Department of Computer Science

Bachelor of Science (Bioinformatics)

B.Sc. (BI)

CURRICULA

Shri Vaishnav Institute of Management, Indore

Approved by AICTE, New Delhi and Affiliated to DAVV, Indore & RGPV Bhopal

UGC NAAC 'A' Grade Institute

Scheme No. 71, Gumasta Nagar, Indore

Department of Higher Education, Government of Madhya PradeshYearly Syllabus for Undergraduates As recommended by Central Board of Studies of Computer Science andApproved by H E the Governor of M. P. (As per NEP 2020) Session 2021-22

B.Sc. I Year Bioinformatics
Subject: Bioinformatics (Major - I)

Part A: Introduction				
Program Certificate		**Class: B.Sc.**	**First Year**	**Session 2021-22**
Subject: Bioinformatics				
1.	**Course Code**	**S1-BINF1T**		
2.	**Course Title**	**Cell and Molecular Biology (Paper I)**		
3.	**Course Type**	Core Course		
4.	**Pre-requisition**	To study this course a student must have Biology and/or Mathematics as one of the subjects in class 12th.		
5.	**Course Learning Outcomes (CLO)**	**Students shall be able to-** 1. Develop the idea about basics of cell and molecular biology, gene expression patterns and mutations. 2. Apply the Knowledge of biochemical, molecular and physiological aspects of cells and cellular behavior and organizations during tackling the biological problems through *in silico* approach.		
6.	Credit Value	4		
7.	Total Marks	Max. Marks: **25+75**	Min. Passing Marks:**33**	

Part B- Content of the Course		
Total No. of Lectures (in hours per week): 4 hours per week (Total 60 hours)		
Paper I: Cell and Molecular biology		
Unit	**Topics**	**No. of Lectures**

1.	**Cell-Basic Unit of Life** 1.1. History of cell, Cell as a basic unit of life and Cell Theory. 1.2. Ultra structure of cell. Organization of plant and animal cells. Comparison of microbial, plant and animal cell. Cells as experimental models. 1.3.Biochemical components of cells (nucleic acid, carbohydrates, protein, and lipids) Keywords: Cell, Cell Theory, Prokaryotes, Eukaryotes, Biomolecules.	**15**
2.	**Sub cellular components and Cell Division Cycle** 2.1.Sub cellular organization, Cytosol. 2.2.Structure and functions of cytoplasmic organelles: Golgi body, Endoplasmic reticulum, Lysosomes, Peroxixomes, Nucleus, Mitochondria and Chloroplast. 2.3.Structure and function of Cell Membrane. 2.4. Cell division cycle (eukaryotic and prokaryotic), mitosis, meiosis, and cell death. **Keywords**: Cytosol, Cell organelles, Plasma membrane, Mitosis, Meiosis.	**15**
3.	**DNA- Genetic Material** 3.1. DNA as a genetic material, Experimental evidences - Griffith's, McLeod, McCarty and Avery's, Hershey and Chase experiments. 3.2. Structure of DNA, Definition of gene, Chromosome structure and functions, Lampbrush and Polytene chromosome. 3.3. Gene transfer in bacteria: Transformation, Conjugation & Transduction.	**15**

	3.4. DNA replication in prokaryotes & eukaryotes, Proteins necessary for DNA replication, Regulation of DNA replication. **Keywords:** DNA, Gene, Chromosome, Gene Transfer, DNA Replication	
4.	**Gene Expression and Mutation** 4.1. Gene expression: Transcription and translation in prokaryotes & eukaryotes. 4.2. Post translational modification in eukaryotes. 4.3. Regulation of gene expression in prokaryotes & eukaryotes. 4.4. Mutation: types of mutation, mutagens & mutagenesis. Keywords: Gene expression, Transcription, Translation, Mutation, Mutagen.	**15**

Part C- Learning Resources
Textbooks, Reference Books and Other Resources
Suggested Readings: 1. Krebs, Jocelyn E., Goldstein, Elliott S., Kilpatrick, Stephen T., Lewin's GENES XII. United States, Jones &Bartlett Learning, 2017. 2. Molecular Cell Biology, Lodish, H, Berk, A. et, al, WH Freeman & Co Ltd., 2016 3. Molecular Biology of the Cell, Alberts, B., W.W. Norton, United States, 201 4. Molecular Biology: Genes to Proteins, Tropp, Burton E., N.., Jones & Bartlett Learning, LLC, 2020. 5. Molecular Biology of the Gene, Watson James D., et,al. Pearson Education, 2017. **Suggested equivalent online courses:** 1. https://onlinecourses.nptel.ac.in/noc21_cy15/preview 2. https://nptel.ac.in/courses/102/106/102106025/ 3. https://nptel.ac.in/courses/102/106/102106087/

Part D- Assessment and Evaluation		
Maximum Marks: 100 Continuous Comprehensive Evaluation (CCE): **25** University Exam (UE): **75**		
Internal Assessment Continuous Comprehensive Evaluation (CCE): 25	Four Class Test of 4 marks each	16
	Assignment/Presentation	04
	Overall performance in the semester	05
	Total	**25**
External Assessment: University Exam	Section (A): Three Very Short Questions (50 Words Each)	3×3=9
	Section (B): Four Short Questions (200 Words Each)	4×9=36
	Section (C): Two Long Questions (500 Words Each)	2×15=30
	Total	**75**
Any remarks/suggestions: Nil		

Part A- Introduction				
Program Certificate		**Class: B.Sc.**	**First Year**	**Session 2021-22**
Subject: Bioinformatics				
1.	**Course Code**	**S1-BINF1P**		
2.	**Course Title**	Practicals in Cell and Molecular Biology (**Paper 1**)		
3.	**Course Type**	Core Course		
4.	**Pre-requisition**	To study this course a student must have Biology and/or Mathematics as one of the subjects in class 12^{th}.		
5.	**Course Learning Outcomes (CLO)**	Students shall be able to- 1. Apply the knowledge of biochemical, molecular and physiological aspects of cells and cellular behavior and organizations during tackling the biological problems through in silico approach. 2. Conduct experiments, analyse and interpret the results using basic cellular & molecular biological techniques.		
6.	Credit Value	2		
7.	Total Marks	Max. Marks: **25+75**	Min. Passing Marks:**33**	

Part B- Content of Practical Course
Total No. of Lectures (in hours per week): -2 hours per week (Total 30 hours)

Paper I: Practicals in Cell and Molecular Biology		
Practicals	**Topics**	**Number of lectures**
	1. Study of microbial cells by monochrome staining and Gram staining. 2. Study of different stages of mitosis and meiosis. 3. Qualitative tests for carbohydrates, proteins, and lipids. 4. Isolation of chromosomal DNA from plant cell/animal cell. 5. Isolation of genomic/plasmid DNA from microorganisms. 6. Analysis of isolated DNA by Agarose gel electrophoresis. 7. Transformation in E. coli. 8. UV as mutagen	**30**

Part C- Learning Resources

Textbooks, Reference Books and Other Resources

Suggested Readings:

1. Wilson and Walker's Principles and Techniques of Biochemistry and Molecular Biology, United Kingdom: Cambridge University Press, 2018.

2. An Introduction to Practical Biochemistry, David T Plummer, Tata MacGraw-Hill Edition, 2003.

3. Molecular Cloning: A Laboratory Manual, Green and Sambrook, Cold Spring Harbor Laboratory Press, 2013.

4. Molecular Cell Biology, Lodish, H,. Berk, A. et, al, WH Freeman &Co Ltd., 2016.

5. Molecular Biology: Genes ot Proteins, Tropp, Burton E., N.p., Jones & Bartlett Learning, LLC, 2020.

Suggested equivalent online courses:

1. https://onlinecourses.nptel.ac.in/noc21cy15/preview
2. https://nptel.ac.in/courses/102/106/102106025/
3. https://nptel.ac.in/courses/102/106/102106087/

Part D- Assessment and Evaluation (Practical)			
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: B.Sc.**	**First Year**	**Session 2021-22**
Subject: Bioinformatics				
1.	**Course Code**	**S1-BINF2T**		
2.	**Course Title**	**General Introduction to Bioinformatics (Paper II)**		
3.	**Course Type**	Core Course		
4.	**Pre-requisition**	To study this course a student must have Biology and/or Mathematics as one of the subjects in class 12th.		
5.	**Course Learning Outcomes (CLO)**	**The students shall be able to:** 1. Get the general overview of internet protocols and general introduction of bioinformatics. 2. Acquire the knowledge about the biological databases, sequence alignments, data retrieval system, phylogenetic analysis, and comparative genome analysis. 3. Join as lab assistant/ technical assistant in any R&D project in Life sciences.		
6.	Credit Value	4		
7.	Total Marks	Max. Marks: **25+75**	Min. Passing Marks:**33**	

Part B- Content of the Course		
Total No. of Lectures (in hours per week): 4 hours per week (Total 60 hours)		
Paper II: General Introduction to Bioinformatics		
Unit	**Topics**	**No. of Lectures**

1.	**Introduction to Bioinformatics** 1.1. Introduction to Bioinformatics and application-oriented background of bioinformatics. 1.2. Introduction to Biological Databases. 1.3. Types of Biological Databases: Nucleic Acid Databases, Protein Databases, Specialized Genome Databases, Structure Classification Databases and Database. **Keywords**: Biological Databases, Nucleic Acid Database, Protein Databases, Specialized Genome Database, Structure Classification Database, Structure Databases	**15**
2.	Data Acquisition and Information Retrieval from Biological Databases 2.1. Data Acquisition - concept and purposes. 2.2. Information Retrieval from Biological Databases: Integrated information Retrieval (Entrez System), Retrieving database entries. 2.3.The NCBI data model: Introduction, Seg-id, Sequence, 15 collection of sequence, annotation of sequence, describing sequence. 2.4.GenBank Sequence Database: Introduction to structure, Primary and secondary database, Format vs Content: Computer vs. Human, Databases, GenBank Flat file, GCG. **Keywords:** Entrez, NCBI, Sequence, Seq-id, GenBank	**15**
3.	Sequence Alignment and Database Searching **3.1.**Sequence Alignment And Database Searching: Introduction, Evolutionary Basis of Sequence Alignment, **3.2.**Optimal alignment method, Substitution Score and Gap Penalty, Statistical Significance of Alignment. Database similarity searching, FASTA, BLAST, Database searching Artefacts, Position Specific Scoring Matrices. **3.3.**Multiple Sequence Alignment (MSA): About MSA, Structural or Evolutionary Alignment, ways to align Sequences, Tools. **Keywords:** Sequence Alignment, FASTA, BLAST, Optimal alignment method.	**15**

4.	**Phylogenetic Analysis, Predictive Methods, and Comparative Genome Analysis** 4.1. Phylogenetic Analysis: Fundamental of Phylogenetic model, Tree interpretation - Paralogues and orthologues, Tree building and Tree evaluation, Phylogenetic software. 4.2. Predictive Method using Nucleotide Sequence: Introduction, marking repetitive DNA, Database search, Codon bias detection, detecting functional site in DNA. 4.3. Predictive Method using Protein Sequence: Protein identification based on composition, Physical properties based on sequence, Motif and pattern, Secondary 15 structure and folding classes, specialized structure or features, Tertiary structures. 4.4. Structure Database: Introduction to Structure, PDB, MMDB, Structure file format, visualizing structure information, Structure viewers, structure similarity searching, Advanced structure modelling. 4.5. Comparative Genome Analysis: Introduction, application, genome analysis and annotation. **Keywords:** Phylogenetic Analysis, Predictive Method, Motif, PDB, MMDB, Comparative Genome Analysis.	

Part C- Learning Resources

Textbooks, Reference Books and Other Resources

1. Bioinformatics, Andreas D. Baxevanis, David S. Wishart, Gary D., Bade, Wiley, United Kingdom, 2019.
2. Essential Bioinformatics, Xiong, Jin, Cambridge University Press, United States, 2014.
3. Bioinformatics: Sequence and Genome Analysis, Mount, D. W., CBS Publishers & Distributors, India, 2005.
4. Introduction to Bioinformatics, Lesk, Arthur M, Oxford University Press, USA, 2019. 5' edition.
5. Bioinformatics: methods and applications: (Genomics, Proteomics and Drug Discovery), Mendiratta, N., Rastogi, P., Rastogi, S. C., PHI Learning, India, (2013).
6. Bioinformatics: Principles and applications, Ghosh, Z., Mallik, B., Oxford Press, New Delhi, India, 2012.
7. Bioinformatics and Functional Genomics, Pevsner, Jonathan, Wiley, United Kingdom, 2015. 3d' edition.

Suggested equivalent online courses: 1. NPTEL : Biotechnology - NOC: Bioinformatics: Algorithms and Applications .2 Bio-Informatics - IITM - YouTube

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	Four class Test of 4 marks each	16
	Assignment/Presentation	04
	Overall performance in the semester	05
	Total	**25**
External Assessment: University Exam Section: 75 Time: 02:00 Hours	Section (A): Three Very Short Questions (50 Words Each)	3×3=9
	Section (B): Four Short Questions (200 Words Each)	4×9=36
	Section (C): Two Long Questions (500 Words Each)	2×15=30
	Total	**75**
Any remarks/suggestions: Nil		

Part A- Introduction				
Program Certificate		**Class: B.Sc.**	**First Year**	**Session 2021-22**
Subject: Bioinformatics				
1.	**Course Code**	**S1-BINF2P**		
2.	**Course Title**	**Practical in General Introduction to Bioinformatics**		
3.	**Course Type**	Core Course		
4.	**Pre-requisition**	To study this course a student must have Biology and/or Mathematics as one of the subjects in class 12th.		
5.	**Course Learning Outcomes (CLO)**	The students shall be able to: 1. Retrieve the DNA/Protein sequences from databases and analyze them using bioinformatics tools. 2. Perform multiple sequence alignment using bioinformatics tools. 3. Visualize the structures of proteins.		
6.	**Credit Value**	2		
7.	**Total Marks**	Max. Marks: **25+75**	Min. Passing Marks:**33**	

Part B- Content of Practical Course		
Total No. of Lectures (in hours per week): 2 hours per week (Total 30 hours)		
Part II: Practical in General Introduction to Bioinformatics		
Practicals	**Topics**	**No. of Lectures (Hours)**
	1. Introduction to NCBI. 2. Using Entrez to search Literature Databases. 3. Retrieving DNA sequence from GenBank and analyzing various formats of the data stored. 4. Retrieving Protein sequence from GenPept (NCBI) and Expasy. 5. Analyzing Protein Sequences. 6. Analyzing DNA sequence. 7. Sequence alignment using BLAST (Basic Local Alignment Search Tool). 8. Sequence alignment using FASTA. 9. Multiple sequence alignment using ClustalW. 10. Introduction to the structure database PDB. 11. Visualization of the protein structure using VMD. 12. Secondary structure prediction using GOR algorithm.	**30**

Part C- Learning Resources
Textbooks, Reference Books and OtherResources
Suggested Readings: 1. Bioinformatics, Andreas D. Baxevanis, David S.Wishart, GaryD. Bade, Wiley, United Kingdom, 2019. 2. Essential Bioinformatics, Xiong, Jin, Cambridge University Press, United States, 2014. 3. Bioinformatics: Sequence and Genome Analysis, Mount, D. W., CBS Publishers & Distributors, India, 2005. 4. Introduction to Bioinformatics, Lesk, Arthur M, Oxford University Press, USA, 2019. 5th edition. 5. Bioinformatics: methods and applications: (Genomics, Proteomics and Drug Discovery), Mendiratta, N., Rastogi, P., Rastogi, S. C., PHI Learning, India, (2013). 6. Bioinformatics: Principles and applications, Ghosh, Z., Mallik, B., Oxford Press, New Delhi, India, 2012. 7. Bioinformatics and Functional Genomics, Pevsner, Jonathan, Wiley, United Kingdom, 2015. 3rd edition. 8. **Suggested equivalent online courses:** 1. NPTEL::Biotechnology- NOC: BioInformatics: Algorithms and Applications 4. Bio-Informatics- IITM - YouTube

Part D- Assessment and Evaluation (Practical)			
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**

Department of Higher Education, Government of Madhya PradeshYearly Syllabus for Undergraduates
As recommended by Central Board of Studies of Computer Science andApproved by H E the Governor of M. P. (As per NEP 2020)
Session 2021-22

B.Sc. I Year Bioinformatics
Subject: Chemistry (Minor/Elective)

Program Certificate		**Class: B.Sc.**	**First Year**	**Session 2021-22**
Subject: Chemistry				
1.	**Course Code**	**S1-CHEM2T**		
2.	**Course Title**	**Analytical Chemistry (Paper II)**		
3.	**Course Type**	Core Course		
4.	**Pre-requisition**	To study this course a student must have had the subject Chemistry in class 12^{th} or equivalent		
5.	**Course Learning Outcomes (CLO)**	By the end of this course students will learn the following aspects of Chemistry: 1. Basic concepts of Mathematics for Chemists. 2. Fundamentals of Analytical Chemistry and steps involved in analysis. 3. Basic knowledge of Computer for chemists. 4. Basic concepts of Chemical equilibrium. 5. Principles of Chromatography and chromatographic techniques. 6. Various techniques of Spectroscopic Analysis.		

6.	Credit Value	4	
7.	Total Marks	Maximum Marks: CCE-25, University Exam (UE)-75	Min. Passing Marks:**33**

Part B- Content of the Course		
Total No. of Lectures-Tutorials-Practical (In hours per week): L-T-P: 90-0-30		
Unit	**Topics**	**No. of Lectures**
1.	**Mathematics for Chemists** Straight line equation, Logarithmic relations, Curve sketching, Linear graphs & calculation of slopes, Differentiation, differentiation of functions like K_X, e^x, x^n, sin x, log x, 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 measurements. 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, and normality. Expressing the concentration in parts per million (ppm), parts per billion (ppb), Numerical Problems. **Chemical Stoichiometry**- Empirical and Molecular Formulas, Stoichiometric Calculations, Numerical Problems. Keywords/Tags: *Accuracy, Precision, SI units, Units of Concentration, Chemical stoichiometry.*	**10**
3.	**Computer for Chemists** Introduction to computer, Introduction to operating systems like -DOS, Windows, Linux, and Ubuntu. **Use of computer programs** Running of standard programs & packages such as MS-word, MS-excel, PowerPoint, Execution of linear regression x-y Plot. Use of software for drawing structures and molecular formulae. Keywords/Tags: *Operating Systems, MS-word, MS-excel, PowerPoint.*	**10**

4.	**Chemical Equilibrium:** Equilibrium constant and free energy, concept of chemical potential, Thermodynamic derivation of law of chemical equilibrium. Temperature dependence of equilibrium constant; Van't Hoff reaction isochore, Van't Hoff reaction isotherm. Le-Chatelier's principle and its applications. Keywords/Tags: *Chemical Equilibrium, Equilibrium constant, Free Energy. Chemical Potential*	**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 Applications of:** • Flash chromatography. • Ion-exchange chromatography and • Chiral chromatography. Keywords/Tags *Chromatogram, Ion Exchange, Column Selection, Adsorption*	**10**
6.	**Spectral techniques of analysis** **Basics of absorption spectroscopy**: Electromagnetic radiation, Spectral range. Absorbance, Absorptivity, Molar Absorptivity, Fundamental Laws of Absorption, Lambert-Beer Law and its limitations. Constitution & working of photometer, spectrometer, colorimeter. **Ultraviolet (UV) absorption spectroscopy-** Presentation and analysis of UV spectra, Types of electronic transitions, Effect of conjugation. Concept of chromophore 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 RI spectrum, fingerprint region, characteristic absorption of various functional groups and interpretation of RI spectra of simple organic compounds. Keywords/Tags: *Hypsochromic, Hypochromic, Absorption, Spectrum*	**10**

Part C- Learning Resources

Textbooks, Reference Books and OtherResources

Textbooks-

1. Gaur, S., Computer for Chemists, Neel Kamal Prakashan, 2017.
2. Khopkar, S.M. Basic Concepts of Analytical Chemistry. New Age, International 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, PragatiPrakashan, 2018.
7. Sharma B.K., Chromatography. Krishna Prakashan, 2019.
8. Sharma Y.R., Elementary Organic Spectroscopy, S Chand, 2013.
9. Singh, DR, Saxena, G., Singh, B., Inorganic Chemicals, Shivlal Aggarwal & 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, RK. P., Modern Chemistry, Sahitya Bhavan, Agra.
13. Agnihotri, PK, Sahu, D.
14. P., Pillai, A., Sahu, M., Yugbodh Chemistry, Yugbodh Publications, Raipur

Reference Books:

1. Mitra Surbhi, Handbook of Computer Science & IT, Arihant, 2018.
2. Harris, D. C. Quantitative Chemical Analysis. 6th Ed., Freeman (2007).
3. Christian, Gary D; Analytical Chemistry, 6th Ed. John Wiley & Sons, New York, 2004.
4. Barrow, GM. Physical Chemistry. Tata McGraw-Hill (2007).
5. Atkins' Physical Chemistry, 10' Edition, Oxford University Press, 2014.
6. Guru 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, 2006.
8. Finar, IL., Organic Chemistry (Vol. I&1I), 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.ac.in/courses/104/105/104105084/

Web sources

1. http://www.freebookcentre.net/Chemistry/Analytical-Chemistry-Books.html.
2. https://www.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 test 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 -Part A				
Program Certificate		**Class: B.Sc.**	**First Year**	**Session 2021-22**
Subject: Chemistry				
1.	**Course Code**	**S1-CHEM2P**		
2.	**Course Title**	**Analytical Processes and Techniques (Paper II)**		
3.	**Course Type**	Core Course		
4.	**Course Learning Outcomes (CLO)**	By the end of this course students will learn the following aspects of 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 of Spectral Techniques.		
5.	Credit Value	2		
6.	Total Marks	Maximum Marks: CCE-25, University Exam (UE)-75	Min. 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 molarity/normality by weighing and dilution.	**10**
2.	**Quantitative Analysis** • **Titrimetric Analysis** o Standardization of NaOH with Oxalic acid. o Determination of carbonate and hydroxide present in mixture. o Determination of carbonate and bicarbonate present in a mixture. o Determination of free alkali present in different soaps/detergents.	**20**
3.	**Quantitative Analysis by Colorimetry** • Verification of Lambert-Beer Law. • Determination of concentration of colored compounds (e.g., $CuSO_4$. $KMnO_4$)	**10**
4.	**Qualitative Analysis** • Systematic identification of organic compounds by qualitative analysis. • Chromatography: Identification by determination of the Revalues of the given organic/ inorganic compounds by paper / thin layer chromatography. Keywords/Tags: *Analytical, Authentication, Molarity/ Normality, Standardization, Colorimetry, Qualitative Analysis*	

Part C- Learning Resources

Textbooks, Reference Books and 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 Rehana, 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 platform web links:

1. https://www.youtube.com/watch?v=0AlmRDzuTh8.
2. http://amrita.olabs.edu.in/?sub=73&brch=8&sim=133&cnt=1.
3. http://chemcollective.org/vlabs.
4. http://mas-jith.vlabs.ac.in/exp6/Quiz.html
5. https://chem.libretexts.org/Ancillary_Materials/Laboratory_Experiments/Wet_Lab_Experiments/General_Chemistry_Labs/Online _Chemistry Lab Manual/Chem 9Experiments/02%3APaper_ Chromatography _of_ Gel_ Ink Pens_(Experiment).
6. https://edu.rsc.org/experiments/leaf-chromatography/389.article.
7. https://edu.rsc.org/experiments/chromatography-of- sweets/455.article.
8. http://swe.mit.edu/outreach/virtual_resources/paper_chromatog raphy.pdf.
9. http://www.chem.latech.edu/~deddy/chem104/104Standard.html.
10. https://www.chem.purdue.edu/courses/chm224/Miscellaneous/ Model_report_Expt2-revised 2009.pdf.
11. https://www.webpages.uidaho.edu/ifcheng/Chem%20253/labs/ Experiment%203.pdf.
12. http://faculty.ccbemd.edu/~cyau/122%2007%20Acid- base%20titration%20AUG%202013.pdf.
13. https://labbalances.net/blogs/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=1 07807261.6.1518193235316& hstc=107807261.215aea6ed7 77995a4967830c0f9aad.1516987215921.1518111962556.151 8193235316.17& _hsfp=2102249448&hsCtaTracking=8918cf fa-b755-4f72-b4b1-24c1fa8d1a6d%7C12eb2e3f-4662-43eb-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	10	*Viva voce* on Practical	15

solution preparation and analysis. • Numerical problems related to solution preparation. • Any other discussion. *Note: description to be written in practical record.*			
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**

Department of Higher Education, Government of Madhya PradeshYearly Syllabus for Undergraduates
As recommended by Central Board of Studies of Computer Science andApproved by H E the Governor of M. P. (As per NEP 2020)
Session 2021-22

B.Sc. Bioinformatics
Elective- Biotechnology

Part A- Introduction				
Program Certificate		**Class: B.Sc.**	**First Year**	**Session 2021-22**
Subject: Microbiology (Biotechnology elective)				
1.	**Course Code**	**CORE-TH-2SIBTEC2T**		
2.	**Course Title**	**Microbiology and immunology**		
3.	**Course Type**	Core Course		
4.	**Pre-requisition**	To study this course a student must have had the subject Biology in class 12^{th}.		
5.	**Course Learning Outcomes (CLO)**	**Course Objectives:** To create general understanding about microbiology and immunology 1. The students will be able to understand microbial diversity and Nutrition. 2. The students will be able to understand immune system, Immune responses, and Vaccination. 3. The students will be able to describe role of immune system in both maintaining health and contributing to disease.		

		4. The students will be able to understand immunological techniques. **Course Learning Outcomes:** At the end of the course student will be familiar with – 1. Microbial diversity and nutrition. 2. Immune system, its properties, and types. 3. Immunoglobulin structure, types and functions and can apply the concept of hypersensitivity and vaccination for different diseases. 4. Perform various immunological techniques.
6.	Credit Value	4
7.	Total Marks	Max. Marks: **25+75** Min. Passing Marks:**33**

Part B- Content of the Course

Total No. of Lectures- 60

Unit	Topics	No. of Lectures
I	**History, Basic concepts of Microbiology and Culture Media preparation** 1. History, Basic concepts of Microbiology: 1.1.Fundamental, History and evolution of microbiology, Development of microbiology, Application of microbiology ni human welfare. 1.2. Classification, General characteristic and structure of Bacteria, Fungi and Viruses. 2. Media Preparation: 2.1. Methods and Types: Culture, Minimal, Selective, differential, Transport media. 2.2. Synchronous, Batch and Continuous culture **Key Words**: Classification of Microorganisms, Media Preparation.	**12**
II	**Microbial Growth and Growth measurement:** 1. Microbial Growth: 1.1. Definition of growth, Mathematical expression of growth Curve, Generation time, Growth yield, Effect of nutrients on growth. 1.2. Factor affecting growth: Nutrient, Temperature, Oxygen, pH, Osmotic pressure. 2. Growth measurement: 2.1 Measurement of Growth (Direct and Indirect methods): cell number, Cell Mass, and Cell Activity. 2.2. Cell Count: Turbidometric method, Plate count method, Membrane count method, Dry weight, and Wet method by measurement of cellular activity. **Key Words:** Growth, Measurement.	**14**

III	**Basics of Immunology**: 1.1.Concept of Innate and Acquired immunity, Phygocytosis complement and Inflammatory responses. 1.2. Immune cells and organs: Structure, Function and Properties of immune cells - Stem cell, T-cell, B-cell, NK-cell, Macrophagus, Neutrophil, Eosinophil, Basophil, Mastcell, Dentric cell. 1.3. Immune organs: Bone marrow, Thymus, Lymph Node, Spleen, lymphatic system. **Key words:** Immunity, Immune cells.	**10**
IV	**Immunoglobulins and Immune response:** 1. Immunoglobulins 1.1. Antigens: Characteristics of an antigen: Foreignness, Molecular size, Chemical composition and Heterogeneity, Antigen Adjuvants, Epitopes, Haptens. 1.2. Antibodies: Structure, Types, Functions and Properties of antibodies Antigenic determinant on antibodies (Isotypic, Allotypic, Idiotypic). Monoclonal, Polyclonal and Chimeric antibody. 2. Immune response: Generation of immune response: Primary and Secondary immune response, generation of Humoral response (Plasma and Memory cell), Generation of cell mediated immune response (self MHC restriction, T-cell activation, Co-stimulatory signals), Killing Mechanisms by CTL and NK cells, Introduction to tolerance. **Key Words:** Antigens, Antibody.	**15**
V	**Microbial, Immunological Techniques and Vaccination:** 1. Microbial Techniques: 1.1. Principle, Working and applications of instruments -Laminar airflow, Autoclave, Hot air oven. 2. Immunological techniques: 2.1.RIA, ELISA, Western blotting, Principles of Precipitation, Agglutination, Immunodiffusion, Immunoelectrophorosis. 3. Vaccination: 3.1.Vaccines and vaccination: Rubella, Varicella (Chickenpox), Polio, Diptheria, Hepatitis vaccine. Key Words: RIA, ELISA, Laminar air flow, Autoclave, Vaccine.	**10**

Part C- Learning Resources

Textbooks, Reference Books and Other Resources

Suggested Readings:

1. Fundamentals of microbiology and immunology; A.K.Baneriee and Nirmalava Banerjee, New Central Book Agency, New Delhi.
2. Modern concepts of microbiology; H.D. Kumar and Swati Kumar., Vikas Publishing House Pvt Ltd., 2nd Edition.
3. Microbiology; M.J. Pelezar, E.C.S. Chan and N.R.Krieg, McGraw Hil Book company. 1993, 5 editions.
4. A text book of microbiology; R.C.Dubey and D.K.Maheshwari . S Chand and Company Ltd 2004, I" edition.
5. Microbiology; P.D.Sharma, Rastogi Publication, Meerut.
6. General Microbiology Vol I and I; C.B. Powar and H.F.Dagniwala, Himalaya Publication.
7. Microbiology Fundamental and Applications; S.S.Purohit, Agrobias, 7' Edition.
8. Immunology; K.R. Joshi, Agrobios, 5th edition.

Suggested Equivalent online courses:

1. http://www.freebookcentre.net >.. free microbiology books download books online Textbooks.
2. http://open.oregonstate.education>...General Microbiology- Open Textbook-Open Textbooks.
3. http://www.freebookcentre.net>...Immune System and Immunology (PDF63P) download book.
4. http://hmmcollege.ac.in>3...PDF Introduction to Immunology.
5. http://www.malecentrum.sk>.....PDF IMMUNOLOGY &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: 75 Time: 02:00 Hours	Section (A): Three Very Short Questions (50 Words Each)	3×3=9
	Section (B): Four Short Questions (200 Words Each)	4×9=36
	Section (C): Two Long Questions (500 Words Each)	2×15=30
	Total	**75**

Any remarks/suggestions: Nil

Part A- Introduction				
Program Certificate		**Class: B.Sc.**	**First Year**	**Session 2021-22**
Subject: Microbiology elective practical				
1.	**Course Code**	**CORE-PR-2-SI-BTEC2P**		
2.	**Course Title**	Lab on Microbiology and Immunology		
3.	**Course Type**	Core Course		
4.	**Pre-requisition**	To study this course a student must have had the subject Biology in class 12^{th}.		
5.	**Course Learning Outcomes (CLO)**	The **objective of the course** is to prepare students competent in subject through in-depth lecture and laboratory practices- 1. The students will be able to identify microbes using modern techniques. 2. The students will acquire skill and competence in microbiological and immunological laboratory practices applicable to microbiological research or clinical methods of immunology, including accurately reporting observations and analysis. **Course Learning Outcomes:** On completion of this course, learners will be able to have sufficient scientific understanding of microbiology and immunology- 1. Students can apply concept, principle and types of sterilization methods viz performing microbiological experiments. 2. Students can apply the concept and characteristics of antiseptic. disinfected and their mode of action in day-to-day life. 3. Students will apply principle, working and applications of instruments - Laminar airflow, Autoclave, Hot air oven etc.		
6.	**Credit Value**	2		
7.	**Total Marks**	Max. Marks: **25+75**	Min. Passing Marks:**33**	

Part B- Content of Practical Course	
Total No. of Practical (In Hours)- **30**	
Topics	Hours
List of Practical 1. To perform Aseptic technique, Cleaning of glassware's, preparation of Cotton Plugging and Sterilization. 2. To prepare Bacterial and Fungal media. 3. To isolate microbes from Air, Water and Soil. 4. To Study dilution and plating by Pour Plate, Spread Plate methods. 5. To Study microorganisms by Staining method - Simple staining, Gram staining, Endospore staining, Fungal staining, Negative staining 6. To identify bacteria based on staining, Shape and Size. 7. To enumerate microorganism - To t a l and Viable count. 8. To study Antibiotic sensitivity of microbes by the use of antibiotic discs. 9. To isolate and identify pathogenic bacteria from sewage and wastewater. 10. To Determine growth curve and generation time of E. coli. 11. To identify human blood groups. 12. To enumerate total WBC of the given blood sample by hemocytometer. 13. To enumerate the differential Leukocyte of the given blood sample. 14. To enumerate total RBC of the given blood sample by hemocytometer. 15. To isolate and Identify aquatic Fungi from Local waterbody.	**Total 30**

Part C- Learning **Resources**
Textbooks, Reference Books and OtherResources
Suggested Readings – 1. Laboratory Techniques in Modern Biology; N. Swarup. SC. Pathak, S. Arora, Kalyani Publication, New Delhi. 2. Integrated Methodologies in Biology; Shashi Shrivastava. Banerjee, Arun Prakashan, Gwalior. 3. Experiment in Microbiology Plant Pathology and Biotechnology; K. R. Anejaa, New Age International, New Delhi, 2007. 4. Laboratory Manual of Biotechnology; P. N. Swamy, Rastogi Publication, Meerut. 5. Practical Microbiology; R. C. Dubey, D. K. Maheshwari, S Chand &Company, Delhi.

6. Manual of Experiments in Biotechnology: Leena Lakhani, Sheeba Khan, Kailash Pustak Sadan, Bhopal.

Suggested digital platforms web links

http://lipguides.uphsc.edu>.....ebooks Microbiology Immunology &Biochemistry.
http://bookauthority.org>..Microbiology eBook

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: Nil			

Scheme of table work/Experiments

1. Major Experiment 15
2. Minor Experiment-1 10
3. Minor Experiment-2 10
4. Spotting 15
5. Viva-Voce 15
6. Practical Record 10

Department of Higher Education, Government of Madhya PradeshYearly Syllabus for Undergraduates As recommended by Central Board of Studies of Computer Science andApproved by H E the Governor of M. P. (As per NEP 2020) Session 2021-22

B.Sc. I Year

Subject: English Language and Indian Culture (Foundation)

<table>
<tr><th colspan="4">PART A: Introduction</th></tr>
<tr><td colspan="2">Program: UG Level.</td><td>Class: I Year</td><td>Year: 2021-22</td><td>Session: 2021-22 onwards</td></tr>
<tr><td colspan="5">Subject: Foundation Course (English)</td></tr>
<tr><td>1.</td><td>Course Code</td><td colspan="3">X 1-FCHB1T</td></tr>
<tr><td>2.</td><td>Course Title</td><td colspan="3">English Language and Indian Culture</td></tr>
<tr><td>3.</td><td>Course Type (Core Course/Elective/Generic Elective/ Vocational</td><td colspan="3">Foundation Course</td></tr>
<tr><td>4.</td><td>Pre-Requisite (if any)</td><td colspan="3">To study this course, a student should have basic knowledge.
of English language. This course will be studied by all thestudents of UG level under the Foundation Course category.</td></tr>
<tr><td>5.</td><td>Course Learning Outcomes(CLO)</td><td colspan="3">Through this course the students will be able to:
1. Prepare for various competitive exams by developing theirEnglish language competence.
2. Promote their comprehension skills by being exposed to avariety of texts and their interpretations.
3. Build and enhance their vocabulary.
4. Develop their communication skills by strengtheninggrammar and usages.
5. Inculcate values which make them aware of nationalheritage and environmental issues, making them</td></tr>
</table>

		responsible citizens.	
6.	Credit Value	**2**	
7.	Total Marks	Max. Marks: 50	Min. Pass Marks:17

PART B: Content of the Course

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

Total No. of Lectures:

Unit	Topics	No. of Lectures
I	**Reading, Writing and Interpretation Skills:** I. Where the Mind is Without Fear— Rabindranath Tagore [Key **Word: Patriotism]** **2.** National Education — M. K. Gandhi **[Key Word: Edification]** **3.** The Axe- R.K Narayan [Key **Word: Environment]** **4.** The Wonder That Was India- A.L Basham (an excerpt) [Key **Word: Indianness]** **5.** Preface to the Mahabharata C. Rajagopalachari [Key **Word: Indian Mythology**]	05
II	**Comprehension Skill:** Unseen Passage followed by Multiple choice questions	05
III	**Basic Language Skills 1:** Vocabulary Building: Suffix, Prefix, Synonyms, Antonyms, Homophones, Homonyms and One-word substitution. 2: Basic Grammar: Noun, Pronoun, Adjective, Verb, Adverb, Prepositions, Articles, Time, and Tense	05

PART C: Learning Resources

Textbooks, Reference Books, Other Resources

Suggested Readings

Essential English Grammar - Raymond Murphy, Cambridge University Press.

- Practical English Grammar Exercises 1- A. J. Thomson & A. V. Martinet, Oxford India.
- Practical English Usage - Michael Swan, Oxford
- English Grammar in Use - Raymond Murphy, Cambridge University Press.

Part D: Assessment and Evaluation			
Max Marks:50	**Min Marks: 17**	**University Exam (UE)**	**Total:50**

U.E. Time 2 Hours			
	External Assessment (UE)	**Time: 2 Hours**	
	Fifty Multiple Choice /Objective/True-False type questionsto be asked. Each question carries one mark		

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Computer Science andApproved by H E the
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Session 2021-22

B.Sc. I Year
Subject: Environmental Education (Foundation)

Part A Introduction .			
Subject: Environmental Education			
Program UG Level Certificate	Class: I Year	First Year	Session: 2021-22 onwards
1.	Course Code	X1- FCAC1T	
2.	Course Title	**Environmental Education**	
3.	Course Type (Core Course/Elective/Generic Elective/ Vocational	**Foundation Course**	

4.	Pre-Requisite (if any)	A course intended to create awareness about the life of human beings which is an integral part of the environment; and to inculcate the skills required to protect the environment from all sides. To study this course, the student must have knowledge about the environmental components, pollution, biodiversity, and ecosystem at senior secondary, class 12th level:
5.	Course Learning Outcomes (CLO) .	1. To understand various aspects of life forms, ecological processes, and the impacts on them by the human during Anthropocene era. 2. To build capabilities to identify relevant environmental issues, analyze the various underlying causes, evaluate the practices and policies, and develop framework to make inform decisions. 3. To develop empathy for all life forms, awareness, and responsibility toward environmental protection and nature preservation. 4. To develop the critical thinking for shaping strategies such as scientific, social, economic, administrative & legal, environmental protection, conservation of biodiversity, environmental equity, and sustainable development. 5. To prepare for the competitive exams.
6.	Credit Value	2
7.	Max Marks: 50	Min. Pass Marks:17

PART B: Content of the Course		
Total No. of Lectures-15 Hrs. (01 hours per week):		
Total No. of Lectures: 15		
Unit	Topics .	No. of Lectures

I	**Environment and Natural Resources:** • Multidisciplinary nature, Scope, and Importance of Environment • Components of Environment: Atmosphere, Hydrosphere, Lithosphere, andBiosphere. • Brief account of Natural Resources and associated problems: Land Resource,Water Resource, Energy Resource • Concept of Sustainability and Sustainable Development ***Keywords: Environment, Forest, Mineral, Food, Land, Water, Energy, SustainableDevelopment***	5 Hrs.
II	**Biome, Ecosystem and Biodiversity:** • Major Biomes: Tropical, Temperate, Forest, Grassland, Desert, Tundra, Wetland,Estuarine and Marine • Ecosystem: Structure function and types of their Preservation & Restoration . • Biodiversity and its conservation practices. ***Keywords: Biome, Ecosystem, Biodiversity***	4 Hrs.
III	**Environmental Pollution, Management and Social Issues:** • Pollution: Types, Control measures, Management, and associated problems. • Environmental Law and Legislation: Protection and conservation Acts. • International Agreement & Programme. • Environmental Movements, communication, and public awareness programme. • National and International organizations related to environment conservation and monitoring. • Role of information technology in environment and human health. ***Keywords: Pollution, Environmental Legislation, Environmental Movement, Environmental programme and organization.***	6 Hrs.

Suggested activities: (at least one)

1. Visit to an area to document environmental assets: rivers / forest / flora /fauna.
2. Visit to a local polluted site Urban / Rural/ Industrial / Agricultural
3. Study of simple ecosystem.

PART C: Learning Resources

Textbooks, Reference Books, Other Resources

- Singh; J.S., Singh S.P. and Gupta, S.R.; "Ecology; Environment Science and Conservation ", SChand publishing, New Delhi, (2018).
- Divan, S. and Rosencranz, A., "Environmental Law and Policy in India: Cases, Material &Status" Oxford University Press, India, (2002) 2nd Edition.
- Odum, E.P., "Fundamentals of Ecology ", Philadelphia Saundres, (1971)
- Bharucha, Erach, "Environmental studies " Universities Press India Pvt. Ltd. Hyderabad (2014) (Hindi Edition also available).
- Kaushik, Anubha, Kaushik, C.P. "Perspectives in Environmental Studies "New age International Publishers, (2018), 6th Edition.
- Asthana, D. K Asthana Meera, "A Textbook of Environmental Studies", S. Chand. Publishing,New Delhi (2007)
- National Digital Library (https://ndl.iitkgp.ac.in/homestudy/science)
- Epg- pathshala (https://epgp.inflibnet.ac.in/Home/Download)
- NPTEL (https://nptel.ac.in/course.html)
- Coursera (https://www.coursera.org/search?query=environmental+science&page=1)

Suggested equivalent online course —

i. The Health Effects of Climate Change (edx)
ii. Climate Change: Financial Risks and Opportunities (edx)
iii. Introduction to Environmental Law and Policy (coursera)
iv. Women in environmental biology (coursera)
v. Our Earth: It's Climate, History, and Processes (coursera)
vi. Ecology, physiology, environmental science (national digital library)

Department of Higher Education, Government of Madhya PradeshYearly Syllabus for Undergraduates As recommended by Central Board of Studies of Computer Science andApproved by H E the Governor of M. P. (As per NEP 2020) Session 2021-22

B.Sc. I Year
Subject: Yoga and Meditation (Foundation

Part-A: Introduction

Program: Certificate course	**Class: B.A. 1** Year	**Year: 2021**	**Session: 2021 — 2022**

Subject: Yogic Science

I.	**Course Code**	**Al-YOSC1F**	
2.	**Course Title**	**Yoga and Meditation (Paper-2)**	
3.	**Course Type**	Foundation Course	
4.	**Pre-requisite (If any)**	**For BA I Year students, this** course is compulsory for all.	
5.	**Course Learning Outcomes**	**After studying this course, students will be able** to: **• Take care of their own Physical Mental emotional, social, and spiritual health.**	
6:	**Credit Value**	**Theory-2**	
7.	**Total Marks**	**Max.** Marks: 50	Min. Passing Marks: **17**

Part-B: Content of the Course

Total numbers of Lectures (in hours per week): 2 hours per week
Total Lectures: 30 hours; L — T — P: 2 — 0 — 0

Units	**Topics**	**No. of Lectures**
I	**Introduction to Yoga and Yogic Practices** 1. Yoga: Etymology, definitions, aim, objectives, and misconceptions 2. Yoga: Its Origin, history, and development 3. Rules and regulations to be followed by Yoga Practitioners 4. Introduction to Yoga practices 5. Shatkarma: meaning, purpose and their significance in Yoga Sadhana 6. Introduction to Yogic Loosening practices and Surya Namaskar Key Words: History and Development of Yoga, Shatkarma, Common Yogic Practices.	**10**
II	**Breathing Practices and Pranayama** **1.** Sectional Breathing (Abdominal, Thoracic and Clavicular) 2. Yogic Deep Breathing 3. Concept of Puraka, Rechaka and Kumbhaka 4. Concept of Bandha and Mudra	**10**

	5. Anulmoa Viloma/Nadi Shodhana 6. Shitali 7. Bhramari Key Words: Sectional breathing, Deep breathing, Bandha & Mudra,Shitali, Bhramari	
III	**Practices leading to Meditation.** 1. Recitation of Pranava Mantra 2. Recitation of Hymns, in vocations and prayers 3. Anter Maun 4. Breath Meditation 5. Om Dhyana **Keywords** Pranava Mantra, Anter Maun, Breath Meditation, Om Dhyana	**10**

Part-C: Learning Resources
Textbooks, Reference Books, Other resources
1. Singh S. P & Yogi Mukesh: Foundation of Yoga, Standard Publication, New Delhi, 2010. 2. Swami Dhirendra Brahmchari: Yogasana Vijnana, Dhirendra Yoga Publication, New Delhi,1966. 3. **Saraswati, Swami Satyananda: Asana, Pranayama, Mudra, Bandha (APMB), Yoga Publication Trust, Munger, 2013.** 4. H. R. Nagendra: Asana, Pranayama, Mudra, Bandha, Swami Vivekananda Yog Prakashan, **Bangalore, 2002.** 5. Ishwar Bhardwaj: SaralYogasana, Satyam Publishing House, New Delhi, 2018. 6. Shri Rai Singh Chouhan: Mudra Rahasya, Bhartiya Yog Sansthan, New Delhi, 2014. 7. Dr. Vishwanath Prasad Sanha: Dhyan Yoga, Bhartiya Yog Sansthan, New Delhi, 1987. 8. Shri Deshraj: Dhyan Sadhana, Bhartiya Yoga Sansthan, New Delhi, 2015. Suggestive **digital platforms web links:** 1. www.rishikeshnathyogshala.com Suggestive equivalent online Courses- 1. **Liatps://sahaNdi.com/hathayoga-course** 2. https://theyogainstitute.org/

Part D: Assessment and Evaluation

Maximum Marks: 50 University Examination (Objective) 50 Time: **01.00 Hour**		
External Assessment: University Examination	Objective questions	50
	Total	**50**