



Rayat Shikshan Sanstha's

Yashwantrao Chavan Institute of Science, Satara (Autonomous)

Lead College, Karmaveer Bhaurao Patil University

Reaccredited by NAAC (3rd Cycle) with 'A+' grade (CGPA 3.57).

ISO 9001:2015 Certified

Bachelor of Science Part – I

Bioinformatics

Syllabus

to be implemented w.e. f. June, 2023 NEP 2020

Rayat Shikshan Sanstha's
Yashavantrao Chavan Institute of Science, Satara
Department of Bioinformatics
Syllabus for Bachelor of Science (Bioinformatics) Part I

1. TITLE: Bioinformatics

2. YEAR OF IMPLEMENTATION: New Syllabi for the B.Sc. I Bioinformatics will be implemented from June 2023 onwards.

3. PREAMBLE:

Bioinformatics is a rapidly evolving interdisciplinary field at the intersection of biology, computer science, and data analysis. It plays a pivotal role in unraveling the complexities of life sciences, enabling us to decode the secrets of genomics, proteomics, and structural biology. The Bachelor of Science (B.Sc.) in Bioinformatics program is designed to equip students with the knowledge and skills necessary to excel in this dynamic and groundbreaking field.

4. Programme Objectives :

1. To provide students with a strong foundation of knowledge in their chosen field of study, including fundamental concepts, theories, and principles.
2. To cultivate research skills, including the ability to design experiments, gather and analyze data, and draw evidence-based conclusions.
3. To enhance students' written and oral communication skills, enabling them to effectively convey scientific concepts, research findings, and ideas to diverse audiences.
4. To equip students with quantitative and analytical skills necessary for data analysis, modelling, and interpretation in their field of study.
5. To develop proficiency in using relevant technology and tools that are essential for their field, including software, laboratory equipment, and data analysis tools.
6. To encourage community engagement and a sense of social responsibility, inspiring students to use their knowledge and skills for the betterment of society.

5. Programme Outcomes:

1. Students will have a deep understanding of the principles and concepts of science.
2. Students will be competent in designing and managing biological databases, ensuring data integrity and accessibility for research purposes.

3. Graduates will be able to integrate techniques into biological research, contributing to advancements in fields such as genetics, drug discovery, and disease modeling.
4. Graduates will effectively communicate scientific findings and research results through written reports, presentations, and publications.
5. Graduates will collaborate with researchers and professionals from diverse fields, including biology, computer science, and medicine, to solve complex biological problems.
6. Graduates will demonstrate problem-solving skills by applying techniques to real-world biological challenges and proposing innovative solutions

6. Programme specific objectives:

1. To provide students with a strong foundation in bioinformatics principles, algorithms, and methodologies, enabling them to understand and address biological challenges using computational tools.
2. To equip students with in-depth knowledge of genomics, including DNA sequencing technologies, genome assembly, annotation, and analysis.
3. To enable students to explore protein structure and function, including the prediction of protein structures, protein-protein interactions, and structural analysis.
4. To develop students' skills in processing, analyzing, and interpreting biological data, including sequence alignment, phylogenetics, and functional annotation.
5. To teach students how to design and manage biological databases, ensuring efficient data storage and retrieval for research purposes.
6. To familiarize students with bioinformatics software and databases commonly used in research and industry, enabling them to leverage existing resources effectively.
7. To provide opportunities for students to work on real-world bioinformatics projects, allowing them to apply their skills to practical research problems.

- **Program specific outcomes:**

1. Graduates will be proficient in analyzing and interpreting biological sequences, including DNA, RNA, and protein sequences, using relevant algorithms and tools.
2. Graduates will have the ability to predict protein structures, analyze protein-ligand interactions, and model three-dimensional structures using computational methods.

3. Graduates will be skilled in mining large biological datasets for patterns, associations, and insights, enabling them to make data-driven discoveries.
4. Graduates will be able to create clear and informative data visualizations that facilitate the communication of complex biological findings to both technical and non-technical audiences.
5. Graduates will be skilled in assessing data quality, implementing data validation procedures, and ensuring the reliability of biological data.
6. Graduates will be prepared for careers in bioinformatics research, pharmaceuticals, healthcare, and related industries, with the skills and knowledge needed to excel in their chosen roles.

DURATION: The course shall be a full-time course.

PATTERN: Semester Examination

MEDIUM OF INSTRUCTION: English

Course Structure for B.Sc. I. (Semester- I)

Theory				Practical				
Course Title	Course Code	Lecture per week	Credits	Course	Course Title	Course Code	Lecture per week	Credits
Fundamentals of Computer	BBiT- 111	4	2	Practical -1	Fundamentals of Computer and Bioinformatics - I Lab-I	BBiP - 113	4	2
Fundamental of Bioinformatics	BBiT- 112		2					

Course Structure for B.Sc. I. (Semester- II)

Theory				Practical				
Paper Title	Paper Code	Lecture per week	Credits	Course	Paper Title	Paper Code	Lecture per week	Credits
Introduction to Programming : R language	BBIT- 121	4	2	Practical - 2	Practical based on Paper BBIT 121 and 122 Lab- II	BBIP - 123	4	2
Introduction to Molecular Biology	BBIT 122		2					

Note: B= B. Sc. , T=Theory and P= Practical.

Structure and Title of Courses of B. Sc.*** B. Sc. I Semester I ***

Course Number	Course Code	Course Name
I	BBIT- 111	Fundamentals of Computer
II	BBIT- 112	Fundamentals of Bioinformatics
Lab-I	BBIP- 113	Fundamentals of Computer and Bioinformatics Lab-I

*** B. Sc. I Semester II***

Course Number	Course Code	Course Name
III	BBIT 121	Introduction to Programming : R language
IV	BBIT 122	Introduction to Molecular Biology
Lab-II	BBIP 123	Practical based on BBIT 121 and 122

Subject Title according to NEP 2020

Course category	Semester	Subject	Course code Format	Course title
Major	I	Bioinformatics	BBIT 111	Fundamentals of Computer Science
			BBIT 112	Fundamentals of Bioinformatics
			BBIT 113:	Lab I Based on Paper BBiT 111 & 112
	II		BBIT – 121	Introduction to Programming : R language
			BBIT – 122	Introduction to Molecular Biology
			BBIP – 123	Lab II Based on Paper BBiT 121 & 122
Minor	I	Bioinformatics	BBIT 114	Bioinformatics for Plant Sciences
			BBIT 115	Bioinformatics for Animal Sciences
			BBIT 116:	Lab I Based on Paper BBiT 114 & 115
	II		BBIT – 124	Bioinformatics for Microbial Sciences
			BBIT – 125	Bioinformatics for Biochemical Sciences
			BBIP – 126	Lab II Based on Paper BBiT 124 & 125
OE	I	Creative writing	BBiTOE 117	Fundamental of Creative writing
			BBiTOE 118	Creative writing
	I	DEGG	BBiOE 119	Democracy, Election and Good Governance
IKS	I		BBITIKS1	Basics of Ayurveda
CC	I	Sports Psychology	BBITCC1	Sports Psychology

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B.Sc. I Syllabus for Course in Bioinformatics

SEMESTER – I

Course Code – BBIT 111: Fundamentals of Computer

Course Objectives: Students should be able to ...

1. Define basic concepts and terminology of computers.
2. Understand operate desktop computers to carry out computational tasks.
3. Learn working of Hardware and Software and the importance of operating systems.
4. Identify programming languages, number systems, peripheral devices, networking, multimedia and internet concepts.

Credits (Total Credits 2)	SEMESTER – I BBIT 111- Fundamentals of Computer	No. of hours (30)
Unit - I	Introduction to Computers Introduction, Characteristics, History & Evolution, Organization of Computers, Applications of Computers in Various Fields, Computer Hardware and Software, Computer Languages – Machine Language, Assembly Language, High-level Language, Language translators: Compiler, Interpreter, Assembler.	(08)
Unit – II	Peripheral Devices Input Devices – Keyboard, Touch screen, Pointing: Mouse, digitizer, Joystick and scanning devices: Scanner, OMR, OCR, and MICR. Output Devices – Monitors (CRT, TFT, LCD, Plasma), Screen Image Projector, Printers & its types, Plotters. Memory Devices - Primary Memory & its types (RAM, ROM), Secondary memory & its types (Hard Disk, Flash Drives, Magnetic Tape, Optical Discs- CD, DVD, Blue-Ray)	(08)
Unit – III	Introduction to OS : Meaning and Definition, Structure of O.S., Types of O.S., Functions of O.S., Introduction to DOS : History and versions of DOS. Fundamentals of DOS, Getting Started with DOS: Booting Process (DOS, Windows, Unix/Linux), System Files and Command.com, Internal DOS Files & Directories, Elementary External DOS Commands, Creating a Batch Files, Additional Commands.	(08)

	<p>Windows Operating system : Components of window Desktop, windows explorer, control panel, Managing the files and folders, Accessories: Paint, calculator and notepad.</p> <p>Unix/Linux : Introduction to Linux, Philosophy and Concepts, Linux Basics and System Startup, User Environment, Graphical Interface, Linux Utilities, Command Line/ Shell, Linux Documentation, File Sharing and Security, Processes, System Configuration and Program Installation, Linux Program Usage</p>	
Unit - IV	<p>Introduction to MS- Office - Introduction to software packages, Components of MS-Office, Features of MSOffice. MS-Word - Introduction, Menus, Document types, Working with Document, Formating document, Creating table, Tools, Printing document. MS-Excel - Introduction, Spread sheet application, Spreadsheet Converting file to different formats, Computation Data- Setting formula, finding total in rows and columns. MS Power Point - Introduction, Creating Presentation, Graphics.</p>	(06)

Course Outcomes: Students will be able to...

1. Describe basic concepts and terminology of information technology.
2. Evaluate the fundamentals of personal computers and their operations.
3. Operate their small account using the computers and master the world of Information Technology
4. Use the computer for basic purposes of preparing his personnel/business letters, viewing information on internet (the web), sending mails, preparing his business presentations, playing games etc.

Reference Books :

1. P. K. Sinha (1992), Computer Fundamentals, BPB Publications, Sixth Edition.
2. V. Rajaraman (2013), Introduction to Information Technology, PHI, Second Edition.
3. Chetan Shrivastava (2010), Fundamental of Information Technology, Kalyani Publishers..
4. Guy Hart-Davis(2023) "The ABCs of Microsoft Office 97 Professional edition", BPB Publications.
5. Karl Schwartz(1998), "Microsoft Windows 98 Training Guide" BPB Publications.
6. C.S. French(1998) "Data Processing and Information Technology", BPB Publications
7. P.K Sinha (1992)`Computer Fundamentals`, BPB Publications
8. Guy Hart-Davis(2023) "The ABCs of Microsoft Office 97 Professional edition", BPB Publications.
9. Karl Schwartz(1998), "Microsoft Windows 98 Training Guide" BPB Publications.
10. C.S. French(1998) "Data Processing and Information Technology", BPB Publications
11. P.K Sinha (1992)`Computer Fundamentals`, BPB Publications

Course Code – BBIT 112 : Fundamentals of Bioinformatics**Course Objectives: Students should be able to ...**

1. Understand the basics of bioinformatics and its scope in the future
2. Recognize the tools necessary for analysis of biological molecules.
3. Conceptualize the types of databases and its online software's.
4. Perceive the knowledge of predicting the structure and function of biomolecules.

Credits (Total Credits 2)	SEMESTER – I BBIT 112- Fundamentals of Bioinformatics	No. of hours (30)
Unit - I	Basics of bioinformatics Definition and scope of bioinformatics. Importance of Bioinformatics in modern biology and medicine. Biological molecules, biological databases, bioinformatic tools and softwares. Need of bioinformatician, biological & clinical data generation, data visualization. Applications and future trends in bioinformatics.	(08)
Unit – II	Introduction to biological databases and its types <ol style="list-style-type: none"> a. Nature, types, and sources of biological data b. File formats of biological data c. NCBI/EBI/EXPASY d. GenBank/EMBL/DDBJ e. UniProtKB f. PDB g. CATH/SCOP/PDBsum 2. Derived databases and data repositories <ol style="list-style-type: none"> 1. Gene Cards 2. TCGA 	(08)
Unit – III	<ol style="list-style-type: none"> 1. Basic sequence analysis and data visualization <ol style="list-style-type: none"> a. Dot plots b. Pairwise sequence alignment c. Multiple sequence alignment d. Sequence visualization <ol style="list-style-type: none"> i. UCSC Genome Browser ii..NCBI Genome Data Viewer 2. Protein structure prediction & visualization <ol style="list-style-type: none"> a. Structure prediction: Homology modelling b. Visualization <ol style="list-style-type: none"> i. RASMOL/PyMol ii. SPDBV 	(08)

Unit - IV	<ol style="list-style-type: none"> 1. Biological sequence & structure similarity search <ol style="list-style-type: none"> a. Pairwise Sequence Similarity Searching BLAST (NCBI), FASTA (EBI), BLAT (UCSC). b. Structure Similarity Searching RCSB (PDB), VAST (NCBI), TM-ALIGN. 2. Functional prediction & analysis <ol style="list-style-type: none"> 1. Sequence based <ol style="list-style-type: none"> 1. Prosite 2. Pfam 3. STRING 2. Protein structure based <ol style="list-style-type: none"> 1. ProFunc 2. DALI 3. CASTp 4. PROSA 	(06)
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Course Outcomes: Students will be able to...

1. Determine the essential scope of bioinformatics .
2. Utilize the tools necessary for analysing the biological molecules
3. Justify the types of nucleic acids and their processes
4. Predict the structure of proteins and analyse it using online databases.

Reference Books:

1. Jean-Michel Claverie and Cedric Notredame (2006) "Bioinformatics For Dummies", Wiley Publishing Inc., Indianapolis, Indiana. 2nd Edition
2. David W. Mount (2004) "Bioinformatics: Sequence and Genome Analysis" Publisher Cold Spring Harbor Laboratory Press, U.S.2nd Edition.
3. Phillip Compeau and Pavel Pevzner (2014), "Bioinformatics Algorithms: An Active Learning Approach" Active Learning Publishers.
4. Jonathan Pevsner (2015) "Bioinformatics and Functional Genomics" Wiley-Blackwell Publisher .
5. Arthur M. Lesk (2019) "Introduction to Bioinformatics" Publisher OUP Oxford.
6. Marketa Zvelebil and Jeremy O. Baum(2007) "Understanding Bioinformatics" ,Publisher Garland Science,Ist Edition
7. Neil C. Jones and Pavel A. Pevzner(2004) "An Introduction to Bioinformatics Algorithms" ,MIT Press.
8. Jin Xiong (2007)"Essential Bioinformatics" Cambridge University Press,Ist Edition.
9. Richard Durbin, Sean R. Eddy, Anders Krogh, and Graeme Mitchison(1998)"Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids" Cambridge University Press .
10. Steven Haddock and Casey Dun (2010) ,"Practical Computing for Biologists" ,Sinauer Associates is an imprint of Oxford University Press.

SEMESTER – I**Course code BBIP 113 : Practical based on BBIT 111 and 112****Course Objectives: Students should be able to,**

1. Understand the use of computer and its working .
2. Execute the commands of the operating systems .
3. Operate the online softwares for nucleotide and protein analysis.
4. Visualise the sequence and structure of DNA and protein using various software's .

Credits (Total Credits 2)	SEMESTER – I BBIP 113 List of Practical (15)	No. of hours (60)
1.	Demonstration of Peripheral Devices	2
2.	MS-DOS Prompt and commands	2
3.	Demonstration of Windows Operating System	2
4.	<p>MS – EXCEL</p> <p>1) Create a worksheet on students list of 4 faculties and perform following database function on it.</p> <ol style="list-style-type: none"> a. Sort data by name b. Filter data by Class c. Subtotal of number of students by Class <p>2) Import or fetch external data from web-sources</p> <ol style="list-style-type: none"> a. Data cleaning and organizing. b. Data visualization: Prepare a bar chart and pie chart from this data 	4
5.	<p>MS – WORD</p> <p>I] Create an article in MS-WORD interpreting the results from any of the above MS-Excel examples. Make use of: Page border and shading, set margins, orientation, size, columns, watermark (as draft).</p>	4
6.	<p>MS-POWER POINT</p> <p>I] Create a MS-Powerpoint presentation to present the results from any of the above MS-Excel examples. Create and work with master slides, make use of transitions and animations, apply themes and layouts, use pictures, graphics, shapes and tables.</p> <p>Given a data and information, summarize them into WORD, EXCEL and POWERPOINT, demonstrating better representation and easy understanding to the audience.</p>	4

7.	<p>Experiments on Linux:</p> <p>A. Checking system status</p> <ol style="list-style-type: none"> 1. Memory [df, du, free] 2. Task manager [uname, ps, top, kill] 3. Networking [ping, ifconfig, netstat] 4. Workload optimization <p>B. File systems</p> <ol style="list-style-type: none"> 1. Navigating & Searching files and folders[pwd, ls, cd] 2. Reading Files [cat, more, less, head, tail] 3. Files and folders Creation, deletion, modification [mkdir, rmdir, cp, mv, rm, touch] 4. Permission management & Sharing [chmod, chown] 5. Compression of files & folders [tar, gzip, gunzip] <p>C. Install, Run & Uninstall Linux Programs</p> <p>D. Perform Linux Commands</p> <ol style="list-style-type: none"> 1. grep 2. find <p>E. Help Doc [man, command_name --help]</p>	8
8.	Using online nucleotide databases (NCBI, EBI, EXPASY, Genbank, EMBL, DDBJ), Protein databases(PDB,Uniprot ,SWISS PROT)	4
9.	Visit to derived databases and data repositories	4
10.	Pairwise sequence alignment using DOTPLOT, Needleman-Wunsch algorithm and Smith-Waterman algorithm.	8
11.	Multiple sequence alignment using Clustal Omega	2
12.	Sequence visualisation using UCSC Genome browser	2
13.	Sequence Similarity search using BLAST	4
14.	Functional Prediction based on sequence: Prosite, Pfam, STRING	4
15.	Protein structure visualisation using RASMOL /PyMOI	2
16.	Protein structure analysis: Analysis & Functional Prediction & using PROSA, ProFunc, DALI, CASTp, PROSA	4

Course Outcomes: Students will be able to-

1. Demonstrate the different parts with peripheral devices and various commanding systems.
2. create their own files, folders; store, format and present data & information using MS office
3. apply various similarity searches of pairwise, multiple sequence and structural alignments using online softwares tools to access and use different bioinformatics databases and repositories
4. Visualise, Analyse and Interpret biological sequence and protein structures.

Reference Books:

1. P. K. Sinha (1992), Computer Fundamentals, BPB Publications, Sixth Edition.
2. V. Rajaraman (2013), Introduction to Information Technology, PHI, Second Edition.
3. Chetan Shrivastava (2010), Fundamental of Information Technology, Kalyani Publishers..
4. Guy Hart-Davis(2023) "The ABCs of Microsoft Office 97 Professional edition", BPB Publications.
5. Karl Schwartz(1998), "Microsoft Windows 98 Training Guide" BPB Publications.
6. C.S. French(1998) "Data Processing and Information Technology", BPB Publications
7. P.K Sinha (1992) `Computer Fundamentals`, BPB Publications
11. Jean-Michel Claverie and Cedric Notredame (2006) "Bioinformatics For Dummies", Wiley Publishing Inc., Indianapolis, Indiana. 2nd Edition
12. David W. Mount(2004) "Bioinformatics: Sequence and Genome Analysis" Publisher Cold Spring Harbor Laboratory Press, U.S. 2nd Edition.
13. Phillip Compeau and Pavel Pevzner (2014), "Bioinformatics Algorithms: An Active Learning Approach" Active Learning Publishers.
14. Jonathan Pevsner (2015) "Bioinformatics and Functional Genomics" Wiley-Blackwell Publisher .
15. Arthur M. Lesk (2019) "Introduction to Bioinformatics" Publisher OUP Oxford.
16. Marketa Zvelebil and Jeremy O. Baum(2007) "Understanding Bioinformatics" ,Publisher Garland Science, 1st Edition
17. Neil C. Jones and Pavel A. Pevzner(2004) "An Introduction to Bioinformatics Algorithms" ,MIT Press.
18. Jin Xiong (2007) "Essential Bioinformatics" Cambridge University Press, 1st Edition.
19. Richard Durbin, Sean R. Eddy, Anders Krogh, and Graeme Mitchison(1998) "Biological Sequence Analysis: Probabilistic Models of Proteins and Nucleic Acids" Cambridge University Press .
20. Steven Haddock and Casey Dun (2010) , "Practical Computing for Biologists" , Sinauer Associates is an imprint of Oxford University Press.

Semester – II**Course code- BBIT 121: Introduction to Programming: R language**

Course Objectives: Students should be able to,

1. Infer the concepts of programming languages and logic building.
2. Understand the features of R programme and enlist the data types and objects in R .
3. Execute the basic operations in R and create their own functions.
4. Deduct the conditional statements and handle the files using various functions .

Credits (Total Credits 2)	SEMESTER – II BBIT 121 : Introduction to Programming : R language	No. of hours per unit/credits
Unit - I	<ol style="list-style-type: none"> 1. Concept of programming and logic building 2. Introduction to R and R studio 3. Features of R 4. Data types in R 5. Objects in R <ol style="list-style-type: none"> a. Vector b. List c. Matrix d. Array e. Data frame f. Factor 	(08)
Unit – II	<ol style="list-style-type: none"> 1. Basic operations in R <ol style="list-style-type: none"> 1. Addition, Subtraction, Multiplication & Division 2. Row, Column & Other Operations on data frames and matrix 3. Repeats, Sorting, Ordering 2. R functions <ol style="list-style-type: none"> 1. In-built 2. Apply and types 3. Custom 3. String manipulation <ol style="list-style-type: none"> 1. Expressions: Grep 2. Concatenate, Paste, Splitting functions, Replace functions, Replace 	(08)
Unit – III	<ul style="list-style-type: none"> • Conditional statements <ul style="list-style-type: none"> ○ If ○ If – else • Loops <ul style="list-style-type: none"> ○ ‘For’ ○ ‘While’ 	(08)

	<ul style="list-style-type: none"> • File Handling <ul style="list-style-type: none"> ○ Reading: txt, csv, excel files ○ Writing ○ Deleting 	
Unit - IV	<ul style="list-style-type: none"> • Data analysis <ul style="list-style-type: none"> ○ Data calculation ○ Manipulation ○ Formatting • Data Representation/Visualization <ul style="list-style-type: none"> ○ Scatter Plot, Bar Plots, Histogram, Pie chart and their variations • R packages and libraries • Bioconductor 	(06)

Course Outcomes: Students will be able to,

1. Describe the concept of R programming language .
2. Justify the features of R and its data types
3. Operate the basics in R and apply the functions
4. Analyse the Data from visualization and libraries .

Reference Books :

1. Alain F. Zuur, Elena N. Ieno, Erik H.W.G. Meesters ,(2009),A Beginner's Guide to R (Use R) By, Springer.
2. Andrie de Vries, Joris Meys, R Programming For Dummies,(2016) 2ed Wiley (India), Low price edition.
3. Heumann, Christian, Schomaker, Michael, Shalabh(2016), Introduction to Statistics and Data Analysis With Exercises, Solutions and Applications in R., Publisher” Springer
4. Saroj Dahiya Ratnoo, Himmat Singh Ratnoo,(2021) Essentials of R with Data Analytics, Wiley (India), Low price edition.
5. Pierre Lafaye de Micheaux, Rémy Drouilhet, Benoit Lique, (2013) The R Software-Fundamentals of Programming and Statistical Analysis – Springer.
6. Hadley Wickham and Garrett Grolemund (2017), "R for Data Science", Shroff/O'Reilly Publishers.
7. Norman Matloff ,(2011), "The Art of R Programming: A Tour of Statistical Software Design"
8. Hadley Wickham (2014) ,"Advanced R", Chapman and Hall/CRC Publisher.
9. Paul Teetor ,(2019)"R Cookbook" Shroff/O'Reilly Publishers.
10. Phil Spector (2008)"Data Manipulation with R", Shroff/O'Reilly Publishers.
11. Max Kuhn and Kjell Johnson, (2018) "Applied Predictive Modeling",Springer Publications.

Semester -II**Course Code – BBIT 122: Introduction to Cell and Molecular Biology**

Course Objectives: Students should be able to,

1. Recognize the different functions of cells and relate it as a basic unit of life
2. Identify various cellular processes involving chromosomes ,DNA and its packaging in the cell.
3. Explain the characteristics of prokaryotic and eukaryotic organisms and determine its structure .
4. Illustrate the molecular processes and its detail mechanism.

Credits (Total Credits 2)	SEMESTER – II BBIT 122: Introduction to Cell and Molecular Biology	No. of hours per unit
Unit - I	Cell Biology: <ul style="list-style-type: none"> • Cell as a basic unit of life. • Cell organization of prokaryotic and eukaryotic cells. • Structural and functional capitalization of cell:– Mitochondria, Chloroplast, Lysosomes, Golgi bodies, Plasma membrane, Cytoskeleton, Cell wall and Nucleus. 	(08)
Unit – II	Cellular processes - <ul style="list-style-type: none"> • Cell cycle, cell division - mitosis and meiosis. • Chromosome structure, gene, gene number, gene clusters and Pseudogene. • Packing of DNA, supercoiled DNA, nucleosome. • Inverted repeats, repetitive DNA sequence, satellite DNA. 	(08)
Unit – III	Molecular Biology processes - <ul style="list-style-type: none"> • DNA Replication (Semi conservative mode) Concepts of replication initiation, elongation and termination in prokaryotes and eukaryotes, enzymes and accessory proteins involved in DNA replication, Fidelity in replication, • Process of transcription : Initiation, Elongation ,Termination. • Process of translation : Initiation, Elongation and Termination 	(06)
Unit - IV	DNA mutation, Damage and repair systems <ul style="list-style-type: none"> • Mutation:-Nonsense, missense and point mutations, intragenic and intergenic suppression, frameshift mutations, physical, chemical and biological mutagens. 	(08)

	<ul style="list-style-type: none"> • DNA Damage and Repair mechanism – DNA damage types ,DNA repair enzymes, photoreactivation, nucleotide excision repair, mismatch correction, SOS repair. • Genetic Code: Properties of Genetic code 	
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Course Outcomes: Students will be able to,

1. Describe the structure and functions of various cell organelles .
2. Summarize the molecular processes like cell cycle and its division involved in nucleus .
3. Explain the molecular processes and execute the mechanisms behind it .
4. Investigate the Mutations occurring in DNA and able to interpret the results.

Reference Books:

1. April Chloe Terrazas (2013), Cellular Biology: Organelles, Structure, Function (Super Smart Science) Crazy Brainz.
2. Benjamin Lewin, (2007)Genes IX, Jones and Bartlett Publishers, Inc
3. Gerald Karp (2010) Cell Biology ,Wiley Publisher,6th Edition International Student Version.
4. Halder Kar (2011), Cell Biology ,Genetics ,Molecular Biology, New Central Book Agency Publisher, 2nd Revised edition
5. Harvey Lodish, Chris A. Kaiser, Arnold Berk, Monty Krieger (2007), Molecular Cell Biology, W. H. Freeman Publisher, 6th edition
6. Joseph M. Tager , Angelo Azzi , Sergio Papa , Ferruccio Guerrieri,(2011), Organelles in Eukaryotic Cells: Molecular Structure and Interactions, Springer Publisher.
7. L. Canedo(2011)Cell Function and Disease,Springer Publication, 1988th edition.
8. P.S.Verma, Agarwal V.K, (2004) Cell Biology, Genetics, Evolution & Ecology (multicolor Edition): Evolution And Ecology, S Chand Publication, Reprint Edn. 2006
9. T.Devsena (2012),Cell Biology,Oxford University Press ,First Edition

10. Veer Bala Rastogi, (2021), Cell Biology , Medtech Publisher , Ist edition.
11. Bruce Alberts, Alexander Johnson, Julian Lewis, David Morgan, Martin Raff, Keith Roberts, and Peter Walter. Molecular Biology of the Cell (6th Edition)
12. Abraham L Kierszenbaum, Laura L. Tres (2011), Histology and Cell Biology: An Introduction to Pathology 3rd Edition, Elsevier / Mosby Publisher .
13. Verma P.S, Textbook Of Cytology, S Chand & Co Publication

SEMESTER – II**Course code BBIP 123 : Practical based on BBIT 121 and 122**

Course Objectives: Students should be able to,

- 1) Recognise the good laboratory practices and maintain biosafety protocols
- 2) Operate light compound microscope and identify different structures under microscope.
- 3) Compose isolation methods for DNA/RNA extraction.
- 4) Perform R programming language with the help of tools .

Credits (Total Credits 2)	SEMESTER – II BBIP 123 List of Practical (15)	No. of hours (60)
1)	Good Laboratory Practices and Biosafety.	4
2)	Light compound microscope and its handling	4
3)	Study of mitosis on onion root tips/Human cheek cells	4
4)	Study of meiosis on onion buds	4
5)	Isolation and separation of cell organelles from plant cell	4
6)	Qualitative tests of carbohydrates and lipids from given solutions (Glucose, Fructose, Sucrose, Lactose)	4
7)	DNA isolation from plant/animal.	4
8)	Estimation of total protein in given solutions by Lowry's method	4
9)	Features Data types and objects of R	4
10)	Basic operations in R a.Addition, Subtraction, Multiplication & Division b.Row, Column & Other Operations on data frames and matrix c.Repeats, Sorting, Ordering	4

11)	2. R functions i. In-built ii. Apply and types iii. Custom	4
12)	3. String manipulation i. Expressions: Grep ii. Concatenate, Paste, Splitting functions, Replace functions, Replace	4
13)	<ul style="list-style-type: none"> • Conditional statements <ul style="list-style-type: none"> ○ If ○ If – else • Loops <ul style="list-style-type: none"> ○ ‘For’ ○ ‘While’ • File Handling <ul style="list-style-type: none"> ○ Reading: txt, csv, excel files ○ Writing ○ Deleting 	4
14)	Data analysis - Data calculation, Manipulation, Formatting	4
15)	Data Representation/Visualization - Scatter Plot, Bar Plots, Histogram, Pie chart and their variations	4

Course Outcomes: Students will be able to,

1. Perform good laboratory practices by using proper sterilisation techniques
2. Demonstrate the various stages in cell division.
3. Perform the isolation of nucleic acid from any material .
4. Operate R programming language and perform various data analysis and visualize it.

Reference Books:

1. Alain F. Zuur, Elena N. Ieno, Erik H.W.G. Meesters ,(2009),A Beginner's Guide to R (Use R) By, Springer.
2. Phil Spector (2008)"Data Manipulation with R", Shroff/O'Reilly Publishers.
3. Max Kuhn and Kjell Johnson, (2018) "Applied Predictive Modeling",Springer Publications.
4. Ashwani Kumar S.K. Gakhar, Monika Miglani (2019), Molecular Biology laboratory manual, Dreamtech Press.
5. Mr. Ratul Mukerjee Mr. Ansuman Ray (2019), Basic Lab Manual of Microbiology, Biochemistry and Molecular Biology, Taurean Publications

6. Andrie de Vries, Joris Meys, R Programming For Dummies,(2016) 2ed Wiley (India), Low price edition.
7. Heumann, Christian, Schomaker, Michael, Shalabh(2016), Introduction to Statistics and Data Analysis With Exercises, Solutions and Applications in R., Publisher” Springer
8. Saroj Dahiya Ratnoo, Himmat Singh Ratnoo,(2021) Essentials of R with Data Analytics, Wiley (India), Low price edition.
9. Pierre Lafaye de Micheaux, Rémy Drouilhet, Benoit Liquet, (2013) The R Software-Fundamentals of Programming and Statistical Analysis – Springer.
10. Hadley Wickham and Garrett Grolemund (2017), "R for Data Science", Shroff/O'Reilly Publishers.
11. Norman Matloff ,(2011), "The Art of R Programming: A Tour of Statistical Software Design"
12. Hadley Wickham (2014) , "Advanced R", Chapman and Hall/CRC Publisher.
13. Paul Teetor ,(2019)"R Cookbook" Shroff/O'Reilly Publishers.
14. H. P. Puttaraju ,(2007) ,Molecular Biology and Biochemistry: A Lab Manual: Manual Series: 01: A Lab Manual with Colour Plates (Manual Series-I): v. 1, **New India Publishing Agency.**

Minor Course Syllabus for B.Sc. I Bioinformatics

Karmaveer Bhaurao Patil University, Satara
Yashavantrao Chavan Institute of Science, Satara
Syllabus to be Introduced from June 2023

Batchelor of Science (B. Sc.) Part - I: Bioinformatics
Bioinformatics (Minor)

Semester I

BBIT- 114: Bioinformatics For Plant sciences

Course Objectives: Students should able to

1. Understand basics of bioinformatics
2. Understand the use of different plant databases
3. Understand sequences, alignments and dynamic programming
4. Recognize gene expression analysis in plants

Credits=4	SEMESTER-I	No. of lectures per unit
Unit I	Minor Theory Course (Paper Code) Bioinformatics in Botany Fundamentals of the plant kingdom	07
	1.1 The general outline of the plant kingdom 1.2 Evolutionary history of Plants, Evolutionary time scale 1.3 General characters of plants 1.4 Thallophytes and archegoniates	
Unit II	Structural bioinformatics in plants	08
	2.1 Introduction to structure of biomolecules, DNA and protein structure 2.2 Chloroplast genome and its importance 2.3 Plant mitochondrial genome and its importance 2.4 Plant ITS sequence and its importance	
Unit III	Plant database and its types	07
	3.1 Introduction of Biological Databases- 3.2 Nucleic acid databases: NCBI, DDBJ, and EMBL and GenBank 3.3 Protein databases: Swiss-Prot, UniProt 3.4. Plant database – Phytosomes	
Unit IV	Data generation and applications of bioinformatics in plant sciences	08
	4.1.Molecular Identification – 16s RNA, Large scale plant molecular biology data: introduction and generation	

	4.3 Genome sequencing 4.4 Protein sequencing 4.5 Applications of Bioinformatics in plant sciences	
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Course Outcomes: The students will be able to.

1. Explain different plant groups
2. Identify different molecular structures in plants
3. Use different plant databases
4. Generate different molecular data from plants

References:

1. Claverie J and Notredame C (2011) Bioinformatics for Dummies; John Wiley and Sons
2. Andreas Baxevanis, B. F. Francis Ouellette and B. F. Cuellette (1998) Bioinformatics: A Practical Guide to the analysis of Genes and Proteins, Wiley Publishers, New York
3. Jagota A. (2000) Data Analysis and Classification for Bioinformatics. Published by the Bay Press. University of Michigan, USA
4. Kumar, H. D. (1993). Molecular Biology and Biotechnology, Vikas Publ., New Delhi.
5. Mount D. W. (2001) Bioinformatics Sequence and Genome Analysis. Cold Spring Harbour Laboratory. New York.
6. Eric Lee, (2018) Beginners Guide To Bioinformatics For High Throughput Sequencing
7. R. Amjesh, S.S. Vinodchandra, (2019) Bioinformatics for beginners .
8. Maxwell James, (2021) Bioinformatics for beginners

Karmaveer Bhaurao Patil University, Satara
Yashavantrao Chavan Institute of Science, Satara
Syllabus to be Introduced from June 2023

Bachelor of Science (B. Sc.) Part - I: Bioinformatics
Bioinformatics (Minor)
Semester I

BBIT -115 : Bioinformatics For Animal Sciences

Course Objectives: Students should be able to,

1. Understand basics of animal sciences.
2. Understand the use of different animal databases
3. Understand sequences, alignments and dynamic programming
4. Recognize gene expression analysis in animals

Credits=2	SEMESTER-I Minor Theory Course (BBIT 115) Bioinformatics for Animal Sciences	No. of lectures per unit
Unit I	Fundamentals of the Animal kingdom	07
	<ol style="list-style-type: none"> 1. The general outline of the Animal kingdom 2. Evolutionary history of Animal, Evolutionary time scale 3. General characters of Kingdom Animalia and its phylum 4. About Vertebrates and invertebrates 	
Unit II	Bioinformatics data types related to animals	08
	<ol style="list-style-type: none"> 1. Introduction to structure and properties of biomolecules <ol style="list-style-type: none"> a. DNA (Genome) b. RNA (Transcriptome) c. Protein (Proteome) 2. Genetics, Epigenetics and its importance- Mutations 3. Molecular markers <ol style="list-style-type: none"> a. DNA Barcoding - Mitochondrial genome(mtDNA) and its importance b. ITS sequence and its importance 	
Unit III	Bioinformatics databases and analysis related to animals	07
	<ol style="list-style-type: none"> 1. Access to animal data from biological databases <ol style="list-style-type: none"> i. Animal-Specific databases ii. AnimalTFDB iii. agReg-SNPdb iv. Mouse Genome Informatics 	

	<ul style="list-style-type: none"> v. Goat Genome Variation Database vi. Bgee vii. WormBase viii. FlyAtlas, FlyBase <p>2. Future perspectives and case studies</p> <ul style="list-style-type: none"> i. Emerging technologies and bioinformatics methodologies to address biodiversity loss ii. Ethics & data protection related to animals iii. Case study: Bioinformatics in government policy making iv. Group presentation: Presentation of published research paper highlighting bioinformatics application in zoology. 	
Unit IV	DNA isolation methods and applications of bioinformatics in animal sciences	08
	<ul style="list-style-type: none"> 1. Large scale Animal molecular biology data: introduction and generation 2. Gel electrophoresis 3. PCR 4. Genome sequencing 5. Protein sequencing 6. Applications of Bioinformatics in animal sciences 	

Course Outcomes: The students will be able to,

1. Explain different animal groups as per taxonomic classification.
2. Use different animal databases to analyse the animal specific data.
3. Understand methods, scope, perspectives, case studies related to animal bioinformatics
4. Generate different molecular data from animals

References:

1. Claverie J and Notredame C (2011), Bioinformatics for Dummies; John Wiley and Sons
2. Andreas Baxevanis, B. F. Francis Ouellette and B. F. Cuellette (1998) Bioinformatics: A Practical Guide to the analysis of Genes and Proteins, Wiley Publishers, New York
3. Jagota A. (2000) Data Analysis and Classification for Bioinformatics. Published by the Bay Press. University of Michigan, USA
4. Kumar, H. D. (1993) Molecular Biology and Biotechnology, Vikas Publ., New Delhi.
5. Mount D. W. (2001) Bioinformatics Sequence and Genome Analysis. Cold Spring Harbour Laboratory. New York.
6. Eric Lee(2018), Beginners Guide To Bioinformatics For High Throughput Sequencing
7. R. Amjesh, S.S. Vinodchandra, (2019) Bioinformatics for beginners
8. Maxwell James, (2021)Bioinformatics for beginners .
9. <https://www.animalgenome.org/>
10. <http://catalog.illinois.edu/graduate/aces/concentration/animal-sciences/bioinformatics/>
11. http://www.jakraya.com/journal/pdf/21-vcsArticle_3.pdf
12. <https://guides.library.yale.edu/bioinformatics/animal-resources>

13. http://cabgrid.res.in/cabin/publication/smfa/Module%20IV/7.%20Bioinformatics%20tools%20for%20classification%20and%20prediction_Dinesh%20Kumar.pdf
14. <https://academic.oup.com/nar/article/51/D1/D816/6775385>

Bioinformatics (Minor)
Semester I

BBIP 116 :Lab I based on paper BBIT 114 and BBIT 115

Course Objectives: Students should be able to,

1. Classify the given animal specimens by taxonomic identification .
2. Perform the basic procedures required for data retrieval from animal databases
3. Understand the use and importance of softwares of animal databases
4. Design the forward and reverse primers for animal sequences .

Credits: 02	SEMESTER-I BBIP 116 :Lab I based on paper BBIT 114 and BBIT 115	No. of hours allotted 60 hrs 4 hrs / Practical
1.	Study general characteristics of plants by observing the plant specimens.	4
2.	Perform classification of plant species as per Plant taxonomy from Class upto Species level	4
3.	Isolation of chloroplasts	4
4.	Isolation of plant genomic DNA	4
5.	Study general characteristics of animals by observing the animal specimens	4
6.	Isolation of animal genomic DNA	4
7.	Visit to Phytosomes database	4
8.	Retrieval of protein sequence from plant database SWISS PROT	4
9.	Retrieval of protein sequence from plant database UNIPROT	4
10.	Retrieval of biological sequence from animal databases- NCBI database: gene, mRNA, protein, 16S rRNA sequence retrieval	4
11.	Ensembl genome browser: Human, Mouse, Indian Cobra, Zebrafish	4
12.	Animal sequence (DNA, RNA, Protein) BLAST search	4

13.	Mouse Genome Informatics, Goat Genome Variation Database	4
14.	Bgee, WormBase, FlyAtlas, FlyBase	4
15.	Designing the forward and reverse primers	4

Course outcomes: The students will be able to,

1. Perform Isolation of plant and animals genomic DNA .
2. Use different animal and Plant databases to retrieve and analyze animal biological sequences
3. Use mutation/SNP databases related to animals
4. Comparing genomes of animals to identify similarity and differences between them.

References:

1. Claverie J and Notredame C (2011), Bioinformatics for Dummies; John Wiley and Sons
2. Andreas Baxevanis, B. F. Francis Ouellette and B. F. Cuellette (1998) Bioinformatics: A Practical Guide to the analysis of Genes and Proteins, Wiley Publishers, New York
3. Jagota A. (2000) Data Analysis and Classification for Bioinformatics. Published by the Bay Press. University of Michigan, USA
4. Kumar, H. D. (1993) Molecular Biology and Biotechnology, Vikas Publ., New Delhi.
5. Mount D. W. (2001) Bioinformatics Sequence and Genome Analysis. Cold Spring Harbour Laboratory. New York.
6. Eric Lee(2018), Beginners Guide To Bioinformatics For High Throughput Sequencing
7. R. Amjesh, S.S. Vinodchandra, (2019) Bioinformatics for beginners
8. Maxwell James, (2021)Bioinformatics for beginners .
9. <https://www.animalgenome.org/>
10. <http://catalog.illinois.edu/graduate/aces/concentration/animal-sciences/bioinformatics/>
11. http://www.jakraya.com/journal/pdf/21-vcsArticle_3.pdf
12. <https://guides.library.yale.edu/bioinformatics/animal-resources>
13. http://cabgrid.res.in/cabin/publication/smfa/Module%20IV/7.%20Bioinformatics%20tools%20for%20classification%20and%20prediction_Dinesh%20Kumar.pdf
14. <https://academic.oup.com/nar/article/51/D1/D816/6775385>

Syllabus of Co-curricular Course (CC)
On
Sports Psychology

**Rayat Shikshan Sanstha's
Yashavantrao Chavan Institute of Science, Satara(Autonomous)
Syllabus to be introduced from June 2023**

Bachelor of Science (B. Sc.) Part - I: Bioinformatics (CC)

**Semester I
Cocurricular Course- Sports Psychology**

Learning objectives: The student should be able to,

1. understand the basic concepts of Sports Psychology.
2. imbibe the knowledge of personality development.
3. achieve motivation and goal setting in sports.
4. impart the knowledge about leadership skill.

Credits (02)	Paper Code: BBITCC1 Sports Psychology	No. of hours per unit/ credits
Credit I: Unit I	Basics of sport psychology	07
	1.1 A brief history and development of sport psychology. 1.2 Scope of Sports Psychology in Physical Education. 1.3 Meaning, Definition and importance of sports psychology in Physical Education. 1.4 Role of sports psychologists.	
Credit I: Unit II	Personality and Sports	08
	2.1 Meaning, Definition and Structure of Personality. 2.2 Types and Traits of personality. 2.3 Assessment of personality in Sports. 2.4 Personality and Performance in Sports.	
Credit II: Unit III	Motivation in Sports	08
	3.1 Definition and theories of Motivation. 3.2 Types of motivation and their implication in Sports. 3.3 Techniques of Motivation Enhancement. 3.4 Achievement Motivation and Competitiveness.	
Credit II: Unit IV	Indigenous Strategies and Leadership	07
	4.1 Yoga and Sports. 4.2 Role of Meditation in Sports. 4.3 Nature and Types of leadership. 4.4 Components of effective leadership.	

Learning Outcomes: The students will be able to.....

1. identify the basic concepts of Sports Psychology.
2. extend the knowledge of personality development.
3. develop motivation and goal setting in sports.
4. apply indigenous strategies in Sports Psychology

Reference Books:

1. Kamalesh M. L. 2012. Psychology in Physical Education and Sports.
2. Nideffer R. 1981. The Ethics and Practice of Applied Sports Psychology.
3. Richard M. S. 1980. Psychology in Sports: Methods and Applications.
4. Thomas E., Chulvi-Medrano I and Paduva E. 2022. Sports Medicine and Physical Fitness.

Syllabus Of Open Elective course (O.E)
On
Creative Writing

1. **TITLE** : Creative Writing
2. **YEAR OF IMPLEMENTATION** : 2023-2024
3. **CLASS** : B.Sc. I
4. **DURATION** : One Year
5. **MEDIUM OF INSTRUCTION** : English

Creative Writing

Course objectives:

Students should be able to ...

1. Understand the creative writing process, various elements of creative writing
2. Critically appreciate various literary genres
3. Know the new trends of creative writing
4. Explore employment opportunities in the creative fields such as content writing, advertising, film industry etc.

Course I: BBiTOE 117 : Fundamentals of Creative Writing

Course Objectives:

Students should be able to...

1. understand the creative writing, elements, process
2. identify the different literary genres
3. explore the new trends of creative writing
4. learn the effective writing skills

Credits (2)	Title	No. of hours(30)
Unit I	Introduction to Creative Writing	7
	<ul style="list-style-type: none"> • Definition of creativity • Meaning of Creative Writing • Imagination and writing • Can creative writing be taught? • Art and craft of the writing 	
Unit II	Creative Writing Process	8
	<ul style="list-style-type: none"> • Process • Elements of creative writing: Plot, Setting, Character, Dialogue, Point of View, Literary Devices and Figurative Language, • Elements of Style ,Grammar and the Structure of Language 	
Unit III	Genres of Creative Writing	8

	<ul style="list-style-type: none"> • Poetry • Short story • Essay writing • Novel • Play 	
Unit IV	New Trends in Creative Writing	7
	<ul style="list-style-type: none"> • Blog writing • Content writing 	

Course outcomes:

Students will be able to

1. Read as writers, developing their critical faculties and their confidence so that they can analyse their own writing as well as that of others.
2. Identify and use a range of writing craft techniques.
3. Structure their work through a variety of different voices and forms and write for various literary and social media
4. Critically appreciate various forms of literature

Reference Books:

1. Aaron, Jane E. , 2007, first edition, The Little, Brown Compact Handbook with Exercises, Little Brown, New York
2. Al Alvarez, 2005, first edition, The Writer's Voice, Bloomsbury, London
3. Anderson, Linda, 2005, first edition, Creative Writing: A Workbook with Readings, Routledge, Oxfordshire
4. Bell, Julia and Magrs, Paul, 2001, first edition ,The Creative Writing Coursebook, Macmillan, London
5. Blake, Carole, 1999, first edition, From Pitch to Publication, Macmillan, Basingstoke
6. Brande, Dorothea, Jeremy P Tarcher, 1981, first edition, Becoming a Writer, Los Angeles
7. Burroway, Janet, 2010, first edition, Imaginative Writing: The Elements of Craft. 3rd ed. Penguin Publishers, Palgrave, Basingstoke
8. Dawson, Paul, 2005 , first edition, Creative Writing and the New Humanities, Routledge, London
9. Graham, Robert, 2013, first edition, The Road to Somewhere: a creative writing companion, Routledge, London
10. King, Stephen, 2001, first edition On Writing, New English Library, London
11. Morley David, 2007, Reprint 2010, The Cambridge Introduction to Creative Writing, Cambridge University Press, New Delhi
12. Walter Allen, 1948, first edition , Writers on writing, Dent, London

Course II: BBITOE 118: Creative Writing

Course objectives:

Students should be able to....

1. understand the basics of diary, essay, play and poetry writing
2. learn the art and craft of different forms of writings
3. differentiate between the various forms of creative writing
4. analyse the different types of poems

Credits (2)	Title	No. of hours (30)
Unit I	Diary Writing	7
	<ul style="list-style-type: none"> • Format • Elements of diary writing • Types • Features of diary writing 	
Unit II	Essay Writing	8
	<ul style="list-style-type: none"> • Organizing a paragraph • Types • Structure • Language and style 	
Unit III	Poetry Writing	8
	<ul style="list-style-type: none"> • Definition of poetry • Types of poems 1. Structure 2. Elements of a poem- language, style, imagery 	
Unit IV	Play Writing	7
	<ul style="list-style-type: none"> • Origin • Dialogue writing • Structure • Language • Style 	

Course outcomes:

Students will be able to ...

1. identify and use a range of writing craft techniques.
2. structure their work through a variety of different voices and forms
3. write a poem and a play
4. seek employment in various creative fields such as advertising, content writing, publishing industry, review writing etc.

Reference Books:

1. Aaron, Jane E. ,2007, first edition, The Little, Brown Compact Handbook with Exercises, Little Brown, New York
2. Anderson, Linda ,2005, first edition Creative Writing: A Workbook with Readings, Rutledge, Oxfordshire
3. BVehn, Robin and Twichell, Chase (eds), 1992, first edition, The Practice of Writing poetry: Writing Exercises from Poets who Teach, HarperResource, New York
4. Booker Christopher, 2004, first edition, The Seven Basic Plots, Continuum, London, first edition
5. Brande, Dorothea, Jeremy P Tarcher, 1981, first edition Becoming a Writer, Los

Syllabus of Indian Knowledge System (IKS)

On

Ancient Indian Health Sciences

Rayat Shikshan Sanstha's
Yashavantrao Chavan Institute of Science, Satara (Autonomous)
Lead College of Karmveer Bhaurao Patil University, Satara
Paper-Indian Knowledge System (Indian Health Science)

Course Title: Ancient Indian Health Science

Credit:-02

Hours:-30

Course Objective: Student should be able to

1. Recall concept of ancient medicine.
2. List of Pancha Mahabhuta
3. Describe concept of ahara
4. Identify preventive approaches for good health

Credits (Total Credits 2)	Ancient Indian Health Science	No. of hours per unit
Unit - I	<p>Basic of Health Sciences in Ancient India</p> <ul style="list-style-type: none"> • Definition of Ayurveda • Aim of Ayurveda • Scope of Ayurveda • Concept of Health according to Ayurveda 	(07)
Unit – II	<p>Principles and Significance of Health Science as per Indian tradition.</p> <ul style="list-style-type: none"> • Pancha Mahabhuta Concept • Tridosha Concept(vata, pitta. Kapha) • Concept of Prakruti (Body Constitution) • Concept of Vikurti • Concept of Sapta Dhatu (Body Elements) • Concept of Mala (Waste Products) • Concept of Srotas (Body Channels) • Concept of Agni (Digestive Fire) • Concept of Koshta (Alimentary Tract) 	(09)

Unit – III	Concept of Nutrition in Health Sciences <ul style="list-style-type: none"> • Concept of Ahara as per Ancient Indian Wisdom • The role of spices in Health Sciences • Benefits of the Satvik Ahara 	(07)
Unit - IV	Preventive approaches for good health <ul style="list-style-type: none"> • Concept of Vihara (Lifestyle) • Dinacharya (Daily regimen) • Rithucharya (Seasonal regimen) • Sada vritta (Ethical Regimen): Rules of good conduct • Dhamiya & Adhamiyavega (Preventive Regimens) 	(07)

Course outcomes: Student will be able to

1. Memorize the Concept of Health Science in Ancient India.
2. Discuss Principles and Significance of Health Sciences as per Indian tradition
3. Classify Concept of nutrition for good health.
4. Implement preventive approaches in real life.

References:

1. Dr. Shubha and Dr. Ravi Rao (2016): A Text Book of Padartha Vijnana Evam Ayurveda Itihas; Chaukhambha Orientalia, Varanasi
2. Dr. Vidyalashmi K. and Dr. Shrikanth P.H. (2019): Padartha Vijnana Evam Ayurveda Itihasa; Chaukhambha Orientalia, Varanasi
3. Dr. Giridhar M. Kanthi (2018): A Text Book of Ayurvedic human anatomy (Sharir Rachana Vigyan).
4. Dr.Subhash Ranade, Dr. R.R. Deshpande and Dr. Swati Chaubhe (2017): A Text Book of Kriya Sharira.
5. Vaidya Bhagwan Dash (1994): Basic Principles of Ayurveda.
6. Girindranath Bhisagacarya (2003): History of Indian Medicine: From Earliest Times to the Present.
7. Ancient Indian Medicine-- Dr. P. Kutumbia

Web Links:

1. http://ccras.nic.in/sites/default/files/ebooks/24052018_CCRAS_Cardiac_disorders.pdf
2. <https://vikaspedia.in/health/ayush/ayurveda-1/ayurveda-based-dietary-guidelines-for-mental-disorders/the-concept-of-ahara-diet-in-ayurveda>