes**
7. **https://swayam.gov.in/explorer?searchText=microbiolog**
8.

Part-D Assessment and evaluation

Suggested Continuous Evaluation Methods:

Maximum Marks:	**100**
Continuous Comprehensive Evaluation (CCE):	**25**
University Exam (UE):	**75**

Internal Assessment Continuous Comprehensive Evaluation(CCE):25	**Class Test**		**15**
	Assignment / Presentation		**10**
	Total		**25**
External Assessment University Exam Section:25 Time: 02.00Hours	**Section (A): Three Very Short Questions (50 Words Each)**		**3x3=30**
	Section (B): Four Short Questions (200 Words Each)		**4x9=36**

	Section (C): Two Long Questions (500 Words Each)		**2x15=30**
	Total		**75**

Part A Introduction			
Program Certificate Course	**Class: B.SC.**	**Year : FIRST Year**	**Session :2021-2022 onwards**

Subject : Microbiology			
1	**Course Code**	**S1-MBIO1P**	
2	**Course Title**	**Study of Microorganisms (Paper I)Practical**	
3	**Course Type**	**Core Course**	
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:** • **Isolation of various types of bacteria and yeasts.** • **Microscopic examination of various types of bacteria, fungi and protozoa.** • **Structure of important animal, plant, bacterial viruses using electron micrographs.**	
6	**Credit Value**	**2**	
7	**Total Marks**	**Maximum Marks:25+75**	**Minimum Passing Marks: 33**

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 autotrophic bacteria and cyanobacteria, Rhizobia from root nodules**	**4**
2.	**Isolation of lactobacillus from curd**	**6**

3	**Isolation of yeast from ripened fruits.**	**2**
4.	**Preparation of temporary wet mount and microscopic examination of Mucor, aspergilla's and penicillium.**	**2**
5.	**Preparation of smear and microscopic examination of Staphylococcus, Lactobacillus, Escherichia, Vibrio, and Leptospira.**	**3**
6.	**Preparation of temporary wet mount and microscopic examination of Amoeba, Euglena, Paramecium, and Chlamydomonas.**	**3**
7.	**Study of the structure of important animal viruses(rabid, influenza, paramour, hepatitis B and retrovirus**	**3**
8.	**Study of the structure of important plant viruses (calico, Gemini, tobacco, ring spot, cucumber mosaic and alpha –alpha mosaic viruses) using electron microscope**	**3**
9.	**Any other experiment may be designed on the basis of theoretical aspects.**	**3**

KEYWORDS: Isolation of bacteria, bacteria cell structure fungi cell structure protozoa cell structure virus.

Part- C Learning Resources

Text Books, References, and other Resources

Books

Suggested reading:

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.I, 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 Course	**Class: B.SC.**	**Year : FIRST Year**	**Session :2021-2022 onwards**

Part-D Assessment and evaluation

Internal assessment	Marks	External assessment	Marks
Class interaction Quiz	10	Viva voce on practical	15
Attendance	05	Practical record file	10
Assignment(Charts /Model Seminar /Rural service technology(Dissemination/Report of Excursion/ lab visit/Survey/Industrial visit)	10	Table work/Experiments	50
Total	25		75

Any remarks sugggestions: Nil

	Subject : Microbiology			
1	**Course Code**		**S1-MBIO2T**	
2	**Course Title**		**Microbial Techniques (Paper II)**	
3	**Course Type**		**Core Course**	
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:25+75**	**Minimum Passing Marks: 33**	
	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,** **Key word:microscopy, light microscope, wet mount,Hnging drop method, Bacterial staining.**		**15**
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: **11. Pelzer, M.J., , E.C.S and Krieg, N.R. "Microbiology" Tata McGraw- Hill, New DELHI,(2001)** **12. Tortuga G.J, Finke Br, Case "Microbiology". An Introduction, 9th edition Pearson Education (2008)** **13. Willey J.M., Sherwood L.M., Wool verton C.J.,"PRESCOTT'S Microbiology", 9th edition (2013)** **14. Madigan, M.T., Marino, J.M., Dunlap, P.V. AND Clark D.P., "Brock Biology of Microorganisms, 12th edition, Pearson Benjamin Cummings, San Francisco (2009).** **15. Sum Bali, Gaeta and Mathura, R.S., "Principles of Microbiology" M.C. Grew Hill edition.(2017)** **16. Agatha Narayan, R. and Picnicker, C.K.S., "Text book of microbiology", 6th edition Oriental Longman Publication, U.S.A (2000).** **17. Dubiety, R.C., And Maheshwari, D.K., "Text book of microbiology". S. Chand & Company Ltd., New Delhi.(2008).** **18. Sharma, P.D., "Microbiology". Kasogi Publications, Meerut. (2014).** **19. Singh, R.P., "Applied Microbiology". Kalian Publishers, New Delhi. (2007)** **10 Shimmy, Q.J., "Microbiology"-I". Kailās Sadden, Bhopal.**		

	Suggested equivalent online courses: 9. https://www.com.mooc-list.com/course/small-and-mighty-introduction-microbiology-futurelearn 10. https://www.mooc-list.com/course/microbiology-saylororg 11. https://www.mooc-list.com/course/bacteria-and-chronic-infections-coursera 12. https://www.coursera.org/lecture/bacterial/-infections/1-1-introduction-to-bacteria-by-bioinformaticstician-phd-peder-worning-HZ64m 13. https://www.openstax.org/books/microbiology/pages/1-3-types-of-microorganisms 14. https://openstax.org/books/microbiology/pages/4-1-prokaryotic-habitats-relationships-and-microbiomes 15. https://swayam.gov.in/explorer?searchText=microbiology
	Part-D Assessment and evaluation
	Suggested Continuous Evaluation Methods: **Maximum Marks: 100** **Continuous Comprehensive Evaluation (CCE): 25** **University Exam (UE): 75**

Internal Assessment Continuous Comprehensive Evaluation(CCE):25	**Class Test**		**15**
	Assignment / Presentation		**10**
	Total		**25**
External Assessment University Exam Section:25 Time: 02.00Hours	**Section (A): Three Very Short Questions (50 Words Each)**		**3x3=30**
	Section (B): Four Short Questions (200 Words Each)		**4x9=36**
	Section (C): Two Long Questions (500 Words Each)		**2x15=30**
	Total		**75**

Part A Introduction

Program Certificate Course	**Class: B.SC.**	**Year : FIRST Year**	**Session :2021-2022 onwards**

Subject : Microbiology

1	**Course Code**	**S1-MBIO2P**	
2	**Course Title**	**Microbial Tools and Techniques (Paper II)Practical**	
3	**Course Type**	**Core Course**	
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:25+75**	**Minimum Passing Marks: 33**

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:

2. https://www.mooc-list.com/course/introduction-practical-Microbiology-futurelearn
3. https://study.com/articles/List_of_Free_Online_Microbiology_Courses_and_Training_Options.html

Part-D Assessment and evaluation

Internal assessment	Marks	External assessment	Marks
Class interaction Quiz	10	Viva voce on practical	15

Attendance	**05**	**Practical record file**	**10**
Assignment(Charts /Model Seminar /Rural service technology(Dissemination/Report of Excursion/ lab visit/Survey/Industrial visit)	**10**	**Table work/Experiments**	**50**
Total	**25**		**75**
Any remarks sugggestions:Nil			

Part A- Introduction			
Program: Certificate	**Class**: B.Sc. I Year	**Year**: 2021	**Session**: 2021
Subject: Physics			
Course Code	**S1-PHYS1T**		
. Course Title	**Thermodynamics and Statistical Physics (Paper-1)**		
Course Type (Core/Elective/ Generic Elective/Vocational/...)	Core course		
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 enable the students to understand the basic Physics of heat and temperature in relation to energy, work, radiation and matter 2. The students are expected to learn that "how laws of thermodynamics are used in a heat engine to transform heat into work". 3. This course will also develop an understanding of the various concepts of statistics andthe methods to apply them in thermodynamics. 4. Students will understand the importance of studying statistical mechanics with the behavior of particles under classical and quantum Conditions.		
Credit Value	**4**		
Total Marks	Max. Marks: 25+75	Min passing Marks :33	

Part B- Content of the Course		
Total numbers of Lectures(in hours):60		
Unit	**Topics**	**Numbers of Lectures**
1	**Historical background &Laws of thermodynamics** **1.Historical background:** 1.1 A brief historical background of thermodynamics and statistical Physics in the context of India and Indian culture, Contribution of S.N Bose in Statistical Physics. **2.Laws of thermodynamics:** **2.1**Thermodynamical system and thermodynamical coordinates, Thermal equilibrium, Zeroth law of thermodynamics, The concept of path function and point function, work done by and on the system. **2.2** First law of thermodynamics, Internal energy as a state of function, Reversible and irreversible change, Heat engine and its efficiency, Carnot's cycle, Carnot's engine and its efficiency, Carnot's theorem, Otto engine , diesel engine. **2.3** Second law of thermodynamics, Statement of Kelvin-Planck and Clapeyron, Absolute scale of temperature: Zero of absolute scale, Size of degree, Identity of perfect gas scale and absolute scale. **Keywords / Tags**: Thermodynamics, Internal energy, Heat engine, Absolute scale	**12**

II	**Entropy** 1. Concept of entropy, Claudius theorem, Entropy as point function, changes in entropy in reversible and irreversible processes. 2. Change in entropy of an ideal gas, change in entropy when two liquids at different temperatures are mixed (or two liquids at different temperatures are kept in contact). 3. Principle of increase of Entropy, change in entropy of the universe in an irreversible process, Disorder and heat death of universe. 4. Physical significance of Entropy, Temperature-entropy (T-S) diagram, third law of thermodynamics. 5. **Keywords/Tags**: Reversible process, Entropy, Ideal gas.	**12**
III	**Thermodynamic potentials and kinetic theory of gases.** **1. Thermodynamic potential and its application:** 1.1 Thermodynamic potentials, Thermal equilibrium, Internal energy, Helmholtz free energy, Enthalpy and Gibbs free energy. 1.2 Derivation of Maxwell's relations from thermodynamic potentials. Gibbs- Helmotz equation, Thermodynamic energy equation for ideal and van der Waal gas. 1.3 Tds equation, Derivation of expressions for Cp-Cv and their special cases for ideal and van der Waal gases, Derivation of the expression Es/Et=Cp/ Cv. 1.4 Clausius –clapeyron latent heat equation, Temperature change in adiabatic process, Principle of refrigeration, Joule –Thomson effect, cooling by adiabatic demagnetization, Production and measurement of very low temperatures. **2. Kinetic theory of gases:** 2.1 Behavior of a real gas and its deviation from an ideal gas, Virial equation, Andrews experiment on CO2 gas. 2.2 Critical constant, continuity of the liquid and gaseous state, Vapor and gas state, Boyle temperature, van der Waals equation for real gas, Values of critical constant, Law of the corresponding state. **Keywords/Tags:** Potential, Enthalpy, Adiabatic, Real gas, Critical constant.	**12**

IV	**Classical Statistics** 1. Probability, Distribution of N particles in two identical boxes, probability of occurrence of either event, probability of composite events, weightage probability. 2. Probability distribution and its narrowing with the increase in number of particles, Expression for average properties, constraints, accessible and non-accessible microstates. 3. Ensemble theory(Micro-canonical, Canonical and Grand canonical), Macro and micro states with examples, Principle of equal a prior probability, Concept of phase space 4. Boltzmann Canonical distribution law: Application: average energy of one dimensional harmonic oscillator. 5. Derivation of law of equipartition of energy from statistics, Equilibrium between two system in thermal contact and β parameter, Statistical interpretation of entropy and relation S=k logW. 6. Boltzman partition function and derivation of expression for internal energy, Helmotz free energy, Enthalpy and Gibbs free energy. **Keywords/Tags:** Probability, Microstate, Ensemble theory, Partition function.	**12**
V	**Quantum Statistics** 1. Indistinguishability of particles and its consequences, Maxwell-Boltzmann statistics (Classical statistics): Maxwell –Boltzmann statistics distribution law of velocity and speed, Maxwell- Boltzmann statistics and its distribution law. 2. Quantum statistics: Bose –Einstein statistics and distribution law, Derivation of Planck's radiation law from B-E statistics, Rayleigh - Jeans law, Wien'sdisplacement law and Stefan's law. 3. Fermi-Dirac statistics and Is distribution law, Explanation of free electron theory, Fermi level and Fermienergy. 4. Comparison between the Maxwell - Boltzmann, Bose Einstein and Fermi - Dirac statistics **Keywords/Tags**: Indistinguishability, Velocity distribution, Fermi level.	

Part C-Learning Resources

Text Books, Reference Books, Other resources

Suggested Readings:

1. Zemansky M. W. &Ditman R., "Heat and Thermodynamics", Tata McGraw- Hill
2. Sears and Salinger, "Themodynamics, Kinetic Theory & Statistical Thermodynamics",Narosa.
3. Garg S. C. &Ghosh C. K., "Thermal Physics", Tata McGraw-Hill.
4. Subrahmanyam N., BrijLal, Hemne P.S., " Heat Thermodynamics and statistical", S Chand, 2012.

Suggested equivalent online courses:
1. https://www.edx.org/course/thermodynamics Thermodynamics course.

Part D-Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 100
Continuous Comprehensive Evaluation (CCE): 25marks University Exam (UE) 75 marks

Internal Assessment: Continuous Comprehensive Evaluation (CCE):25	ClassTest Assignment/Presentation	15 10
External Assessment: University Exam Section:75 Time : 02.00 Hours	**Section(A)** : Three Very Short Questions (50 Words Each) **Section (B):** Four Short Questions (200 Words Each) **Section (C**): Two Long Questions (500 Words Each)	03 x 03 = 09 04 x 09= 36 02 x 15 = 30 Total 75

Any remarks/ suggestions:

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Part A- Introduction			
Program: Certificate	**Class**: B.Sc. I Year	Year: 2021	Session: 2021
Subject: Physics			
Course Code	**S1-PHYS1P**		
Course Title	**Thermodynamics and Statistical Physics (Paper1)**		
Course Type (Core/Elective/ Generic Elective/Vocational/...)	Core course		

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 gain practical knowledgeabout heat and radiation by performing variousExperiments. 2. The students will acquire knowledge about thedifferent forms of distribution of subatomicparticles in the system using statistical methods. 3. The students will be able to use various themodynamical instruments in daily life.	
Credit Value	**2**	
Total Marks	Max. Marks25+75	Min passing Marks :33

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 the mechanical equivalent of heat by Callendar&Barne's method.	**30**
2	Determination of efficiency of electrical Kettle with variable voltages.	
3	Determination of temperature coefficient of a resistance usingplatinum resistance thermometer.	
4	Determination of electromotive force of a thermocouple.	
5	Determination of thermal conductivity of a bad conductor by Lee's disc method.	
6	Verification of Newton's law of cooling.	

7	Determination of the ratio of specific heat of air by Clement-Desorme's method	
8	Determination of specific heat of a liquid with the help of Newton's law of cooling,	
9	Determination of the coefficient of thermal conductivity of a metal bySearl's method.	
10	Determination of thermal conductivity of the rubber using Calorimeter.	
11	Determination of mechanical equivalent of heat (J) using Joule Calorimeter.	
12	Determination of Stefan's constant using thermocouple.	
13	Study of statistical distribution and determination of standard deviation with the help of black and white dice.	
14	Determination of the temperature coefficient of a resistance with the help of Carey-Foster bridge.	
15	Determination of the critical constant of a gas/vapour.	

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Part C-Learning Resources

Text Books, Reference Books, Other resources

Suggested Readings:

1. Prakash I. & Ramakrishna, "A Text Book of Practical Physics", KitabMahal, 2011, 11/e.
2. Squires G. L., "Practical Physics", Cambridge University Press, 2015, 4/e.
3. Flint B. L. and Worsnop H. T., "Advanced Practical Physics for students, AsiaPublishing 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 D-Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Internal Assessment	Marks	External Assessment	Marks

Class Interaction/Quiz	**10**	**Viva Voce on Practical**	**15**
Attendance	**5**	**Practical Record File**	**10**
Assignments (Charts/ Model Seminar/ Rural Service Technology Dissemination/ Report of Excursion/ Lab Visits/Survey / Industrial visit)	**10**	**Table work/Experiments**	**50**
TOTAL	**25**		**75**

Any remarks/ suggestions:

Part A- Introduction			
Program:Certificate	**Class**:B.Sc.IYear	**Year**: 2021	**Session**: 2021-2022
Subject: Physics			
Course Code	**S1-PHYS2T**		
. Course Title	**Mechanics and General Properties of Matter Paper2**		
Course Type (Core/Elective/ Generic Elective/Vocational/...)	Core course		
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: 25+75	Minimum passingMarks:33

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.	**12**

	Keywords/Tags: Scalar field, Vector field, Vector integral, Gradient, Divergence, Curl.	
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 ratio.	**12**

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). **Keywords/Tags:**Conservative force field, Gravitational potential, Gravitational self-energy, Central force, reduced mass, Scattering.	**12**

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 D-Assessment and Evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 100
Continuous Comprehensive Evaluation (CCE): 25marks University Exam (UE) 75 marks

Internal Assessment: Continuous Comprehensive Evaluation (CCE):25	ClassTest Assignment/Presentation	15 10
External Assessment: University Exam Section: 75 Time : 02.00 Hours	**Section(A)** : Three Very Short Questions (50 Words Each) **Section (B):** Four Short Questions (200 Words Each) **Section (C**): Two Long Questions (500 Words Each)	03 x 03 = 09 04 x 09= 36 02 x 15 = 30 Total 75

Any remarks/ suggestions:

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Part A- Introduction			
Program: Certificate	**Class**: B.Sc. I Year	**Year**: 2021	**Session**: 2021
Subject: Physics			
Course Code	**S1-PHYS2P**		
. Course Title	**Mechanics and General Properties of Matter Lab (Paper2)**		
. Course Type Core/Elective/ Generic Elective/Vocational/...	Core course		
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: 25+75	Min passing Marks :33

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 D-Assessment and Evaluation

Suggested Continuous Evaluation Methods:

Internal Assessment	Marks	External Assessment	Marks
Class Interaction/Quiz	10	Viva Voce on Practical	15
Attendance	5	Practical Record File	10
Assignments (Charts/ Model Seminar/ Rural Service Technology Dissemination/ Report of Excursion/ Lab Visits/Survey / Industrial visit)	10	Table work/Experiments	50
TOTAL	25		75

Any remarks/ suggestions:

Part A Introduction			
Program : Certificate/Diploma/Degree	Class : I Year	Year : 2021	Session : 2021-2022
Subject:Zoology			
1	Course Code	S1-ZOOL1T	
2	Course Title	Animal Diversity: Non-Chordata(Paper1)	
3	Course Type (Core Course/Elective/Generic Elective/Vocational)	Core Course	
4	Pre-Requisite (if any)	To study this course a student must have had the subject Biology in 12th Class	
5	Course Learning outcomes (CLO)	Upon completion of the course student should be able to • Learn about the importance of systemic, taxonomy and phylogeny to get a concrete idea of evolution of non-chordate phyla.	

		• Understand the various morphological,anatomical structures and functions of animals of different phyla. • Get the knowledge about economics, ecological and medical significance of various animals in human welfare. • Understand the important parasites and their control measures.	
6	**Credit Value**	(Credit) 4	
7	**Total Marks**	Max.Marks:25+75	Min.Passing Marks : 33

Part B – Content of the Course

Total No. of Lectures + Practical (in hours per week) : 2 Hours per week

Total No. of Lectures / Practical:

Module	Topics	No. of Lecture
I	**Taxonomy ,Phylogeny and Protozoa** **1.Taxonomy** 1.1 Elementary knowledge of Zoology Nomenclature and International Code 1.2 Classification of Animal Kingdom upto Phylum of acoelomate and coelomate non-chordates according to parker and haswell 7thedition **2. Phylogeny** 2.1 Definition and Examples **3. Protozoa** 3.1 Phylum Protozoa :General characters of the phylum and outline classification up to classes with distinctive characters and suitables examples 3.2 Structure,Life history and pathogenicity of material parasite(Plasmodium Vivax) 3.3 Protozoa and disease **Keywords/Tags :** ICZN ,Classification ,Protozoa , Plasmodium	**11**
II	**Porifera , Coelenterata** **1.Porifera** **1.1** Phylum Porifera : General characters of the phylum and outline classification up to classes with distinctive characters and suitable examples **1.2** Type study of Sycon **1.3** Canal system of Sponges **2. Coelenterata** 2.1 Phylum Coelenterata :General characters of the phylum and outline classification up to classes with distinctive characters and suitable examples 2.2 Type study of Obelia 2.3 Corals and Coral reef formation **Keywords/Tags :**Classification ,Porifera ,Sycon ,Coelenterata ,Obelia Coral reefs	**11**

III	**Platyhelminthes , Nemathelminthes ,Annelida** **1. Platyhelminthes** **1.1** Phylum Platyhelminthes : General characters of the phylum and outline classification up to classes with distinctive characters and suitable examples **1.2** External morphology and life history of Liver fluke **2. Nemathelminthes** **2.1** Phylum Nemathelminthe : General characters of the phylum and outline classification up to classes with distinctive characters and suitable examples **2.2** Pathogenic symptoms of Nematodes and diseases **3.Annelida** 3.1 PhylumAnnelida : General characters of the phylum and outline classification up to classes with distinctive characters and suitable examples 3.2 Types study of Earthworm(Pheretima) 3.3 Structure and significance of Trochophore Larva **Keywords/Tags :** Classification , Platyhelminthes , Liver fluke Nematode disease, Annelida ,Pheretima , Trochophore.	**14**
IV	**Arthopoda ,Mollusca** **1. Arthopoda** 1.1 Phylum Arthopoda :General Characters of the phylum and outline classification up to classes with distinctive characters and suitable examples 1.2 Types study of Prawn 1.3Larval forms of crustacean 1.4 Insects as a vectors of human disease **2. Mollusca** 2.1 Phylum Mollusca : General Characters of the phylum and outline classification up to classes with distinctive characters and suitable examples 2.2 Types study of Pila 2.3 Structure and Signification of Glochidium Larva **Keywords/Tags :** Classification , Arthopoda Prawn ,Crustacea Larva,Insects ,Mollusca ,Pila ,Glochidium.	**12**
V	**Echinodermata ,Hemichordata** **Echinodermata** 1.1 Phylum Echinodermata :General Characters of the phylum and outline classification up to classes with distinctive characters and suitable examples 1.2External features and water vascular system of Starfish (Asterias) 1.3 Larval forms of Echinodermata **2. Hemichordata** 2.1 Phylum Hemichordata : General Characters of	**12**

	the phylum and outline classification up to classes with distinctive characters and suitable examples 2.2 Balanoglossus-External morphology 2.3 Structure and Signification of Tornaria larva **Keywords/Tags :** Classification , Echinodermata , Asterias , Echinodermata Larva,Hemichordata, Balanoglossus , Tornaria	

Part C- Learning Resources

Text Books, Reference Books, Other resources

Suggested Readings :

- Parker,Haswell, WA,"A Text Book of Zoology",VII edition,Vol.I & II ,Low price publications ,Delhi,1990.
- Barnes ,RD,"Invertebrate Zoology", VII Edition ,Cengage Learning,India,2006
- Pechenik ,JA,"Biology of the Invertebrates "Mc Grow-Hill Education,VII Edition,2015
- Sedgwick ,A,"A Students text book of Zoology", Vol.I,II & Vol .III.,Low Price publication ,Delhi,1990.
- Dhami and Dhami ,"Invertebrate Zoology"R.Chand & Co.India,2009
- Jordan and verma ,"Invertebrate Zoology"S Chand &Company ,New Delhi,2013
- Agrwal, VK ,"Zoology for Degree Students :Non-Chordata",S Chand &Company ,2017

Part-D Assessment and evaluation

Suggested Continuous Evaluation Methods:
Maximum Marks: 100
Continuous Comprehensive Evaluation (CCE): 25
University Exam (UE): 75

Internal Assessment Continuous Comprehensive Evaluation(CCE):25	Class Test	15
	Assignment / Presentation	10
	Total Marks	25

External Assessment University Exam Section:25 **Time: 02.00Hours**	**Section (A): Three Very Short Questions (50 Words Each)**		**3x3=09**
	Section (B): Four Short Questions (200 Words Each)		**4x9=36**
	Section (C): Two Long Questions (500 Words Each)		**2x15=30**
	Total		**75**

Practical Syllabus

Part A Introduction

Program : Certificate/Diploma/Degree	Class : I Year	Year : 2021	Session : 2021-2022

Subject:Zoology

1	**Course Code**	**S1-ZOOL1 P**	
2	**Course Title**	Invertebrata (Paper-1)	
3	**Course Type (Core Course/Elective/Generic Elective/Vocational)**	Core Course	
4	**Pre-Requisite (if any)**	To study this course a student must have had the subject Biology in 12thClass	
5	**Course Learning outcomes (CLO)**	Upon completion of the course student should be able to • Identify invertebrate animals of different phyla and their histology through study of museum specimens and slides • Learn their different systems through dissections • Enhance collaborative learning and communication skills through practical sessions,team work,group discussions assignments and projects.	
6	**Credit Value**	(Credit) 2	
7	**Total Marks**	Max.Marks:25+75	Min.Passing Marks : 33

Part B – Content of the Course

Total No. of Lectures + Practical (in hours per week) : 2 Hours per week

Total No. of Lectures / Practical:

Module	Topics	No. of Lecture
1.	Study of museum specimens and slides relevant to the invertebrates	25
2.	Dissection (Demonstration Only –Through You Tube Video or Models or Charts) a. Earthworm –Digestive systems ,Nervous system b. Prawn –Nervous system and appendages c. Pila - Nervous system d. Cockroach –Digestive System, Nervous system(Easily available animal in residential areas which can be used for dissection and mounting)	12
3.	Mounting a. Locally available small non-chordates,their larvae b. Mouth Parts of Insects	5
4.	Examination of pond water for study of different kinds of microscopic non-chordates organisms	8

5.	Economic Importance of any two Insects	5
6.	Parasitic Adaptation of any one parasite	5

Keywords/Tags: Museum specimens ,Slides ,Dissection , Mounting ,Benefited insects, parasitic adaptation.

Part C- Learning Resources

Text Books, Reference Books, Other resources

Suggested Readings :

- Arunuam, N. Nair,NC,Leelavathy,S, Pandian, NS, Murugan,T, Jayasurya,"practical Zoology-Invertebrata",Volume-I, Saras Publication,2013
- Lal,SS,"A Text book of practical Zoology-Invertebrates",Rastogi Publications,2016
- Prakash ,Mand Arora,CK," Laboratary Animals",Anmol Publications,New Delhi, 1998
- Verma,PS," A Manual of practical Zoology-Invertebrates",S.Chand & Co,2013

Part-D Assessment and evaluation

Suggested Continuous Evaluation Methods:

Internal Assessment	**Marks**	**External Assessment**	**marks**
Class Interaction/Quiz	10	Viva Voce on Practicals	15
Attendance	05	Practical Records File	10
Assignments (Charts/Models Seminar/Rural Service/Technology Dissemination/Reports of Excursion/Lab Visits/Survey/Industrial visit)	10	**Tables works/Experiments** a. Spotting b. Dissection c. Mounting d. Examination of Pond Water e. Economic Importance of Insects f. Parasitic Adaptations	50 16 08 04 10 06 06
Total	25		75
Any Remarks/Suggestion:			

	Part A Introduction		
Program Certificate Course	**Class: B.SC.**	**Year : FIRST Year**	**Session :2021-2022 onwards**
	Subject : ZOOLOGY		
1	**Course Code**		**S1-ZOOL2T**
2	**Course Title**		**Cell biology, reproductive biology and developmental biology (paper II)**
3	**Course Type**		**Core Course**
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**	**Minimum**

		Marks:25+75	**Passing Marks: 33**

	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.**	**15**

	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.**	
IV	**4. Developmental Biology:** **4.1 Fertilization** **4.2Embryonic 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:

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

B — **Part-D Assessment and evaluation**

Suggested Continuous Evaluation Methods:

Maximum Marks: 100

Continuous Comprehensive Evaluation (CCE): 25

University Exam (UE): 75

Internal Assessment Continuous Comprehensive Evaluation(CCE):25	Class Test		15
	Assignment / Presentation		10
	Total		25
External Assessment University Exam Section:25 Time: 02.00Hours	Section (A): Three Very Short Questions (50 Words Each)		3x3=30

	Section (B): Four Short Questions (200 Words Each)		**4x9=36**
	Section (C): Two Long Questions (500 Words Each)		**2x15=30**
	Total		**75**

Part A Introduction

PRACTICAL SYLLABUS

Program Certificate Course	**Class: B.SC.**	**Year : FIRST Year**	**Session :2021-2022 onwards**

Subject: ZOOLOGY		
1	**Course Code**	**S1-ZOOL2P**
2	**Course Title**	**CYTOLOGY, REPRODUCTIVE BIOLOGY & EMBROLOGY (Paper2)**
3	**Course Type**	**Core Course**
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:25+75	Minimum Passing Marks: 33

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)**			
Part-D Assessment and evaluation			
Internal assessment	**Marks**	**External assessment**	**Marks**
Class interaction Quiz	**10**	**Viva voce on practical**	**15**
Attendance	**05**	**Practical record file**	**10**
Assignment(Charts /Model Seminar /Rural service technology(Dissemination/Report of Excursion/ lab visit/Survey/Industrial visit)	**10**	**Table work/Experiments**	**50**
Total	**25**		**75**
Any remarks sugggestions: Nil			