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# PUNJABI UNIVERSITY

PATIALA, PUNJAB, INDIA

(Established under Punjab Act No. 35 of 1961)



## Syllabi

For

**B.Sc. (Hons) BIOTECHNOLOGY**

**Course Code: BTHB3PUP**

**(Choice Based Credit System)**

For

**Sessions: 2023-24, 2024-25, 2025-26**

**Faculty of Life Science**

**Punjabi University, Patiala**

*Amrita Jha*  
*15/8/23*

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SEMESTER V		SEMESTER VI	
BTHB3101T	Bioprocess Technology	BTHB3201T	Bio Analytical Tools
BTHB3102T	Recombinant DNA Technology	BTHB3202T	Genomics and Proteomics
BTHB3103T	Animal Biotechnology*/	BTHB3203T	Medical Microbiology*
BTHB3104T	Animal Diversity I*	BTHB3204T	Animal Diversity II*
BTHB3105T	Plant Biotechnology*/	BTHB3205T	Bioinformatics*
BTHB3106T	Plant Diversity I*	BTHB3206T	Plant diversity II*
BTHB3107T	Basics of Forensic Science*/	BTHB3207T	Food Biotechnology*
BTHB3108T	Chemistry-5*	BTHB3208T	Chemistry-6*

**Note:** Weightage of different components in internal assessment is as: Attendance -20%; Written Assignment /project works/seminar/industrial visit-40%; Two-mid semester Tests/internal examination-40%.

\*Candidates have to select one option from papers of semester V-

- BTHB3103T or BTHB3104T
- BTHB3105T or BTHB3106T
- BTHB3107T or BTHB3108T

\*Candidates have to select one option from papers of semester VI-

- BTHB3203T or BTHB3204T
- BTHB3205T or BTHB3206T
- BTHB3207T or BTHB3208T

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**B.Sc. (Hons.) Biotechnology PART III**  
**Course Code- BTHB3PUP**

**CHOICE BASED CREDIT SYSTEM**  
(Academic Session 2023-2024, 2024-2025 & 2025-26)

SEMESTER-V					
Paper No and code	Name of paper	Credits per Week	Internal Marks*	External Marks	Total Marks
BTHB3101T	Bioprocess Technology	4	26	74	100
BTHB3102T	Recombinant DNA Technology	4	26	74	100
BTHB3103T BTHB3104T	Animal Biotechnology* Animal Diversity-I*	4	26	74	100
BTHB3105T BTHB3106T	Plant Biotechnology* / Plant Diversity-I*	4	26	74	100
BTHB3107T BTHB3108T	Basics of Forensic Science* Chemistry-5*	4	26	74	100
BTHB3101L	Practical Pertaining to Theory Paper- BTHB3101T	2	---	50	50
BTHB3102L	Practical Pertaining to Theory BTHB3102T	2	---	50	50
BTHB3103L	Practical Pertaining to Theory Paper- BTHB3103T/ BTHB3104T	2	---	50	50
BTHB3104L	Practical Pertaining to Theory Paper- BTHB3105T/ BTHB3106T	2	---	50	50
BTHB3105L	Practical pertaining to Theory Paper BTHB3107T/ BTHB3108T	2	---	50	50
<b>Total</b>		<b>30</b>	<b>130</b>	<b>620</b>	<b>750</b>

**Note:** Weightage of different components in internal assessment is as: Attendance -20%; Written Assignment project works seminar industrial visit-40%; Two-mid semester Tests/internal examination-40%

\* Candidates have to select one option from papers of semester V-

- BTHB3103T or BTHB3104T
- BTHB3105T or BTHB3106T
- BTHB3107T or BTHB3108T



**B.Sc. (Hons.) Biotechnology PART III****Course code – BTHB3PUP****CHOICE BASED CREDIT SYSTEM**

(Academic Session 2023-2024, 2024-2025 &amp; 2025-26)

SEMESTER VI					
Paper No and Code	Name of paper	Credit per Week	Internal Marks*	External Marks	Total Marks
BTHB3201T	Bio Analytical Tools	4	26	74	100
BTHB3202T	Genomics and Proteomics	4	26	74	100
BTHB3203T BTHB3204T	Medical Microbiology*/ Animal Diversity-II*	4	26	74	100
BTHB3205T BTHB3206T	Bioinformatics*/ Plant Diversity II*	4	26	74	100
BTHB3207T BTHB3208T	Food Biotechnology*/ Chemistry-6*	4	26	74	100
BTHB3201L	Practical Pertaining to Theory BTHB3201T	2	---	50	50
BTHB3202L	Practical Pertaining to Theory BTHB3202T	2	---	50	50
BTHB3203L	Practical Pertaining to Theory Paper BTHB3203T/ BTHB3204T	2	---	50	50
BTHB3204L	Practical Pertaining to Theory Paper BTHB3205T/ BTHB3206T	2	-	50	50
BTHB3205L	Practical pertaining to BTHB3207T/ BTHB3208T	2		50	50
<b>Total</b>		<b>30</b>	<b>130</b>	<b>620</b>	<b>750</b>

\*Candidates have to select one option from papers of semester VI-

- BTHB3203T or BTHB3204T
- BTHB3205T or BTHB3206T
- BTHB3207T or BTHB3208T

**B.Sc.(HONS.)BIOTECHNOLOGY**  
**COURSE CODE- BTHB3PUP**

**PART III (5TH SEMESTER)**

**BIOPROCESS TECHNOLOGY-CODE:BTHB3101T**

**TimeAllowed: 3hrs; MM:74; PassPercentage:40%**

**OBJECTIVES:**

- The aim of this subject is to instruct students with an in-depth understanding of the key process design concepts relating to the production of biomolecules of industrial importance, produced using isolated microbial and mammalian cells.
- This will also provide students with an up-to-date knowledge of upstream and downstream processing technology.
- Throughout this module, the emphasis will be on relating how market requirements influence the development and cost-effective optimization of biotechnology processes, stressing the multidisciplinary nature of this sector.
- Students will be equipped with a knowledge and understanding of mainstream bioprocess design heuristics so that they may engage productively within multidisciplinary process development teams.

**INSTRUCTIONS FOR THE PAPER-SETTER**

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and carry 11 marks each. Section C will consist of 15 short answer type questions which will cover the entire syllabus uniformly and will carry 30 marks in all.

**INSTRUCTIONS FOR THE CANDIDATES**

1. Candidates are required to attempt two questions each from sections A and B of the question paper and the entire section C.

**SECTION-A**

**UNIT I**

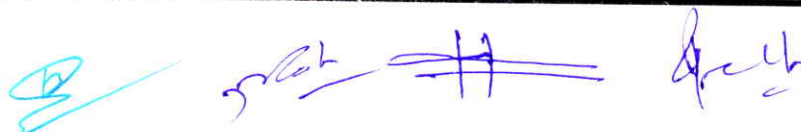
**(10 Periods)**

Introduction to bioprocess technology. Range of bioprocess technology and its chronological development. Basic principle components of fermentation technology. Types of microbial culture and its growth kinetics- Batch, Fed batch and Continuous culture.

**UNIT II**

**(20 Periods)**

Design of bioprocess vessels- Significance of Impeller, Baffles, Sparger; Types of culture production vessels- Airlift; Cyclone Column; Packed Tower and their application in production processes. Principles of upstrea



mprocessing -Media preparation,Inoculadevelopmentand sterilization.

## SECTION-B

### UNIT III (15 Periods)

Introduction to oxygen requirement in bioprocess: mass transfer coefficient: factors affecting KLa. Bioprocess measurement and control system with special reference to computer aided process control.

### UNIT IV (15 Periods)

Introduction to downstream processing, product recovery and purification. Effluent treatment. Microbial production of ethanol, amylase, lactic acid and Single Cell Proteins.

### SUGGESTED READINGS

1. Casida LE. (1991). Industrial Microbiology, 1st edition, Wiley Eastern Limited.
2. Crueger W and Crueger A. (2000). Biotechnology: A textbook of Industrial Microbiology, 2nd edition, Panima Publishing Co. New Delhi.
3. Patel AH. (1996). Industrial Microbiology, 1st edition, Macmillan India Limited.
4. Stanbury PF, Whitaker A and Hall SJ. (2006). Principles of Fermentation Technology, 2nd edition, Elsevier Science Ltd

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## RECOMBINANT DNA TECHNOLOGY-CODE: BTHB3102T

Time Allowed: 3hrs; MM:74; Pass Percentage:40%

### OBJECTIVES:

- This subject covers both the principles and the applications of molecular biology methods with an emphasis on the application of recombinant DNA technology to animals, plants and microbial organisms.
- It describes the use of genetically engineered products to solve environmental problems and cure human diseases.
- It also covers the practical application of recombinant DNA technology in industry, food production, human and veterinary medicine, agriculture and bioengineering.
- It will also discuss the use of recombinant DNA technology to identify, map and sequence genes and to determine their function.

### INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and carry 11 marks each. Section C will consist of 15 short answer type questions which will cover the entire syllabus uniformly and will carry 30 marks in all.

### INSTRUCTIONS FOR THE CANDIDATES

1. Candidates are required to attempt two questions each from sections A and B of the question paper and the entire section C.

### SECTION-A

#### UNIT I

(15 Periods)

Molecular tools and applications-restriction enzymes, ligases, polymerases, alkaline phosphatase. Gene Recombination and Gene transfer: Transformation, Episomes, Plasmids and other cloning vectors (Bacteriophage-derived vectors, artificial chromosomes), Microinjection, Electroporation, Ultrasonication. Principle and applications of Polymerase chain reaction (PCR), primer-design, and RT-(Reverse transcription) PCR.

#### UNIT II

(20 Periods)

Restriction and modification system, restriction mapping, Southern and Northern hybridization. Preparation and comparison of Genomic and cDNA library, screening of recombinants, reverse transcription, Genomemapping, DNA fingerprinting, Applications of Genetic Engineering Genetic engineering in animals: Production and applications of transgenic mice, role of ES cells in gene targeting in mice. Therapeutic products produced by genetic engineering-blood proteins, human hormones, immune modulators and vaccines (one example each).

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## SECTION-B

### UNIT III

(10 Periods)

Random and site-directed mutagenesis: Primer extension and PCR based methods of site directed mutagenesis, Random mutagenesis, Gene shuffling, production of chimeric proteins, Protein engineering concepts and examples (any two).

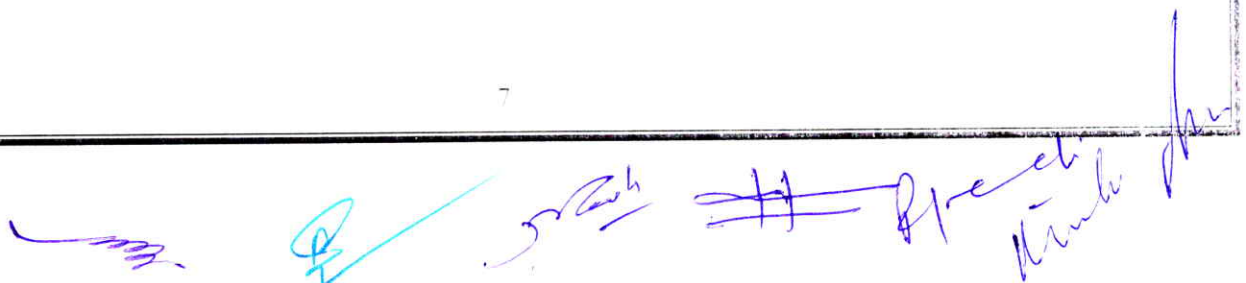
### UNIT IV

(15 Periods)

Genetic engineering in plants: Use of *Agrobacterium tumefaciens* and *A. rhizogenes*, Ti plasmids, Strategies for gene transfer to plant cells. Direct DNA transfer to plants, Gene targeting in plants, Use of plant viruses as episomal expression vectors.

### SUGGESTED READINGS

1. Brown TA. (2006). Gene Cloning and DNA Analysis, 5th edition. Blackwell Publishing, Oxford, U.K.
2. Clark DP and Pazdernik NJ. (2009). Biotechnology - Applying the Genetic Revolution. Elsevier Academic Press, USA.
3. Glick, B.R., Pasternak, J.J. (2003). Molecular Biotechnology - Principles and Applications of recombinant DNA. ASM Press, Washington
4. Primrose SB and Twyman RM. (2006). Principles of Gene Manipulation and Genomics, 7th edition. Blackwell Publishing, Oxford, U.K.
5. Sambrook J, Fritsch EF and Maniatis T. (2001). Molecular Cloning - A Laboratory Manual, 3rd edition. Cold Spring Harbor Laboratory Press.



**ANIMAL BIOTECHNOLOGY-CODE: BTHB3103T**

**Time Allowed: 3hrs; MM:74; Pass Percentage:40%**

**OBJECTIVES:**

- This subject covers the topics for the identification and characterization of animal breeds.
- Students will study the methods of developing DNA based diagnostics and genetically engineered vaccines for animals.
- This subject also includes animal genomics studies and its varied applications.
- Students will learn embryo-transfer technology, cloning, and transgenic animals.
- This subject also covers DNA forensics, molecular diagnostics, wildlife conservation, stem cell research and bio-processing technologies.

**INSTRUCTIONS FOR THE PAPER-SETTER**

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and carry 11 marks each. Section C will consist of 15 short answer type questions which will cover the entire syllabus uniformly and will carry 30 marks in all.

**INSTRUCTIONS FOR THE CANDIDATES**

1. Candidates are required to attempt two questions each from sections A and B of the question paper and the entire section C.

**SECTION-A**

**UNIT I** (10 Periods)

Gen transfer methods in Animals-  
Microinjection, Embryonic Stem cell, gen transfer, Retrovirus & Gen transfer.

**UNIT II** (10 Periods)

Introduction to transgenesis, Transgenic Animals- Mice, Cow, Pig, Sheep, Goat, Bird, Insect. Animal diseases need help of Biotechnology - Foot and mouth disease, Coccidiosis, Trypanosomiasis, Theileriosis.

**SECTION-B**

**UNIT III** (20 Periods)

Animal propagation- Artificial insemination, Animal Clones, Conservation Biology- Embryo transfer techniques, Introduction to Stem Cell Technology and its applications.

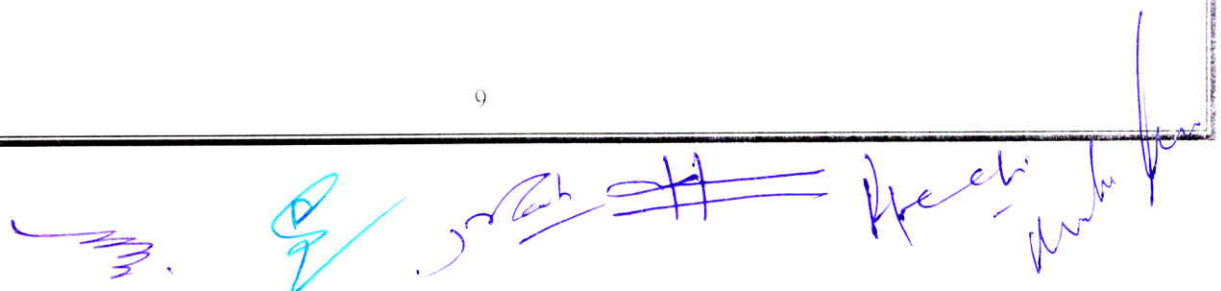
**UNIT IV** (20 Periods)

Genetic modification in Medicine-  
gene therapy, types of gene therapy, vectors in gene therapy, molecular engineering, human

genetic engineering, problems & ethics.

### SUGGESTED READINGS-

1. Brown, T.A. (1998). Molecular biology Labfax II: Gene analysis. II Edition. Academic Press, California, USA.
2. Butler, M. (2004). Animal cell culture and technology: The basics. II Edition. Bioscientific publishers.
3. Glick, B.R. and Pasternak, J.J. (2009). Molecular biotechnology - Principles and applications of recombinant DNA. IV Edition. ASM press, Washington, USA.
4. Griffiths, A.J.F., J.H. Miller, Suzuki, D.T., Lewontin, R.C. and Gelbart, W.M. (2009). An introduction to genetic analysis. IX Edition. Freeman & Co., N.Y., USA.
5. Watson, J.D., Myers, R.M., Caudy, A. and Witkowski, J.K. (2007). Recombinant DNA - genes and genomes - A short course. III Edition. Freeman and Co., N.Y., USA.



**ANIMAL DIVERSITY-I CODE: BTHB3104T**

**Time Allowed: 3hrs; MM:74; Pass Percentage:40%**

**OBJECTIVES**

- Students will be able to identify the Phylum or subphylum.
- Students will be able to define and discuss the means of locomotion used by each phylum or subphylum.
- Students will be able to define characters of each phylum and class.
- Students will be able to understand the type of symmetry and level of organization of each group.
- Students will be able to define and/or locate on a specimen all of the underlined terms in the text.
- Students will learn to explain and compare the life cycles of the Hydrozoa, Scyphozoa and Anthozoa.

**INSTRUCTIONS FOR THE PAPER-SETTER**

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and carry 11 marks each. Section C will consist of 15 short answer type questions which will cover the entire syllabus uniformly and will carry 30 marks in all.

**INSTRUCTIONS FOR THE CANDIDATES**

1. Candidates are required to attempt two questions each from sections A and B of the question paper and the entire section C.

**SECTION-A**

**UNIT I**

**(15 Periods)**

- Outline of classification of Non-Chordates up to subclasses. Coelomata, Acoelomata, Symmetries, Deutrostomes, Protostomes.
- Protozoa: Locomotion, Reproduction, evolution of Sex, General features of *Paramecium* and *Plasmodium*. Pathogenic protozoans
- Porifera: General characters, outline of Classification: skeleton, Canal System

**UNIT II**

**(15 Periods)**

- Coelenterata: General Characters, Outline of classifications Polymorphism, Various types of stinging cells: Metagenesis, coral reefs and their formation.
- Platyhelminthes- General Characters: Outline of classification: Pathogenic flatworms: Parasitic adaptations.
- Aschelminthes: General features, Outline of classification, Pathogenic roundworms and their vectors in relation to man: Parasite adaptation.



## SECTION-B

### UNIT III

(15 Periods)

- a) Annelida: - General features, Outline of classification, Coelom; Metameric segmentation, General features of Earthworm. Vermicomposting.
- b) Arthropoda: General Features, Outline of Classification; Larval forms of crustacean, Respiration in Arthropoda; Metamorphosis in insects; Social insects; Insect vectors of diseases; Apiculture, Sericulture.

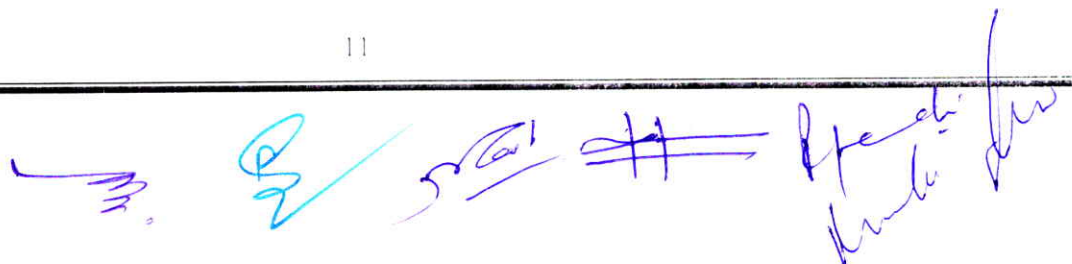
### UNIT IV

(15 Periods)

- a) Mollusca: general features, Outline of classification, Shell Diversity; Torsion in gastropoda,
- b) Echinodermata: General features, Outline of Classification Larval forms
- c) Hemichordata: Phylogeny; Affinities of *Balanoglossus*

### SUGGESTED READINGS

1. Barnes, R.S.K., Calow, P., Olive, P.J.W., Golding, D.W. & J.I., Spicer (2002) The Invertebrates: A New Synthesis. III Edition. Blackwell Science.
2. Barrington, E.J.W. (1979) Invertebrate Structure and Functions. II Edition. E.L.B.S. and Nelson.
3. Boradale, L.A. and Potts, E.A. (1961) Invertebrates: A Manual for the use of Students. Asia Publishing Home.
4. Bushbaum, R. (1964) Animals without Backbones. University of Chicago Press



**PLANT BIOTECHNOLOGY CODE: BTHB3105T**

**Time Allowed: 3hrs; MM:74; Pass Percentage:40%**

**OBJECTIVES**

- The objective of the course is to give students new knowledge and widening of the knowledge acquired in other course by handling of classical and modern plant biotechnology processes, including breeding of healthy plants, plants with improved characteristics and plants for biomolecule production.
- Students will develop molecular strategies to support plant breeding programs, including molecular biodiversity analysis, quantitative genetics and molecular marker-trait associations.
- Students will be able to develop a model to introduce and to study the expression of genes related to plant adaptations.
- Students will learn to apply biotechnology to the development of agriculture.
- Students will learn to apply and develop strategies to produce bio-products (metabolites, enzymes, recombinant proteins)
- Students will understand biotechnological processes that have also applicative value in pharmaceutical and food industry, in agriculture and in ecology.

**INSTRUCTIONS FOR THE PAPER-SETTER**

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and carry 11 marks each. Section C will consist of 15 short answer type questions which will cover the entire syllabus uniformly and will carry 30 marks in all.

**INSTRUCTIONS FOR THE CANDIDATES**

1. Candidates are required to attempt two questions each from sections A and B of the question paper and the entire section C.

**SECTION-A**

**UNIT-I**

**(15 Periods)**

Introduction, Cryo and organogenic differentiation, Types of culture: Seed, Embryo, Callus, Organs, Cell and Protoplast culture, Micropopagation Axillary bud proliferation, Meristem and shoot tip culture, culture, organogenesis, embryogenesis, advantages and disadvantages of micropopagation.

**UNIT-II**

**(20 Periods)**


In vitro haploid production Androgenic methods: Anther culture, Microspore culture andogenesis Significance and use of haploids, Ploidy level and chromosome doubling, diploidization, Gynogenic haploids, factors effecting gynogenesis, chromosome elimination techniques for production of haploids in cereals.

**SECTION-B**

**UNIT-III**

**(20 Periods)**

Protoplast Isolation and fusion Methods of protoplast isolation, Protoplast development,



Somatic hybridization, identification and selection of hybrid cells, Cybrids, Potential of somatic hybridization limitations. Somaclonal variation Nomenclature, methods, applications basis and disadvantages.

#### UNIT-IV

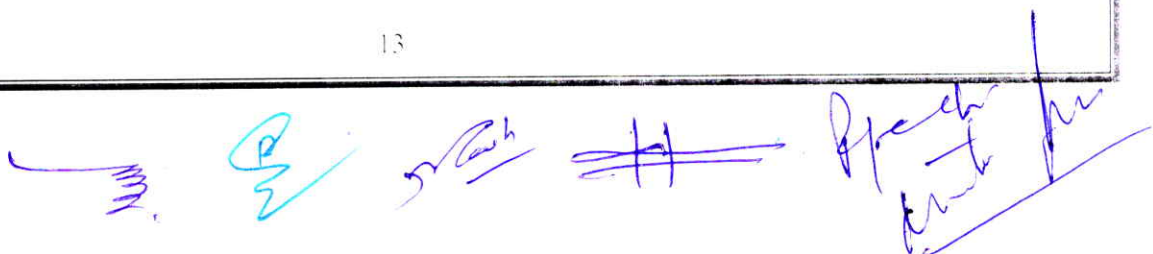
(10 Periods)

Plant Growth Promoting bacteria.

Nitrogen fixation, Nitrogenase, Hydrogenase, Nodulation, Biocontrol of pathogens, Growth promotion by free-living bacteria.

#### SUGGESTED READINGS

1. Bhojwani, S.S. and Razdan 2004 Plant Tissue Culture and Practice.
2. Brown, T. A. Gene cloning and DNA analysis: An Introduction. Blackwell Publication.
3. Gardner, E.J. Simmons, M.J. Snustad, D.P. 2008<sup>th</sup> edition Principles of Genetics. Wiley India.
4. Raven, P.H., Johnson, G.B., Losos, J.B. and Singer, S.R. 2005 Biology. Tata MC Graw Hill.
5. Reinert, J. and Bajaj, Y.P.S. 1997 Applied and Fundamental Aspects of Plant Cell, Tissue and Organ Culture. Narosa Publishing House.
6. Russell, P.J. 2009 Genetics - A Molecular Approach. 3<sup>rd</sup> edition. Benjamin Co.
7. Sambrook & Russel. Molecular Cloning: A laboratory manual. (3<sup>rd</sup> edition)
8. Slater, A., Scott, N.W. & Fowler, M.R. 2008 Plant Biotechnology: The Genetic Manipulation of Plants. Oxford University Press.



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**PLANT DIVERSITY-I CODE: BTHB3106T**

**Time Allowed: 3hrs; MM:74; Pass Percentage:40%**

**OBJECTIVES**

- Students will learn taxa of lower and higher plant giving characteristics, structures, forms, life cycle and economic importance.
- Students will be able to identify characteristics that distinguish the various plants adaptations

**INSTRUCTIONS FOR THE PAPER-SETTER**

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and carry 11 marks each. Section C will consist of 15 short answer type questions which will cover the entire syllabus uniformly and will carry 30 marks in all.

**INSTRUCTIONS FOR THE CANDIDATES**

1. Candidates are required to attempt two questions each from sections A and B of the question paper and the entire section C.
2. The use of scientific calculator is allowed.

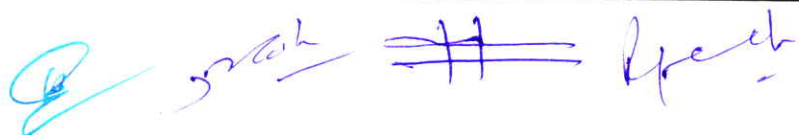
**SECTION-A**

**UNIT I**

Algae: (20 Periods)  
General character, classification and economic importance. Life histories of algae belonging to various classes:  
Chlorophyceae -  
*Volvox, Oedogonium* Xanthophyceae -  
*Chaetoceros, Vaucheria* Phaeophyceae -  
*Ectocarpus* Rhodophyceae -  
*Polysiphonia*

**UNIT II**

Fungi: (20 Periods)  
General characters, classification & economic importance. Life histories of Fungi:  
Mastigomycotina -  
*Phytophthora* Zygomycotina -  
*Mucor* Ascomycotina -  
*Saccharomyces* Basidiomycotina -  
*Agaricus* Deutromycotina -  
*Colletotrichum*





## SECTION-B

### UNIT III

Lichens: (10 Periods)

Classification, general structure, reproduction and economic importance. Plant diseases: 4 of 36

Causal organism, symptoms and control of following plant diseases. Rust & Smut of Wheat.

White rust of Crucifers. Late blight of Potato. Red rot of Sugarcane. Citrus Canker.

### UNIT IV

Bryophytes: (10 Periods)

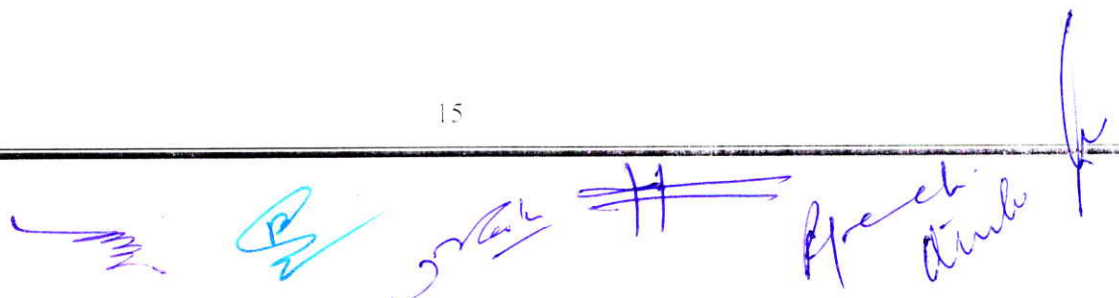
General characters, classification & economic importance. Life histories of following:

*Marchantia*.

*Funaria*.

### SUGGESTED READINGS

1. Agrios, G.N. 1997 Plant Pathology, 4<sup>th</sup> edition. Academic Press, U.K.
2. Alexopoulos, C.J., Mims, C.W. and Blackwell, M. 1996 Introductory Mycology, 4<sup>th</sup> edition. John Wiley and Sons (Asia) Singapore.
3. Bold, H.C. & Wayne, M.J. 1996 (2<sup>nd</sup> Ed.) Introduction to Algae.
4. Kumar, H.D. 1999. Introductory Phycology. Aff. East-West Press Pvt Ltd., Delhi.
5. Lee, R.E. 2008. Phycology, Fourth Edition. Cambridge University Press, USA.
6. Sambamurthy 2008 A Textbook of Bryophytes, Pteridophytes, Gymnosperms and Paleobotany. IK International Publishers.
7. Shaw, A.J. and Goffinet, B. 2000 Bryophyte Biology. Cambridge University Press.
8. Vanden Hoek, C.; Mann, D.J. & Jahns, H.M. 1995. Algae: An introduction to Phycology. Cambridge Univ. Press.
9. Vander-Poorteri 2009 Introduction to Bryophytes. COP.
10. Webster, J. and Weber, R. 2007 Introduction to Fungi, 3<sup>rd</sup> edition. Cambridge University Press, Cambridge.
11. Wickens, G.E. 2004 Economic Botany: Principles and Practices. Springer. Kuwer Publishers, Dordrecht, The Netherlands



**BASICS OF FORENSIC SCIENCE-CODE: BTHB3107T**

**Time Allowed: 3hrs; MM:74; Pass Percentage:40%**

**OBJECTIVES:**

- Students will understand the use of creativity in problem solving.
- Students will use primary scientific literature effectively in their own research.
- Students will be demonstrated practical experience of public speaking and presentation of their ideas and research.
- Students will be demonstrated competency in written forms of scientific communication.
- Students will learn principles and scientific knowledge in order to find facts about a criminal case.

**INSTRUCTIONS FOR THE PAPER-SETTER**

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and carry 1 mark each. Section C will consist of 15 short answer type questions which will cover the entire syllabus uniformly and will carry 30 marks in all.

**INSTRUCTIONS FOR THE CANDIDATES**

1. Candidates are required to attempt two questions each from sections A and B of the question paper and the entire section C.

**SECTION-A**

**UNIT I**

**(15 Periods)**

Introduction and principles of forensic science, forensic science laboratory and its organization and service, tools and techniques in forensic science, branches of forensic science, causes of crime, role of modus operandi in criminal investigation, Classification of injuries and their medico-legal aspects, method of assessing various types of deaths.

**UNIT II**

**(15 Periods)**

Classification of fire arms and explosives, introduction to internal, external and terminal ballistics, Chemical evidence for explosives, General and individual characteristics of handwriting, examination and comparison of handwritings and analysis of ink various samples.

**SECTION-B**

**UNIT III**

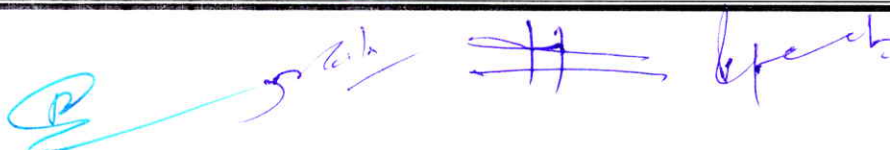
**(15 Periods)**

Role of the toxicologist, significance of toxicological findings, Fundamental principles of fingerprinting, classification of fingerprints, development of fingerprint as science for personal identification.

**UNIT IV**

**(15 Periods)**

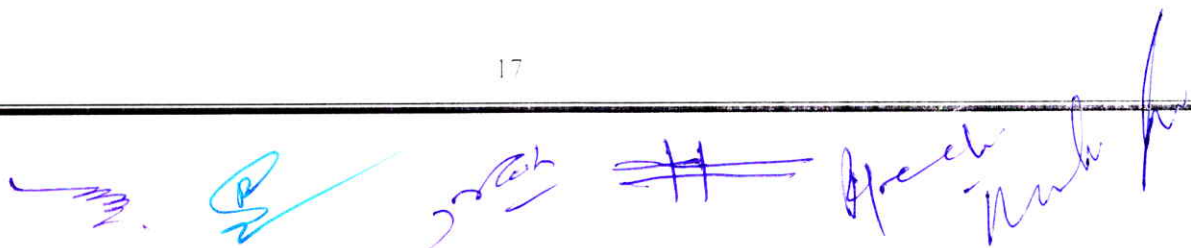
Principle of DNA fingerprinting, application of DNA profiling in forensic medicine, Investigation Tools, eDiscovery, Evidence Preservation, Search and Seizure of



Computers, Introduction to Cybersecurity.

### SUGGESTED READINGS

1. Molecular Biotechnology- Principles and Applications of recombinant DNA. ASM Press, Washington.
2. B.B. Nanda and R.K. Tiwari, Forensic Science in India: A Vision for the Twenty First Century. Select Publishers, New Delhi (2001).
3. M.K. Bhasin and S. Nath, Role of Forensic Science in the New Millennium. University of Delhi, Delhi (2002).
4. S.H. James and J.J. Nordby, Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton (2005).
5. W.G. Eckert and R.K. Wright in Introduction to Forensic Sciences, 2nd Edition, W.G. Eckert (ED.), CRC Press, Boca Raton (1997).
6. R. Saferstein, Criminalistics, 8th Edition, Prentice Hall, New Jersey (2004).
7. W.J. Tilstone, M.L. Hastrup and C. Hald, Fisher's Techniques of Crime Scene Investigation, CRC Press, Boca Raton (2013).



**CHEMISTRY-5-CODE: BTHB3108T**

**Time Allowed: 3hrs; MM:74; Pass Percentage:40%**

**OBJECTIVES:**

- Students will acquire an ability to observe accurately and objectively.
- Students will acquire an ability to solve a problem.
- Students will acquire an ability to think scientifically, independently and to make a rational discussion.
- Students will be able to understand what it means to use spectroscopic methods for qualitative and quantitative analysis.
- This subject will be able to describe the difference between a fluorescence excitation and emission spectrum.
- This subject will determine the vibrations for atomic molecules and identify whether they are infrared active.

**INSTRUCTIONS FOR THE PAPER-SETTER**

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and carry 11 marks each. Section C will consist of 15 short answer type questions which will cover the entire syllabus uniformly and will carry 30 marks in all.

**INSTRUCTIONS FOR THE CANDIDATES**

1. Candidates are required to attempt two questions each from sections A and B of the question paper and the entire section C.

**SECTION-A**

**UNIT I**

**(15 Periods)**

**Spectroscopy** Nuclear magnetic resonance (NMR) spectroscopy. Proton magnetic resonance (<sup>1</sup>H NMR) spectroscopy, nuclear shielding and deshielding, chemical shift and molecular structure, spin-spin splitting and coupling constants, areas of signals interpretation of PMR spectra of simple organic molecules such as ethyl bromide, ethanol

Electromagnetic radiation, regions of spectrum, basic features of different spectrometers, statement of Born-Oppenheimer approximation, degrees of freedom.

**UNIT II**

**(18 Periods)**

**Electromagnetic spectrum: Absorption Spectra** Ultraviolet (UV) absorption spectroscopy - absorption laws (Beer-

Lambert's law, Molar absorptivity, presentation and analysis of UV Spectra, types of electronic transitions, effect of conjugation. Concept of chromophore and auxochrome. Bathochromic, hypsochromic, hyperchromic and hypochromic shifts.



## SECTION-B

### UNIT III

(15 Periods)

**Infrared (IR)** Infrared (IR) absorption spectroscopy-molecular vibrations, Hooke's law, Selection rules, intensity and position of IR bands, measurement of IR spectrum, fingerprint region, characteristic absorption of various functional groups and Interpretation of IR spectra of simple organic compounds.

**Raman Spectrum** Concept of polarizability, pure rotational and pure vibrational Raman spectra of diatomic molecules, selection rules.

### UNIT IV

(18 Periods)

#### Elementary Quantum Mechanics

Black-body radiations, Planck's radiation law, photoelectric effect, heat capacity of solids, Sinusoidal wave equation Hamiltonian operator, Schrodinger wave equation and its importance, physical interpretation of the wave function, postulates of quantum mechanics, particle in a one dimensional box. Schrodinger wave equation for H-atom, separation into three equations (without derivation), quantum numbers and their importance, hydrogen like wave functions, radial wave functions, angular wave functions.

### SUGGESTED READINGS

2. Basic Inorganic Chemistry, F.A. Cotton, G. Wilford and P.L. Gaus, Wiley.
3. Concise Inorganic Chemistry, J.D. Lee, ELBS.
4. Concept of model of Inorganic Chemistry, B. Douglas, D. McDaniel, and J. Alexander, John Wiley.
5. Inorganic Chemistry, D.E. Shriver, P.W. Atkins and C.H. Langford, Oxford.
6. Inorganic Chemistry, W.W. Porterfield Addison-Welsey.
7. Inorganic Chemistry, A.G Sharpe, ELBS
8. Inorganic Chemistry, G.L. Miessler and D.A. Tarr, Prentice Hall.
9. Inorganic Chemistry, Morrison and Boyd, Prentice-Hall.
10. Inorganic Chemistry, L.G Wade Jr. Prentice-Hall.
11. Fundamentals of Organic Chemistry, Solomons, John Wiley.
12. Organic Chemistry, Vol. I, II & III, S.M. Mukherji, S.P. Singh and R.P. Kapoor, Wiley Eastern Ltd. (New Age International).
13. Organic Chemistry, F.A. Carey, McGraw-Hill, Inc.
14. Introduction to Organic Chemistry, Streitwieser, Heathcock and Kosover and Kosover, Macmillan.
15. Physical Chemistry, G.M. Barrow, International Student edition, McGraw Hill.
16. University General Chemistry, C.N.R. Rao, Macmillan.
17. Physical Chemistry, R.A. Alberty, Wiley Eastern Ltd.

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## PRACTICALS

### PRACTICAL BTHB3101L PERTAINING TO THEORY BTHB3101T

1. Bacterial growth curve.
2. Calculation of thermal death point (TDP) of a microbial sample.
3. Production and analysis of ethanol.
4. Production and analysis of amylase.
5. Production and analysis of lactic acid.
6. Isolation of industrially important microorganism from natural resource.

### PRACTICAL BTHB3102L PERTAINING TO THEORY BTHB3102T

1. Isolation of chromosomal DNA from plant cells
2. Isolation of chromosomal DNA from *E. coli*
3. Qualitative and quantitative analysis of DNA using spectrophotometer
4. Plasmid DNA isolation
5. Restriction digestion of DNA
6. Making competent cells
7. Transformation of competent cells.
8. Demonstration of PCR

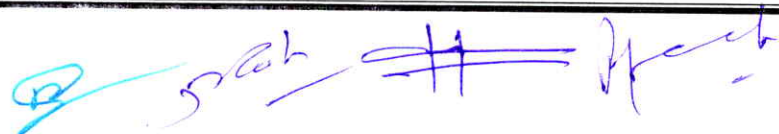
### PRACTICAL BTHB3103L

#### PERTAINING TO THEORY BTHB3103T –ANIMAL BIOTECHNOLOGY

1. Sterilization techniques: Theory and Practical: Glass ware sterilization, Media sterilization, Laboratory sterilization
2. Sources of contamination and decontamination measures.
3. Preparation of Hanks Balanced salt solution
4. Preparation of Minimal Essential Growth medium
5. Isolation of lymphocytes for culturing
6. DNA isolation from animal tissue
7. Quantification of isolated DNA.
8. Resolving DNA on Agarose Gel.

### PRACTICAL BTHB3103L PERTAINING TO THEORY BTHB3104T –ANIMAL DIVERSITY-I

1. Identification and Classification of Any three of the following-  
Porifera: *Scypha*, *Leucosolenia*, *Euspongia*, *Hylonema*, *Euplectella* Cnidaria: *Medrepora*,



*Millepora, Physalia, Porpita, Varella, Aurelia,*  
*Metridium* Platyhelminthes: *Taenia, Fasciola.* Aschelminthes: *Ascaris, Ancylostoma, Enterobius*  
Annelida: *Pheretima, Hirudinaria, Chaetopterus, Nereis, Aphrodite* Arthropoda: *Julus, Scolopendra, Peripatus, Carcinus, Limulus.* Lepisma, *Dragonfly, Musca, Acheta* Mollusca: *Pila, Unio, Mytilus, Loligo, Sepia, Octopus,*  
*Solen* Echinodermata: *Asterias, Ophiothrix, Echinus, Holothuria,*  
*Astrophyton* Hemichordata: *Balanoglossus*

2. Identification of slides with two points of identification.

*Amoeba, Paramoecium, Ceratium, Plasmodium, Opalina, L.S. Sponge, Spicules of sponges, L.S. Hydra, Obelia, Bougainvillia, Larvae of Fasciola, Seta of Earthworm, Radula*

3. Ecological Note-

On any of the specimens in Exercise No I Models of dissection of Earthworm.  
Cockroach Earthworm: Digestive, Nervous System.  
Cockroach: Digestive Reproductive, Nervous System

**PRACTICAL BTHB3104L**

**PERTAINING TO THEORY BTHB3105T – PLANT BIOTECHNOLOGY**

1. Preparation of simple growth nutrient (knop's medium), full strength, half strength, solid and liquid.
2. Preparation of complex nutrient medium (Murashige & Skoog's medium)
3. To selection, Prune, sterilize and prepare explant for culture.
4. Significance of growth hormones in culture medium.
5. To demonstrate various steps of Micropropagation.

**PRACTICAL BTHB3104L**

**PERTAINING TO THEORY BTHB3106T – PLANT DIVERSITY I**

1. Comparative study of thallus and reproductive organs of various algae mentioned in theory
2. Comparative study of vegetative and reproductive parts of various fungi mentioned in theory.
3. Study and section cutting and lectophenol mount of plant disease materials studied in theory.
4. Study of various types of lichens.
5. Study of external features & anatomy of vegetative and reproductive parts of *Marchantia* and *Funaria*
6. Collection of algae, fungi, plant disease materials and bryophytes available locally.

**PRACTICAL BTHB3105L**

**PERTAINING TO THEORY BTHB3107L – BASICS OF FORENSIC SCIENCE**

1. Documentation of crime scene by photography, sketching and field notes.
2. a. Simulation of crime scene for training.  
b. To lift footprints from crime scene.
3. Case studies to depict different types of injuries and death.

4. Separation of nitro compounds (explosives) / ink samples by thin layer chromatography.
5. Investigate method for developing fingerprints by Iodine crystals.
6. PCR amplification of target DNA and DNA profiling.
7. E-Mail Investigation, E-Mail Tracking, IP Tracking, E-Mail Recovery, Recovering deleted evidence, Password Cracking.

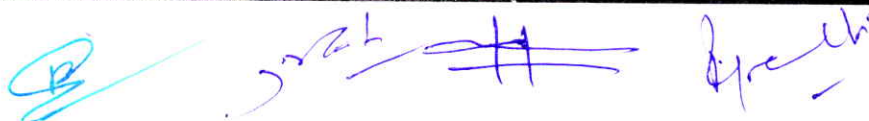
**PRACTICAL BTHB3105L  
PERTAINING TO THEORY BTHB3108T - CHEMISTRY-5**

**1. Synthesis and Analysis**

- (a) Preparation of sodium trioxalato ferrate(III),  $\text{Na}_3[\text{Fe}(\text{C}_2\text{O}_4)_3]$  and determination of its composition by permagnetometry.

**2. Synthesis of Organic Compounds**

- (a) Iodoform from methanol and acetone
- (b) Aromatic electrophilic substitution of benzene
  1. p-nitroacetanilide
  2. 2,4,6-tribromophenol
  3. Diazotization / Coupling
4. Preparation of m-nitroaniline from m-dinitrobenzene
5. Interpretation of different spectra





**B.Sc. (HONS.) BIOTECHNOLOGY**  
**COURSE CODE- BTHB3PUP**

**Part III( 6th semester)**

**BIO-ANALYTICAL TOOLS-CODE:BTHB3201T**

**TimeAllowed: 3hrs; MM:74; PassPercentage:40%**

**OBJECTIVES:**

- The primary objectives of this course are to develop the skills to understand the theory and practice of bio-analytical techniques.
- This subject will provide scientific understanding of analytical techniques and detail interpretation of results.

**INSTRUCTIONS FOR THE PAPER-SETTER**

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and carry 11 marks each. Section C will consist of 15 short answer type questions which will cover the entire syllabus uniformly and will carry 30 marks in all.

**INSTRUCTIONS FOR THE CANDIDATES**

1. Candidates are required to attempt two questions each from sections A and B of the question paper and the entire section C.

**SECTION-A**

**UNIT I (10 Periods)**

Simple microscopy, phase contrast microscopy, fluorescence and electron microscopy (TEM and SEM), pH meter, absorption and emission spectroscopy

**UNIT II (15 Periods)**

Principle and law of absorption fluorimetry, colorimetry, spectrophotometry (visible, UV, infra-red), centrifugation, cell fractionation techniques, isolation of sub-cellular organelles and particles.

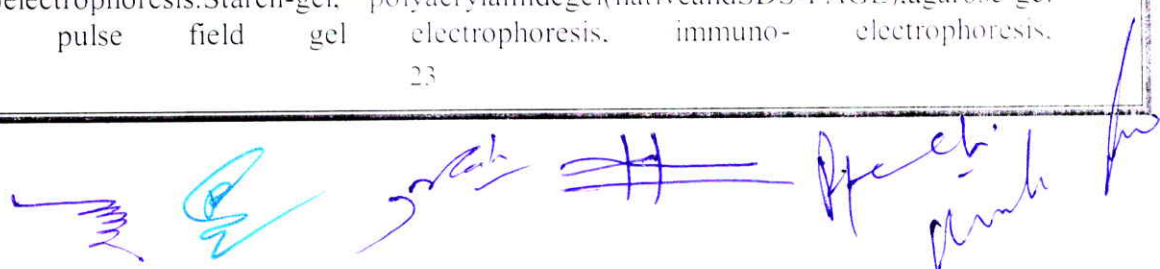
**SECTION-B**

**UNIT III (15 Periods)**

Introduction to the principle of chromatography. Paper chromatography, thin layer chromatography, column chromatography: silica and gel filtration, affinity and ion exchange chromatography, gas chromatography, HPLC.

**UNIT IV (20 Periods)**


Introduction to electrophoresis. Starch-gel, polyacrylamide gel (native and SDS-PAGE), agarose-gel electrophoresis, pulse field gel electrophoresis, immuno-electrophoresis.



isoelectric focusing, Western blotting, Introduction to Biosensors and Nanotechnology and their applications.

### SUGGESTED READINGS

1. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. John Wiley & Sons, Inc.
2. DeRobertis, E. D. P. and DeRobertis, E. M. F. 2006. Cell and Molecular Biology. 8th edition. Lippincott Williams and Wilkins, Philadelphia.
3. Cooper, G. M. and Hausman, R. E. 2009. The Cell: A Molecular Approach. 5th edition. ASM Press & Sunderland, Washington, D.C.; Sinauer Associates, MA.
4. Becker, W. M., Kleinsmith, L. J., Hardin, J. and Bertoni, G. P. 2009. The World of the Cell. 7th edition. Pearson Benjamin Cummings Publishing, San Francisco.



**GENOMICS & PROTEOMICS-CODE:BTBH3202T**

**Time Allowed: 3hrs; MM: 74; Pass Percentage:40%**

**OBJECTIVES:**

- The ultimate goal of this subject is to develop student's understanding towards the identification and characterization of proteins expressed in a genome.
- It includes study of the entire set of proteins in order to understand its structure and function.
- This subject will cover recent developments in genetics, epigenetics, sm
- all RNAs, proteomics, gene expression, mutagenesis and mapping genes.
- It aims to teach students advanced technologies, research methods with major emphasis on the applications of DNA sequencing and protein analysis techniques.

**INSTRUCTIONS FOR THE PAPER-SETTER**

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and carry 11 marks each. Section C will consist of 15 short answer type questions which will cover the entire syllabus uniformly and will carry 30 marks in all.

**INSTRUCTIONS FOR THE CANDIDATES**

1. Candidates are required to attempt two questions each from sections A and B of the question paper and the entire section C.

**SECTION-A**

**UNIT I**

**(15 Periods)**

Introduction to Genomics, DNA sequencing methods- manual & automated: Maxam & Gilbert and Sanger's method. Pyrosequencing, Genome Sequencing: Shotgun & Hierarchical (clone contig) methods, Computer tools for sequencing projects: Genome sequence assembly software.

**UNIT II**

**(10 Periods)**

Managing and Distributing Genome Data: Web based servers and softwares for genome analysis: ENSEMBL, VISTA, UCSC Genome Browser, NCBI genome, Selected Model Organisms' Genomes and Databases.

**SECTION-B**

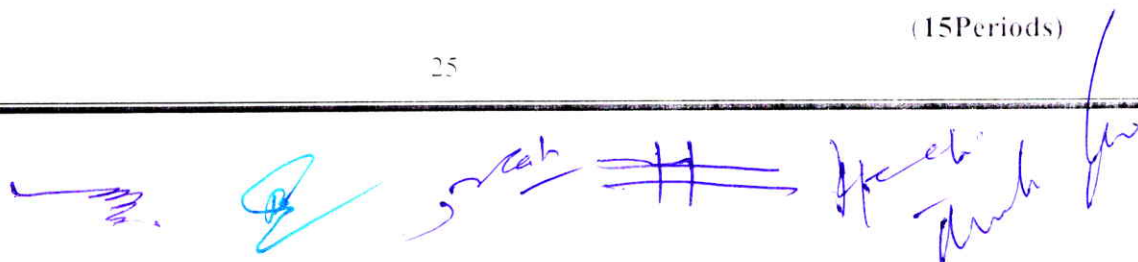
**UNIT III**

**(20 Periods)**

Introduction to protein structure, Chemical properties of proteins, Physical interactions that determine the property of proteins. Short-range interactions, electrostatic forces, van der Waal interactions, hydrogen bonds, Hydrophobic interactions. Determination of sizes (Sedimentation analysis, gel filtration, SDS-PAGE); Native PAGE, Determination of covalent structures-Edman degradation.

**UNIT IV**

**(15 Periods)**

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Introduction to Proteomics. Analysis of proteomes. 2D-PAGE. Sample preparation, solubilization, reduction, resolution. Reproducibility of 2D-PAGE. Mass spectrometry-based methods for protein identification. *De novo* sequencing using mass spectrometric data.

### SUGGESTED READINGS

1. Genes IX by Benjamin Lewin, John and Bartlett Publisher, 2006.
2. Modern Biotechnology, 2nd Edition, S. B. Primrose, Blackwell Publishing, 1987.
3. Molecular Biotechnology: Principles and Applications of Recombinant DNA, 4th Edition, B. R. Glick, J. J. Pasternak and C. L. Patten, 2010.
5. Molecular Cloning: A Laboratory Manual (3rd Edition) Sambrook and Russell Vol. I to III, 1989.
6. Principles of Gene Manipulation 6th Edition, S. B. Primrose, R. M. Twyman and R. W. Old, Blackwell Science, 2001.
7. Snustad, D. P., Simmons, M. J. (2009). Principles of Genetics, V Edition, John Wiley and Sons Inc.
3. Klug, W. S., Cummings, M. R., Spencer, C. A. (2009). Concepts of Genetics, IX Edition, Benjamin Cummings.
4. Russell, P. J. (2009). *i* Genetics - A Molecular Approach, III Edition, Benjamin Cummings.
5. Glick, B. R., Pasternak, J. J. (2003). Molecular Biotechnology - Principles and Applications of Recombinant DNA, ASM Press, Washington.
6. Pevsner, J. (2009). Bioinformatics and Functional Genomics, II Edition, John Wiley & Sons.



**MEDICAL MICROBIOLOGY-CODE:BT HB3203T**

**Time Allowed: 3hrs; MM:74; Pass Percentage:40%**

**OBJECTIVES:**

- Students will be able to identify common infectious agents and the diseases that they cause.
- Students will be able to evaluate methods used to identify infectious agents in the clinical microbiology lab.
- Students will be able to recall microbial physiology including metabolism, regulation and replication.
- Students will be able to explain general and specific mechanisms by which an infectious agent causes disease.
- Students will be able to recognize and diagnose common infectious diseases from the clinical presentation and microbiological lab findings.
- Students will be able to describe the epidemiology of infectious agents including how infectious diseases are transmitted.
- Students will be able to explain intervention employed to prevent infectious diseases including infection control measures and vaccines.

**INSTRUCTIONS FOR THE PAPER-SETTER**

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and carry 11 marks each. Section C will consist of 15 short answer type questions which will cover the entire syllabus uniformly and will carry 30 marks in all.

**INSTRUCTIONS FOR THE CANDIDATES**

1. Candidates are required to attempt two questions each from sections A and B of the question paper and the entire section C.

**SECTION-A**

**UNIT I**

**(18 Periods)**

Introduction: Normal microflora of human body, nosocomial infections, carriers, septic shock, septicemia, pathogenicity, virulence factors, toxins, biosafety levels.

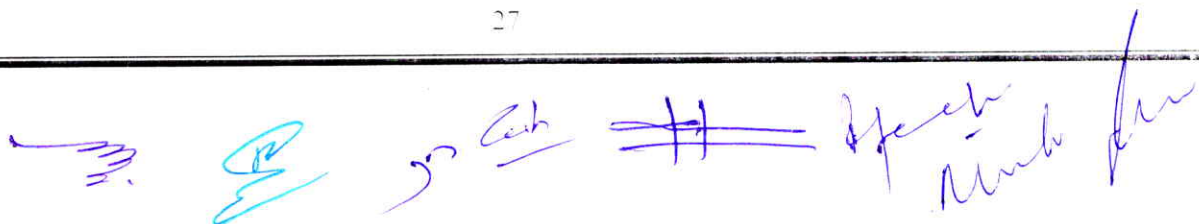
Morphology,

pathogenesis, symptoms, laboratory diagnosis, preventive measures and chemotherapy of gram positive bacteria: *S. aureus*, *S. pyogenes*, *B. anthracis*, *C. perferinges*, *C. tetani*, *C. botulinum*, *C. diphtheriae*, *M. tuberculosis*, *M. leprae*.

**UNIT II**

**(15 Periods)**

Morphology, pathogenesis, symptoms, laboratory diagnosis, preventive measures and chemotherapy caused by gram negative bacteria: *E. coli*, *N. gonorrhoea*, *N. meningitidis*, *P. aeruginosa*, *S. typhi*, *S. dysenteriae*, *Y. pestis*, *B. abortus*, *H. influenzae*, *V. cholerae*.

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*M. pneumoniae, T. pallidum, M. pneumoniae, Rickettsiaceae, Chlamydiae.*

## SECTION-B

### UNIT III

(12 Periods)

Diseases caused by viruses- Picornavirus, Orthomyxoviruses, Paramyxoviruses, Rhabdoviruses, Reoviruses, Poxvirus, Herpesvirus, Papovavirus, Retroviruses (including HIV/AIDS) and Hepatitis viruses.

### UNIT IV

(15 Periods)

Fungal and Protozoan infections. Dermatophytoses (*Trichophyton, Microsporum* and *Epidermophyton*) Subcutaneous infection (*Sporothrix, Cryptococcus*), systemic infection (*Histoplasma, Coccidioides*) and opportunistic fungal infections (*Candidiasis, Aspergillosis*), Gastrointestinal infections (*Amoebiasis, Giardiasis*), Blood-borne infections (*Leishmaniasis, Malaria*)

### SUGGESTED READINGSS

1. Brooks GF, Carroll KC, Butel JS and Morse SA. (2007). Jawetz, Melnick and Adelberg's Medical Microbiology, 24th edition. McGraw Hill Publication.
2. Goering R, Dockrell H, Zuckerman M and Wakelin D. (2007). Mims' Medical Microbiology, 4th edition, Elsevier.
3. Willey JM, Sherwood LM, and Woolverton CJ. (2008). Prescott, Harley and Klein's Microbiology, 7th edition. McGraw Hill Higher Education.



**ANIMAL DIVERSITY II-CODE: BTHB3204T**

**Time Allowed: 3hrs; MM:74; PassPercentage:40%**

**OBJECTIVES:**

- Students will be able to identify organisms of given phylum.
- Students will be able to learn defining characters of each Phylum and Class and identify them
- Students will be able to learn general characteristics of each phylum, e.g. type of coelom, digestive system, circulatory system, fate of blastopore, type of symmetry, number of germ layers.

**INSTRUCTIONS FOR THE PAPER-SETTER**

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and carry 11 marks each. Section C will consist of 15 short answer type questions which will cover the entire syllabus uniformly and will carry 30 marks in all.

**INSTRUCTIONS FOR THE CANDIDATES**

1. Candidates are required to attempt two questions each from sections A and B of the question paper and the entire section C.

**SECTION-A**

**UNIT I: Proto-chordates, Pisces and Ambhibia**

(15

Periods)

Proto-chordates: Outline of classification, General features and important characters of *Herdmania*, *Branchiostoma*

Origin of Chordates

Pisces: Migration in Pisces, Outline of classification  
Amphibia: Classification, Origin, Parental care, Paedogenesis

**UNIT II: Reptilia, Aves and Mammalia**

(15 Periods)

Reptilia: Classification, Origin

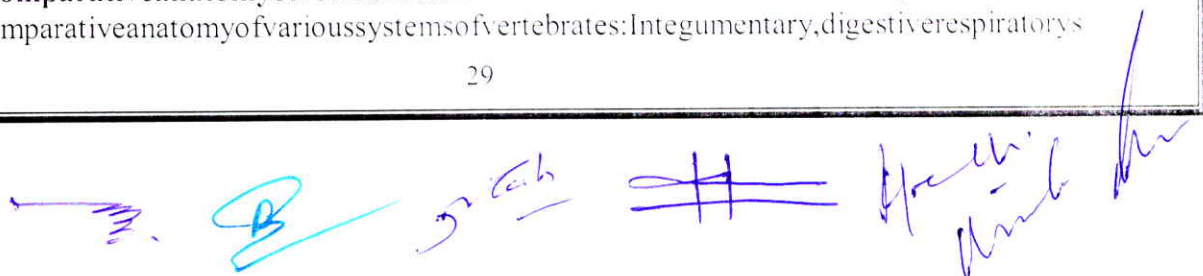
Aves: Classification, Origin, flight-adaptations, migration  
Mammalia: Classification, Origin, dentition

**SECTION-B**

**UNIT III: Comparative anatomy of vertebrates I**

(15

Periods) Comparative anatomy of various systems of vertebrates: Integumentary, digestive, respiratory



systems.

**UNIT IV: Comparative anatomy of**

**vertebrates**

**II**

**(15 Periods) C**

Comparative Anatomy of vertebrates- Heart, Aortic arches, Kidney & urinogenital system, Brain, Eye, Ear.

Autonomic Nervous system in Mammals

**SUGGESTED READINGS**

1. Hall B. K. and Hallgrimsson B. (2008). Strickberger's Evolution. IV Edition. Jones and Bartlett Publishers Inc.
2. Kardong, K. V. (2005) Vertebrates Comparative Anatomy, Function and evolution. IV Edition. McGraw-Hill Higher Education.
3. Kent, G. C. and Carr R. K. (2000). Comparative Anatomy of the Vertebrates. IX Edition. The McGraw-Hill Companies.
4. Weichert, C. K. (1970). Anatomy of Chordate. McGraw Hill.
5. Young, J. Z. (2004). The life of vertebrates. III Edition. Oxford university press.





**BIOINFORMATICS-CODE:BT HB3205T**

**Time Allowed: 3hrs; MM:74; Pass Percentage:40%**

**OBJECTIVES:**

- The basic objective is to give students an introduction to the basic practical techniques of bioinformatics.
- Emphasis will be given to the application of bioinformatics and biological databases to problemsolving in real research problems.
- The students will become familiar with the use of a wide variety of internet applications, biological database and will be able to apply these methods to research problems.
- The aim of practical subject is to provide practical training in bioinformatics methods including accessing the major public sequence databases, use of the different computational tools to find sequences, analysis of protein and nucleic acid sequences by various software packages.

**INSTRUCTIONS FOR THE PAPER-SETTER**

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and carry 11 marks each. Section C will consist of 15 short answer type questions which will cover the entire syllabus uniformly and will carry 30 marks in all.

**INSTRUCTIONS FOR THE CANDIDATES**

1. Candidates are required to attempt two questions each from sections A and B of the question paper and the entire section C.

**SECTION-A**

**UNIT I (10 Periods)**

History of Bioinformatics, The notion of Homology, Sequence Information Sources, EMBL, GENBANK, Entrez, Unigene, Understanding the structure of each source and using it on the web.

**UNIT II (20 Periods)**

Protein Information Sources, PDB, SWISSPROT, TREMBL, Understanding the structure of each source and using it on the web, Introduction of Data Generating Techniques and Bioinformatics problems posed by them- Restriction Digestion, Chromatograms, Blots, PCR, Microarrays, Mass Spectrometry.

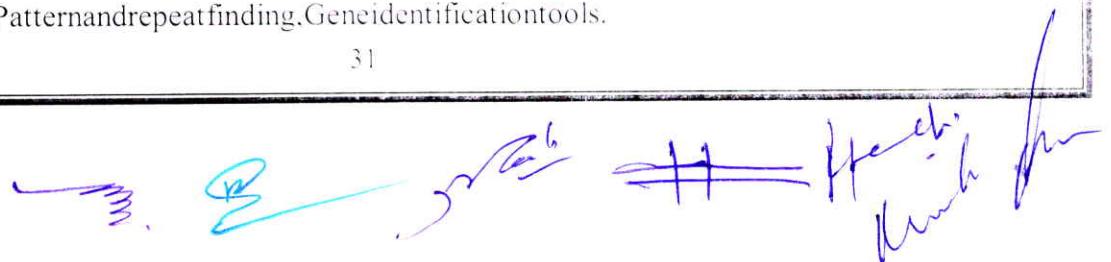
**SECTION-B**

**UNIT III (20 Periods)**

Sequence and Phylogeny analysis, Detecting Open Reading Frames, Outline of sequence Assembly, Mutation/Substitution Matrices, Pairwise Alignments, Introduction to BLAST, using it on the web, Interpreting results, Multiple Sequence Alignment, Phylogenetic Analysis.

**UNIT IV (10 Periods)**

Searching Databases: SRS, Entrez, Sequence Similarity Searches- BLAST, FASTA, Data Submission.  
Genome Annotation: Pattern and repeat finding, Gene identification tools.



### SUGGESTED READINGS

1. Ghosh Z. and Bibek and M. (2008) Bioinformatics: Principles and Applications. Oxford University Press.
2. Pevsner J. (2009) Bioinformatics and Functional Genomics. II Edition. Wiley-Blackwell.
3. Campbell A.M., Heyer L.J. (2006) Discovering Genomics, Proteomics and Bioinformatics. II Edition. Benjamin Cummings.

## PLANT DIVERSITY II-CODE:BT HB3206T

Time Allowed: 3hrs; MM:74; Pass Percentage:40%

### OBJECTIVES:

- Students will learn about seeds and pollen grains which are the key adaptations for life on land
- Students will learn about general characters of pteridophytes and gymnosperms

### INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and carry 11 marks each. Section C will consist of 15 short answer type questions which will cover the entire syllabus uniformly and will carry 30 marks in all.

### INSTRUCTIONS FOR THE CANDIDATES

1. Candidates are required to attempt two questions each from sections A and B of the question paper and the entire section C.

#### SECTION-A

##### UNIT I: Pteridophytes

(10 Periods)

General characters of pteridophytes, affinities with bryophytes & gymnosperms, classification, economic importance, study of life histories of fossil Pteridophytes-*Rhynia*

##### UNIT II: Pteridophytes Type studies

(20 Periods)

Life histories of *Selaginella*-(Heterospory and seed habit), *Equisetum*, *Pteris*, *Lycopodium*

#### SECTION-B

##### UNIT III: Gymnosperms

(20 Periods)

General characters, classification, geological time scale, theories of fossil formation, types of fossils, fossil gymnosperms- *Williamsonia* & *Glossopteris*, telome and stele concept.

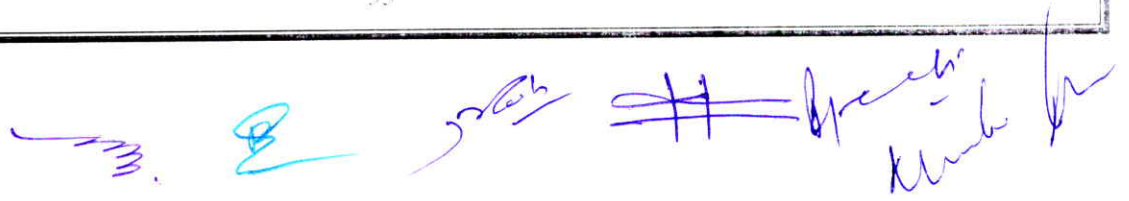
##### UNIT IV: Gymnosperms: Type studies

(10 Periods)

Life histories of *Cycas* & *Pinus*, economic importance of gymnosperms.

### SUGGESTED READINGS

1. Bhatnager, S.P. and Moitra, A. 1996 Gymnosperms. New Age International (P) Ltd. Publishers. New Delhi.
2. Parihar, N.S. 1996. The Biology and Morphology of Pteridophytes. Central Book Depot, Allahabad.
3. Sambamurthy 2008 A Textbook of Bryophytes, Pteridophytes, Gymnosperms and Paleobotany. I.K International Publishers.
4. Wickens, G.E. 2004 Economic Botany: Principles and Practices. Springer. Kluwer Publishers. Dordrecht, The Netherlands



## FOOD BIOTECHNOLOGY-CODE: BTHB3207T

Time Allowed: 3hrs; MM:74;

Pass Percentage:40%

### OBJECTIVES:

- This subject discusses the technological principles and industrial applications of microorganisms and enzymes in food production and processing systems to provide useful products and services.
- This subject will cover basic properties, characteristics of microorganisms and enzymes, their metabolic pathways and how these are harnessed, manipulated and applied to increase productivity in food sector.
- Major fermented food product technologies will also be discussed with specific references to alcoholic beverages, dairy products, organic acid, traditional fermented products.
- The practical component of this subject will include food fermentation and processing concepts to help student's understanding in food technology and related processes.

### INSTRUCTIONS FOR THE PAPER-SETTER

1. The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and carry 11 marks each. Section C will consist of 15 short answer type questions which will cover the entire syllabus uniformly and will carry 30 marks in all.

### INSTRUCTIONS FOR THE CANDIDATES

1. Candidates are required to attempt two questions each from sections A and B of the question paper and the entire section C.

### SECTION-A

#### UNIT I

(12 Periods)

Food and Microorganisms: Composition of food, food as substrates for microbes (intrinsic and extrinsic factors), factors affecting growth of microorganisms, SCP mushroom, food yeast's, algal proteins, applications of enzymes in food processing.

#### UNIT II

(12 Periods)

Principles of food preservation: Physical, chemical, and biological methods of preservations. Contamination, preservation and spoilage of different kinds of foods. Fermented foods: Bread, cocoa, coffee, tea, cheese, yoghurt, meat and alcoholic beverages.

### SECTION-B

#### UNIT III

(10 Periods)

Food adulterants and food additives: Major food adulterants, types and their methods of assay, food additives their function and uses, flavoring agents, coloring agents and vitamins as food additives. Probiotics, biofortified foods, fortified foods, functional foods, nutraceuticals, organic foods. Biotechnology and future foods (Golden rice, potato).



**UNIT IV**

**(15 Periods)**

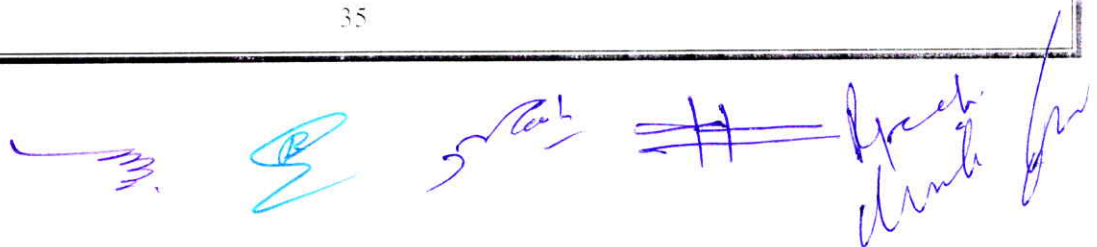
Food and water borne diseases: Shigellosis, salmonellosis, cholera. Food borne intoxications: Staphylococcal, Bacillus and Clostridium.

Detection of microorganisms in food: Qualitative methods to isolate pathogenic microorganisms, test for bacterial toxins in foods:

Quantitative methods for microbial enumeration: Direct enumeration, indirect estimations and standard and recommended methods: Rapid methods and automation: Immunoassays, nucleic acid probe for detection of pathogens.

**SUGGESTED READINGSS**

1. Frazier W.C., Westhoff, D.C. (Ed). (1988). Food microbiology (McGraw Hill).
2. Admas, M.R., Moss, M.O (2005). Food microbiology (Edition 3, Illustrated Publisher Royal Society of Chemistry).
3. Sri Lakshmi B. (2003) Food science (New Age International Publishers, India).
4. Jay J.M., M.J. Loessner, D.A. Golden. (2005). Modern food microbiology (Edition 7, Illustrated Publisher Springer).
5. B. Sivasankar (2004). Food processing and preservation (PHI Private Ltd, New Delhi).
6. Michael P. Doyle (1989). Foodborne bacterial pathogens (Edition illustrated, Publisher Marcel Dekker)
7. Cappuccino J.G., Sherman N. (2007). Microbiology: A laboratory manual (Pearson Benjamin Cummings).

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## CHEMISTRY-6-CODE:BT HB3208T

Time Allowed: 3hrs; MM:74; Pass Percentage:40%

### OBJECTIVES:

- Students will acquire an ability to communicate using the language of chemistry.
- Students will develop an appreciation of chemistry and its application in daily life.
- Students will develop an awareness of the social, economic, environmental and technological implication of chemistry.

### INSTRUCTIONS FOR THE PAPER-SETTER

The question paper will consist of three sections A, B and C. Section A and B will have four questions from the respective sections of the syllabus and carry 11 mark each. Section C will consist of 15 short answer type questions which will cover the entire syllabus uniformly and will carry 30 marks in all.

### INSTRUCTIONS FOR THE CANDIDATES

1. Candidates are required to attempt two questions each from sections A and B of the question paper and the entire section C.

## SECTION-A

### UNIT I

(15 Periods)

**Bioinorganic Chemistry**-Essential and trace elements in biological processes, metalloporphyrins with special reference to haemoglobin and myoglobin. Biological role of alkali and alkaline earth metal ions with special reference to  $\text{Ca}^{+2}$ , Nitrogen fixation.

**Carbohydrates** Classification and nomenclature, Monosaccharides, interconversion of glucose and fructose, chain lengthening and chain shortening of aldoses. Configuration of monosaccharides. Erythro and threo diastereomers. Conversion of glucose into mannose. Formation of glycosides, ethers, and esters. Determination of ring size of monosaccharides. Cyclic structure of D (+)-glucose. Mechanism of mutarotation. Structures of ribose and deoxyribose. An introduction to disaccharides (maltose, sucrose and lactose) and polysaccharides starch and cellulose.

### UNIT II

(15 Periods)

#### **Amino Acids, Peptides, Proteins and Nucleic Acids**

Classification, structure and stereochemistry of amino acids. Acid base behaviour, isoelectric point and electrophoresis. Preparation and reactions of  $\alpha$ -amino acids.

**Structure and nomenclature of peptides and proteins.** Classification of proteins. Peptide structure determination, end group analysis, selective hydrolysis of peptides. Classical levels of protein structure. Protein denaturation/renaturation.

**Nucleic acids:** Introduction. Constituents of nucleic acids Ribonucleosides and ribonucleotides. The double helical structure of DNA.

## SECTION-B

### UNIT III

(18 Periods)

**Solid State** Definition of space lattice and unit cell.



· Lawsofcrystallography, X-raydiffractionbycrystals. DerivationofBragg'sequation. DeterminationofcrystalstructureofNaCl, KCl and CsCl.

**Heterocyclic Compounds** Introduction: Molecular orbital picture and aromatic characteristics ofpyrrole, furan, thiopheneandpyridine. Introductiontocondensedfiveandsixmemberedheterocycles. Preparationof indole, quinoline and isoquinoline .

#### UNITIV

(15Periods)

**Photochemistry** Interactionofradiationwithmatter, differencebetweenthermalandphotochemicalprocess. Lawsofphotochemistry: Grothus-Drapperlaw, Stark-Einsteinlaw, Jablonski diagram depicting various processes occurring in the excited state, qualitative descriptionoffluorescence, non-radiativeprocesses(internalconversion, intersystemcrossing), quantumyield, photosensitized reactions- energy transfer processes (simple examples). Photochemistry ofvisionand colour.

#### SUGGESTEDREADINGSS

1. BasicInorganicChemistry, F.A. Cotton, GWilldsonandP.L. Gaus, Wiley.
2. Concise Inorganic Chemistry, J.D. Lee, ELBS.
3. Conceptof modelsofInorganic Chemistry, B. Douglas, D. McDaniel, and J. Alexander, JolinWiley.
4. InorganicChemistry, D.E. Shriver, P.W. AtkinsandC.H. Langford, Oxford.
5. InorganicChemistry, W.W. Porterfield Addison-Welsey.
6. InorganicChemistry, A.G Sharpe, ELB
7. InorganicChemistry, G.L. MiesslerandD.A. Tarr, PrenticeHall.
8. Inorganic Chemistry, Morrison and Boyd, Prentice-Hall.
9. InorganicChemistry, L.GWadeJr. Prentice-Hall.
11. Fundamentalsof OrganicChemistry, Solomons, JohnWiley.
12. OrganicChemistry, Vol.I, II&III, S.M. Mukherji, S.P. SinghandR.P. Kapoor, WileyEasternLtd. (New AgeInternational).
13. OrganicChemistry, F.A Carey, McGraw-Hill. Inc.
14. IntroductiontoOrganicChemistry, Streitwieser, HeathcockandKosoverandKosover, Macmillan.
15. PhysicalChemistry, G.M. Barrow, InternationalStudentedition, McGrawHill.
16. UniversityGeneral Chemistry, C.N.R. Rao, Macmillan.
17. Physical Chemistry, R.AAlberty, Wiley Eastern Ltd.
18. TheElementsofPhysicalChemistry, P.W. Atkins, Oxford.

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## PRACTICALS

### PRACTICAL BTHB3201L PERTAINING TO THEORY BTHB3201L

1. Native gel electrophoresis of proteins
2. SDS-polyacrylamide slab gel electrophoresis of proteins under reducing conditions.
3. Preparation of the sub-cellular fractions of rat liver cells.
4. Preparation of protoplasts from leaves.
5. Separation of amino acids by paper chromatography.
6. To identify lipids in a given sample by TLC.
7. To verify the validity of Beer's law and determine the molar extinction coefficient of NADH.

### PRACTICAL BTHB3202L PERTAINING TO THEORY BTHB3202L

1. Use of SNP databases at NCBI and other sites
2. Use of OMIM database
3. Detection of Open Reading Frames using ORF Finder
4. Proteomics 2D PAGE database
5. Software for Protein localization.
6. Hydropathy plots
7. Native PAGE
8. SDS-PAGE

### PRACTICAL BTHB3203L PERTAINING TO THEORY BTHB3203T-MEDICAL MICROBIOLOGY

1. Identification of pathogenic bacteria (any two) based on cultural, morphological and biochemical characteristics.
2. Grow the curve of a bacterium.
3. To perform antibiotic testing by Kirby-Bauer method.
4. To prepare temporary mounts of *Aspergillus* and *Candida* by appropriate staining.
5. Staining methods: Gram's staining, permanent slides showing Acid fast staining, Capsule staining and spore staining.

### PRACTICAL BTHB3203L PERTAINING TO THEORY BTHB3204T -ANIMAL DIVERSITY II

1. Identification & Classification up to order of the following: Proto-chordata: *Salpa*, *Doliolum*, *Herdmania*, *Branchiostoma*  
Cyclostomata: *Myxine*, *Petromyzon*  
Chondrichthyes: *Scoliodon*, *Zygonea*, *Pristis*, *Trygon*, *Raja*, *Chimaera*  
Osteichthyes: *Labeo*, *Mystus*, *Catla*, *Hippocampus*, *Anabas*, *Echeneis*, *Lophius*, *Polypeterus*  
Amphibia: *Rana*, *Hyla*, *Amblystoma*, *Necturus*, *Proteus*.  
Reptiles: *Hemidactylus*, *Calotes*, *Draco*, *Phrynosoma*, *Naja*, *Vipera*.



Bungarus Aves: *Columba, Alcedo, Passer*

Mammalia: *Ornithorhynchus, Macropus, Didelphes, Dasyypus*

2. An Ecological Note on any one of the specimens in Experiment I
3. Identification of the following slides  
Mammalian Histology: Liver, Lung, Intestine, Kidney, Ovary, Testes  
Slides of *Salpa, Doliolum*, Spicules of *Herdmania*, Tadpole of Frog
4. Preparation of a permanent mount of *Salpa*, Placoid scales, spicules of *Herdmania*, Pharynx of *Amphioxus*, Tadpole Larva of frog
5. Identification of endoskeletons of frog and rabbit.

**PRACTICAL BTHB3204L  
PERTAINING TO THEORY BTHB3205T-BIOINFORMATICS**

1. Sequence information resource
2. Understanding and use of various web resources: EMBL, Genbank, Entrez, Unigene, Protein information resource (PIR)
3. Understanding and using: PDB, Swissprot, TREMBL
4. Using various BLAST and interpretation of results.
5. Retrieval of information from nucleotide databases.
6. Sequence alignment using BLAST.
7. Multiple sequence alignment using ClustalW.

**PRACTICAL BTHB3204L  
PERTAINING TO THEORY BTHB3206T- PLANT DIVERSITY-II**

1. Examination of morphology and anatomy of vegetative and reproductive parts of *Selaginella*, *Equisetum* & *Pteris*.
2. Examination of morphology and anatomy of vegetative & reproductive parts of *Cycas* & *Pinus*
3. Plant collection (pteridophytes & gymnosperms)

**PRACTICAL BTHB3205L  
PERTAINING TO THEORY BTHB3207T – FOOD BIOTECHNOLOGY**

1. Isolation and identification of microorganisms of spoiled (fungi and bacteria).
2. Inhibitory effect of low temperature on microbial growth.
3. Production and estimation of ethanol.
4. Production of vinegar.
5. Estimation of lactose in milk.
6. Methylene blue reductase test (MBRT) for determination of quality of milk.
7. Plating the milk samples for microbial contamination.
8. Demonstration for the identification of mushrooms by spore prints.
9. Checking the effect of pasteurization of milk by alkaline phosphatase.

**PRACTICAL BTHB3205L**  
**PERTAINING TO THEORY BTHB3208T CHEMISTRY-6**

1. Column Chromatography
2. Separation of leaf pigments from spinach leaves.
3. Physical Experiments
  - (a) To determine the strength of the given acid conductometrically using standard alkali solution.
  - (b) To determine the solubility and solubility product of a given sparingly soluble electrolyte conductometrically.
  - (c) To study the saponification of ethyl acetate conductometrically.
  - (d) To determine the ionisation constant of a weak acid conductometrically.
  - (e) To determine the strength of the given acid solution pH-metrically by using standard alkali solution.
  - (f) To determine the molar refraction of methanol, ethanol and propanol.
  - (g) To study the distribution of benzoic acid between benzene and water, and ether and water.
- (h) Knowledge of Stereochemical Study of Organic Compounds. R and S configuration of optical isomers. E and Z configuration of geometrical isomers. Conformational analysis of cyclohexanes and substituted cyclohexanes.

ਬੀ.ਐੱਸ.ਸੀ ਬਾਇਓਟੈਕ ਆਨਰਜ਼ ਦੇ ਵਿਦਿਆਰਥੀਆਂ ਲਈ, ਪੇਪਰ: ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ, ਭਾਗ-ਪਹਿਲਾ, ਸਮੈਸਟਰ 1 ਅਤੇ 2

For B.Sc. Biotechnology (Hons.) students. Paper: Punjabi Compulsory, Part-1, (Semester 1&2)

ਸੈਸ਼ਨ:2023-24,2024-25,2025-26

### ਸਮੈਸਟਰ ਪਹਿਲਾ

ਕੁਲ ਅੰਕ : 100

ਅੰਦਰੂਨੀ ਮੁਲਾਂਕਣ : 30 ਅੰਕ

ਬਾਹਰੀ ਪਰੀਖਿਆ: 70 ਅੰਕ

ਸਮਾਂ : 3 ਘੰਟੇ

ਵਿਸ਼ੇ ਵਿੱਚੋਂ ਪਾਸ ਹੋਣ ਲਈ ਅੰਕ : 35

ਅਧਿਆਪਨ: 06 ਪੀਰੀਅਡ ਪ੍ਰਤੀ ਹਫ਼ਤਾ

ਕੁੱਲ 04 ਕ੍ਰੈਡਿਟ

#### ਸਿਲੇਬਸ ਤੇ ਪਾਠ ਪੁਸਤਕਾਂ:

ਭਾਗ-ਉ: ਕਥਾ ਰੰਗ (ਸੰਪਾ. ਵਰਿਆਮ ਸਿੰਘ ਸੰਧੂ ਅਤੇ ਡਾ. ਬਲਦੇਵ ਸਿੰਘ ਚੀਮਾ)

12+12=24 ਅੰਕ

ਭਾਗ-ਅ: (1) ਨਿਬੰਧ-ਰਚਨਾ : ਵਿਗਿਆਨ, ਤਕਨਾਲੋਜੀ, ਮਾਤ ਭਾਸ਼ਾ ਅਤੇ ਵਿਗਿਆਨ, ਸਮਕਾਲੀ ਵਿੱਦਿਆ-ਪ੍ਰਬੰਧ, ਮਾਤ ਭਾਸ਼ਾ ਤੇ ਗਿਆਨ ਪ੍ਰਸਾਰ, ਮਾਤ ਭਾਸ਼ਾ ਵਿਚ ਵਿਗਿਆਨ ਦੀ ਪੜ੍ਹਾਈ, ਮਾਤ ਭਾਸ਼ਾ ਤੇ ਵਿਗਿਆਨ ਦਾ ਅਧਿਆਪਨ ਅਤੇ ਵਾਤਾਵਰਣ ਆਦਿ ਵਿਸ਼ਿਆਂ ਨਾਲ ਸਬੰਧਿਤ ਨਿਬੰਧ ਰਚਨਾ।

12 ਅੰਕ

ਅ(2) ਗਿਆਨ-ਵਿਗਿਆਨ ਤੇ ਪੰਜਾਬੀ ਭਾਸ਼ਾ:

(i) ਗਿਆਨ-ਵਿਗਿਆਨ ਅਤੇ ਭਾਸ਼ਾ: ਪੰਜਾਬੀ ਵਿਚ ਵਿਗਿਆਨ ਦੀ ਪੜ੍ਹਾਈ, ਅਧਿਐਨ ਅਤੇ ਖੋਜ ਦੀਆਂ ਸਮੱਸਿਆਵਾਂ, ਵਿਗਿਆਨਕ ਤੇ ਤਕਨੀਕੀ ਸ਼ਬਦਾਵਲੀ ਦਾ ਹੋਰ ਭਾਸ਼ਾਵਾਂ ਵਿਚੋਂ ਸ਼ਬਦ-ਉਧਾਰ ਅਤੇ ਸ਼ਬਦਜੋੜ ਅਤੇ ਉਚਾਰਣ-ਨਿਰਧਾਰਣ ਦੇ ਮਸਲੇ। ਪਾਠਕ੍ਰਮ ਵਿੱਚ ਦਰਜ ਤਕਨੀਕੀ/ਸੰਕਲਪਵਾਚੀ ਸ਼ਬਦਾਵਲੀ ਦਾ ਆਲੋਚਨਾਤਮਕ ਅਧਿਐਨ

06 ਅੰਕ

(ii) ਕੁਦਰਤੀ ਵਿਗਿਆਨਾਂ ਨਾਲ ਸੰਬੰਧਿਤ ਤਕਨੀਕੀ ਸ਼ਬਦਾਵਲੀ (ਲਗਭਗ 100 ਸ਼ਬਦ): ਅਨੁਵਾਦ ਅਤੇ ਵਾਕਾਂ ਵਿਚ ਵਰਤੋਂ।

06 ਅੰਕ

ਭਾਗ-ੲ: ਭਾਗ-ਉ ਦੀ ਪੁਸਤਕ ਕਥਾ ਰੰਗ ਅਤੇ ਭਾਗ-ਅ (2) ਵਿਚੋਂ ਸੰਖੇਪ ਉੱਤਰਾਂ ਵਾਲੇ 11 ਪ੍ਰਸ਼ਨ।

11x2=22 ਅੰਕ

#### ਅੰਕ-ਵੰਡ ਅਤੇ ਪੇਪਰ ਸੈਂਟਰ ਲਈ ਹਦਾਇਤਾਂ:

1. ਪਾਠਕ੍ਰਮ ਦੇ ਦੋ ਭਾਗ ਉ ਅਤੇ ਅ ਹੋਣਗੇ ਪਰੰਤੂ ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਤਿੰਨ ਭਾਗਾਂ ਉ ਅ ਅਤੇ ਲ ਵਿੱਚ ਵੰਡਿਆ ਜਾਵੇਗਾ।

2. ਭਾਗ ਉ ਵਿੱਚੋਂ (i) ਕਿਸੇ ਕਹਾਣੀ ਦਾ ਵਿਸ਼ਾ-ਵਸਤੂ/ਸਾਰ ਅਤੇ ਕਹਾਣੀ ਬਾਰੇ ਪਾਠਕ ਦੇ ਪ੍ਰਭਾਵ (ਤਿੰਨ ਵਿੱਚੋਂ ਇੱਕ)

12 ਅੰਕ

(ii) ਪਾਤਰਾਂ ਸੰਬੰਧੀ ਜਾਣਕਾਰੀ (ਚਾਰ ਵਿੱਚੋਂ ਦੋ)

2 x 6 = 12 ਅੰਕ

4. ਭਾਗ ਅ-(1) ਦਰਸਾਏ ਗਏ ਵਿਸ਼ਿਆਂ ਵਿੱਚੋਂ ਕਿਸੇ ਇੱਕ 'ਤੇ ਨਿਬੰਧ ਲਿਖਣ ਲਈ ਕਿਹਾ ਜਾਵੇਗਾ। (ਤਿੰਨ ਵਿੱਚੋਂ ਇੱਕ)

12 ਅੰਕ

ਅ-(2) ਗਿਆਨ-ਵਿਗਿਆਨ ਅਤੇ ਮਾਤ-ਭਾਸ਼ਾ ਵਾਲੇ ਭਾਗ (i) ਵਿੱਚੋਂ ਦੋ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ ਅਤੇ ਵਿਦਿਆਰਥੀ ਦੋਵਾਂ ਵਿੱਚੋਂ ਇੱਕ ਪ੍ਰਸ਼ਨ ਦਾ ਉੱਤਰ ਲਿਖੇਗਾ।

06 ਅੰਕ

ਅ- (2) ਦੇ ਤਕਨੀਕੀ ਸ਼ਬਦਾਵਲੀ ਵਾਲੇ ਉਪਭਾਗ (ii) ਵਿੱਚੋਂ ਵਿਗਿਆਨਕ ਸ਼ਬਦਾਵਲੀ ਵਿਚੋਂ ਅੰਗਰੇਜ਼ੀ ਦੇ 10 ਸ਼ਬਦ ਦਿੱਤੇ ਜਾਣਗੇ।

ਇਨ੍ਹਾਂ ਵਿਚੋਂ ਵਿਦਿਆਰਥੀ 06 ਸ਼ਬਦਾਂ ਦਾ ਪੰਜਾਬੀ ਅਨੁਵਾਦ ਦੇਵੇਗਾ ਅਤੇ ਉਨ੍ਹਾਂ ਨੂੰ ਵਾਕਾਂ ਵਿਚ ਵਰਤੇਗਾ।

06 ਅੰਕ

5. ਭਾਗ-ੲ: ਪਾਠਕ੍ਰਮ ਦੇ ਭਾਗ ਉ: ਕਥਾ ਰੰਗ ਅਤੇ ਭਾਗ ਅ (2) ਵਿੱਚੋਂ ਸੰਖੇਪ ਉੱਤਰਾਂ ਵਾਲੇ 11 (ਭਾਗ ਉ ਵਿੱਚੋਂ 07 ਅਤੇ ਭਾਗ ਅ-2

ਵਿੱਚੋਂ 4 ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ। ਤਕਨੀਕੀ ਸ਼ਬਦਾਵਲੀ ਵਾਲੇ ਭਾਗ ਵਿਚ ਪਾਠਕ੍ਰਮ ਵਿਚ ਦਰਜ ਅੰਗਰੇਜ਼ੀ ਸ਼ਬਦਾਂ ਦੇ ਪੰਜਾਬੀ ਅਨੁਵਾਦ ਦੀ

ਉਚਿੱਤਤਾ, ਉਨ੍ਹਾਂ ਦੇ ਸੰਭਵ ਬਦਲ, ਸ਼ਬਦਜੋੜਾਂ ਬਾਰੇ ਸਵਾਲ ਪੁੱਛੇ ਜਾ ਸਕਦੇ ਹਨ। ਵਿਦਿਆਰਥੀ ਨੇ ਸਾਰੇ ਪ੍ਰਸ਼ਨਾਂ ਦੇ ਸੰਖੇਪ ਉੱਤਰ ਦੇਣੇ

ਹੋਣਗੇ। ਹਰ ਪ੍ਰਸ਼ਨ ਦੇ 2 ਅੰਕ ਹੋਣਗੇ।

11x2=22 ਅੰਕ

ਬੀ.ਐੱਸ.ਸੀ ਬਾਇਓਟੈਕ ਆਨਰਜ਼ ਦੇ ਵਿਦਿਆਰਥੀਆਂ ਲਈ, ਪੇਪਰ: ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ, ਭਾਗ-ਪਹਿਲਾ, ਸਮੇਸਟਰ 1 ਅਤੇ 2

For B.Sc. Biotechnology (Hons.) students. Paper: Punjabi Compulsory, Part-1, (Semester 1&2)

ਸੈਸ਼ਨ:2023-24,2024-25,2025-26

### ਸਹਾਇਕ ਪਾਠ ਸਮੱਗਰੀ

ਵਿਗਿਆਨਕ ਸ਼ਬਦਾਵਲੀ ਕੋਸ਼, ਭਾਸ਼ਾ ਵਿਭਾਗ, ਪੰਜਾਬ, ਪਟਿਆਲਾ

ਵਿਗਿਆਨ ਨਾਲ ਸੰਬੰਧਿਤ ਤਕਨੀਕੀ/ਸੰਕਲਪੀ ਸ਼ਬਦਾਵਲੀ

1. Abnormal behavior of oxygen: ਅੱਕਸੀਜਨ ਦਾ ਅਸਾਧਾਰਣ ਵਿਵਹਾਰ
2. Absorption: ਸੋਖਣ
3. Actinoid contraction: ਐਕਟੀਨਾਇਡ ਸੁੰਗੜਨ
4. Activation energy: ਉਤੇਜਨ ਊਰਜਾ
5. Adventitious roots: ਰੇਸ਼ੇਦਾਰ ਜੜ੍ਹਾਂ
6. Alkynes: ਐਲਕਾਈਨ. ਖਾਰ
7. Alpha particles: ਐਲਫਾ ਕਣ
8. Amorphous solids: ਅਕ੍ਰਿਸਟਲੀ ਠੋਸ
9. Anther: ਪਦਾਰਕੋਸ਼
10. Antibiotics: ਜੀਵਾਣੂ
11. Antielectron: ਪ੍ਰਤਿ ਇਲੈਕਟ੍ਰਾਨ
12. Apomixes: ਅਸੰਗਪ੍ਰਜਣਨ
13. Applied Physics: ਅਨੁਪ੍ਰਯੁਕਤ ਭੌਤਿਕੀ, ਵਿਚਾਰਕ ਭੌਤਿਕੀ
14. Archesporium: ਆਰਕੀਸਪੋਰੀਅਮ
15. Asexual reproduction: ਅਲਿੰਗੀ ਪ੍ਰਜਣਨ
16. Astronomical scale: ਖਗੋਲੀ ਪੱਧਰ
17. Atomic: ਪ੍ਰਮਾਣਵੀ
18. Autogamy: ਸਵੈਪਰਾਗਣ
19. Automation: ਸਵੈਚਾਲਨ
20. Average rate: ਔਸਤ ਵੇਗ
21. Binary solution: ਦੋ ਅੰਗੀ ਘੋਲ
22. Catalyst/Catalysis: ਉਤਪ੍ਰੇਰ/ਉਤਪ੍ਰੇਰਣ
23. Cell differentiation: ਸੈੱਲ ਵਿਭੇਦਨ
24. Cell division: ਸੈੱਲ ਵਿਭਾਜਨ
25. Cervix: ਗਰਭ ਮਾਰਗ
26. Chemical kinetics: ਰਸਾਇਣਕ ਬਲਗਤਿਕ
27. Circular orbits: ਚੱਕਰਾਕਾਰ ਆਰਬਿਟ
28. Classical Physics: ਕਲਾਸੀਕੀ ਭੌਤਿਕੀ
29. Coleorhiza: ਜੜ੍ਹ ਅੰਕੁਰ ਕਵਚ
30. Concentration of solutions: ਘੋਲਾਂ ਦੀ ਸੰਘਣਤਾ
31. Coordination compounds: ਉਪਸਹਿਸੰਯੋਜਨ ਯੋਗਿਕ
32. Coordination isomerism: ਉਪਸਹਿਸੰਯੋਜਨ ਸਮਅੰਗਕਤਾ
33. Coordination polyhedron: ਉਪਸਹਿਸੰਯੋਜਨ ਬਹੁਫਲਕ
34. Coordination theory: ਉਪਸਹਿਸੰਯੋਜਨ ਯੋਗਿਕਾਂ ਦਾ ਸਿਧਾਂਤ
35. Cyclic structure: ਚੱਕਰੀ ਸੰਰਚਨਾ
36. Depressants: ਅਵਮਨਕ
37. Dialysis: ਡਿਲੀ ਨਿਖੇੜਨ
38. Dioecious: ਬਿਖਮ ਲਿੰਗੀ
39. Distillation: ਕਸ਼ੀਦਣ
40. Double fertilization: ਦੋਹਰਾ ਨਿਸ਼ੇਚਨ
41. Electric circuit: ਬਿਜਲਈ ਸਰਕਟ
42. Electro Chemistry: ਬਿਜਲੀ ਰਸਾਇਣ

ਬੀ.ਐੱਸ.ਸੀ ਬਾਇਓਟੈਕ ਆਨਰਜ਼ ਦੇ ਵਿਦਿਆਰਥੀਆਂ ਲਈ, ਪੇਪਰ: ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ, ਭਾਗ-ਪਹਿਲਾ, ਸਮੈਸਟਰ 1 ਅਤੇ 2

For B.Sc. Biotechnology (Hons.) students, Paper: Punjabi Compulsory, Part-1, (Semester 1&2)

ਸੈਸ਼ਨ:2023-24,2024-25,2025-26

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| 43. Electrodynamics: ਇਲੈਕਟ੍ਰੋਡਾਇਨਾਮਿਕਸ                 | 70. Glans penis: ਸਿਸ਼ਨ ਮੁੰਡ                            |
| 44. Electromagnetic radiations: ਬਿਜਲ<br>ਚੁੰਬਕੀ ਵਿਕਿਰਨਾ | 71. Gravitation: ਗੁਰੂਤਾਕਰਸ਼ਨ                           |
| 45. Electromagnetism: ਬਿਜਲ ਚੁੰਬਕਤਾ                     | 72. Half-life: ਅਰਧ ਆਯੂ                                 |
| 46. Elements: ਤੱਤ                                      | 73. Haploid: ਗੁਣਸੂਤਰੀ ਸੈੱਲ                             |
| 47. Elliptical orbits: ਅੰਡਾਕਾਰ ਆਰਬਿਟ                   | 74. Heat engine: ਤਾਪ ਇੰਜਣ                              |
| 48. Embryo sac: ਭਰੂਣ ਕੋਸ਼                              | 75. Heliocentric Theory: ਸੂਰਜ ਕੇਂਦਰੀ<br>ਸਿਧਾਂਤ         |
| 49. Embryogenesis: ਭਰੂਣ ਨਿਰਮਾਣ                         | 76. Homogamete or isogamete:<br>ਸਮਯੁਗਮਕੀ               |
| 50. Embryonic development: ਭਰੂਣ ਵਿਕਾਸ                  | 77. Hydrogen Bond: ਹਾਈਡ੍ਰੋਜਨ ਬੰਧੇਜ                     |
| 51. Endosperm: ਭਰੂਣਪੇਸ਼                                | 78. Hymen: ਯੋਨੀ ਪਰਦਾ                                   |
| 52. Entropy: ਐਨਟਰਾਪੀ                                   | 79. Hyperacidity: ਅਤੀਤੇਜਾਬੀਪਨ                          |
| 53. Enzyme catalyst: ਐਨਜ਼ਾਈਮ ਉਤਪ੍ਰੇਰਕ                  | 80. Ideal solutions: ਆਦਰਸ਼ ਘੋਲ                         |
| 54. Epicotyl: ਬੀਜ ਪੱਤਰ ਪਰਤ                             | 81. Implantation: ਅੰਤਰ ਰੋਪਣ                            |
| 55. Exothermic: ਤਾਪ ਨਿਕਾਸੀ                             | 82. Impurity defects: ਅਸੁੱਧਤਾ ਦੇਸ਼                     |
| 56. External fertilization: ਬਾਹਰੀ ਨਿਸ਼ੇਚਨ              | 83. Inner transition elements: ਅੰਦਰੂਨੀ<br>ਅੰਤਰਕਾਲੀ ਤੱਤ |
| 57. External genitalia: ਬਾਹਰੀ ਜਣਨ ਅੰਗ                  | 84. Insemination: ਵੀਰਜ ਸੰਚਾਰ                           |
| 58. Fallopian tubes: ਅੰਡਵਹਿਣੀਆਂ                        | 85. Instability constant: ਅਸਥਿਰਤਾ ਸਥਾਈ<br>ਅੰਕ          |
| 59. Ferromagnetism: ਧਾਤ ਚੁੰਬਕਤਾ                        | 86. Interaction: ਅੰਤਰਕਿਰਿਆ                             |
| 60. Fertilization: ਨਿਸ਼ੇਚਨ                             | 87. Intermolecular forces: ਅੰਤਰ ਅਣਵੀ ਬਲ                |
| 61. Filament: ਫਿਲਾਮੈਂਟ                                 | 88. Intermolecular: ਅੰਤਰਅਣਵੀ                           |
| 62. Fission: ਵਿਖੰਡਨ                                    | 89. Internal energy: ਅੰਤਰਿਕ ਊਰਜਾ                       |
| 63. Force: ਬਲ  | 90. Internal fertilization: ਅੰਦਰੂਨੀ ਨਿਸ਼ੇਚਨ            |
| 64. Fossil fuel: ਪਥਰਾਟ ਬਾਲਣ                            | 91. Interstitial compounds: ਅੰਤਰ ਵਿੱਥੀ<br>ਯੋਗਿਕ        |
| 65. Galaxy: ਆਕਾਸ਼ ਗੰਗਾ                                 | 92. Ionic conductance: ਆਇਨਨ ਚਾਲਕਤਾ                     |
| 66. Gamete transfer: ਯੁਗਮਕ ਸਥਾਨਾਂਤਨਣ                   |  |
| 67. Gametes: ਯੁਗਮਕ                                     |  |
| 68. Gametogenesis: ਯੁਗਮਕ ਬਣਨਾ                          |  |
| 69. Geitonogamy: ਸਜਾਤੀ ਪਰਾਗਣ                           |  |

ਬੀ.ਐੱਸ.ਸੀ ਬਾਇਓਟੈਕ ਆਨਰਜ਼ ਦੇ ਵਿਦਿਆਰਥੀਆਂ ਲਈ, ਪੇਪਰ: ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ, ਭਾਗ-ਪਹਿਲਾ, ਸਮੇਸਟਰ 1 ਅਤੇ 2

For B.Sc. Biotechnology (Hons.) students, Paper: Punjabi Compulsory, Part-1, (Semester 1&2)

ਸੈਸ਼ਨ:2023-24,2024-25,2025-26

93. Ionic isomerism: ਆਇਨਨ ਸਮਅੰਗਕਤਾ  
94. Ionization enthalpy: ਆਇਨਨ ਐਨਥੈਲਪੀ  
95. Ionosphere: ਆਈਨੋਸਫੀਅਰ  
96. Isomerism: ਸਮਅੰਗਕਤਾ

97. Kinetic energy: ਗਤਿਜ ਊਰਜਾ  
98. Kinetic theory: ਅਣੂਗਤੀ ਸਿਧਾਂਤ  
99. Kingdom fungi: ਉੱਲੀ ਜਗਤ  
100. Magnitudes: ਪਰਿਮਾਣ

ਬੀ.ਐੱਸ.ਸੀ ਬਾਇਓਟੈਕ ਆਨਰਜ਼ ਦੇ ਵਿਦਿਆਰਥੀਆਂ ਲਈ, ਪੇਪਰ: ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ, ਭਾਗ-ਪਹਿਲਾ, ਸਮੈਸਟਰ 1 ਅਤੇ 2

For B.Sc. Biotechnology (Hons.) students, Paper: Punjabi Compulsory, Part-1, (Semester 1&2)

ਸੈਸ਼ਨ:2023-24,2024-25,2025-26

### ਸਮੈਸਟਰ ਦੂਜਾ

ਕੁਲ ਅੰਕ : 100

ਅੰਦਰੂਨੀ ਮੁਲਾਂਕਣ : 30 ਅੰਕ

ਬਾਹਰੀ ਪਰੀਖਿਆ: 70 ਅੰਕ

ਸਮਾਂ : 3 ਘੰਟੇ

ਸਿਲੇਬਸ ਤੇ ਪਾਠ ਪੁਸਤਕਾਂ:

ਭਾਗ- ਓ: ਵਾਰਤਕ ਵਿਵੇਕ (ਸੰਪਾ. ਡਾ. ਰਾਜਿੰਦਰ ਪਾਲ ਸਿੰਘ ਬਰਾੜ. ਡਾ. ਜਗਤਾਰ ਸਿੰਘ, ਪੰਜਾਬੀ ਯੂਨੀਵਰਸਿਟੀ, ਪਟਿਆਲਾ

12+12= 24 ਅੰਕ

ਭਾਗ ਅ-1 ਪ੍ਰੈਸ ਰਿਪੋਰਟ: ਵਿਗਿਆਨ ਦੇ ਖੇਤਰ ਨਾਲ ਸੰਬੰਧਿਤ ਕਿਸੇ ਆਯੋਜਨ, ਵਿਗਿਆਨ-ਮੇਲੇ, ਇਕੱਤਰਤਾ ਜਾਂ ਸੈਮੀਨਾਰ ਕਾਨਫਰੰਸ ਦੀ ਪ੍ਰੈਸ ਰਿਪੋਰਟ/ ਲਿਖਣ ਦੀ ਸਿਖਲਾਈ 12 ਅੰਕ

ਅ-2 (i) ਵਿਗਿਆਨ ਨਾਲ ਸੰਬੰਧਿਤ ਕਿਸੇ ਅੰਗਰੇਜ਼ੀ ਪੈਰੇ ਦਾ ਪੰਜਾਬੀ ਅਨੁਵਾਦ 06 ਅੰਕ

(ii) ਕੁਦਰਤੀ ਵਿਗਿਆਨਾਂ ਨਾਲ ਸੰਬੰਧਿਤ ਤਕਨੀਕੀ ਸ਼ਬਦਾਵਲੀ (100 ਸ਼ਬਦ): ਅਨੁਵਾਦ ਅਤੇ ਵਾਕਾਂ ਵਿਚ ਵਰਤੋਂ 06 ਅੰਕ

ਭਾਗ-ੲ ਉਪਰੋਕਤ ਸਿਲੇਬਸ ਦੇ ਭਾਗ ਓ ਅਤੇ ਭਾਗ ਅ-2 (ii) 'ਤੇ ਅਧਾਰਤ ਸੰਖੇਪ ਉੱਤਰਾਂ ਵਾਲੇ 11 ਪ੍ਰਸ਼ਨ। 22 ਅੰਕ

ਅੰਕ-ਵੰਡ ਅਤੇ ਪੇਪਰ ਸੈਂਟਰ ਲਈ ਹਦਾਇਤਾਂ:

1. ਪਾਠਕ੍ਰਮ ਦੇ ਦੋ ਭਾਗ ਓ ਅਤੇ ਅ ਹੋਣਗੇ ਪਰੰਤੂ ਪ੍ਰਸ਼ਨ ਪੱਤਰ ਤਿੰਨ ਭਾਗਾਂ ਓ ਅ ਅਤੇ ਲ ਵਿੱਚ ਵੰਡਿਆ ਜਾਵੇਗਾ।

2. ਭਾਗ ਓ ਵਿੱਚੋਂ:

(i) ਕਿਸੇ ਇਕ ਨਿਬੰਧ ਦਾ ਵਿਸ਼ਾ/ਸਾਰ/ ਮੁੱਖ ਵਿਚਾਰਾਂ/ ਪਾਠਕ ਦੇ ਪ੍ਰਭਾਵਾਂ ਬਾਰੇ ਪ੍ਰਸ਼ਨ। (ਤਿੰਨ ਵਿੱਚੋਂ ਇੱਕ) 12 ਅੰਕ

(ii) ਨਿਬੰਧਾਂ ਵਿਚਲੇ ਵਿਚਾਰਾਂ ਸਬੰਧੀ ਸੰਖੇਪ ਪ੍ਰਸ਼ਨ। (ਚਾਰ ਵਿੱਚੋਂ ਦੋ) 2x6 =12 ਅੰਕ

4. ਭਾਗ ਅ-1 ਵਿਗਿਆਨ ਦੇ ਖੇਤਰ ਨਾਲ ਸੰਬੰਧਿਤ ਕਿਸੇ ਆਯੋਜਨ, ਵਿਗਿਆਨ-ਮੇਲੇ, ਇਕੱਤਰਤਾ ਜਾਂ ਸੈਮੀਨਾਰ ਆਦਿ ਦੇ ਆਯੋਜਨਾਂ ਵਿੱਚੋਂ ਦੋ ਵਿਸ਼ੇ ਦੇ ਕੇ ਕਿਸੇ ਵਿਸ਼ੇ 'ਤੇ ਪ੍ਰੈਸ ਰਿਪੋਰਟ ਲਿਖਣ ਲਈ ਕਿਹਾ ਜਾਵੇਗਾ। (ਦੋ ਵਿੱਚੋਂ ਇੱਕ) 12 ਅੰਕ

5. ਅ-2 ਦੇ ਉਪਭਾਗ (i) ਵਿੱਚੋਂ ਦੋ ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ ਅਤੇ ਵਿਦਿਆਰਥੀ ਨੇ ਦੋਵਾਂ ਵਿੱਚੋਂ ਇੱਕ ਪ੍ਰਸ਼ਨ ਕਰਨਾ ਹੋਵੇਗਾ। 06 ਅੰਕ

6. ਅ-2 ਦੇ ਉਪਭਾਗ (ii) ਵਿਚ 10 ਅੰਗਰੇਜ਼ੀ ਸ਼ਬਦ ਦੇ ਕੇ 06 ਸ਼ਬਦਾਂ ਦਾ ਪੰਜਾਬੀ ਅਨੁਵਾਦ ਅਤੇ ਵਾਕਾਂ ਵਿਚ ਵਰਤੋਂ ਲਈ ਕਿਹਾ ਜਾਵੇਗਾ। 06 ਅੰਕ

5. ਭਾਗ-ੲ ਵਿਚ ਪਾਠ ਪੁਸਤਕ ਵਾਰਤਕ ਵਿਵੇਕ ਅਤੇ ਤਕਨੀਕੀ ਸ਼ਬਦਾਵਲੀ ਵਾਲੇ ਭਾਗ ਵਿੱਚੋਂ ਸੰਖੇਪ ਉੱਤਰਾਂ ਵਾਲੇ 11 (ਪਾਠ ਪੁਸਤਕ ਵਾਰਤਕ ਵਿਵੇਕ ਵਿੱਚੋਂ 07 ਅਤੇ ਤਕਨੀਕੀ ਸ਼ਬਦਾਵਲੀ ਵਾਲੇ ਭਾਗ ਵਿੱਚੋਂ 04 ਪ੍ਰਸ਼ਨ ਪੁੱਛੇ ਜਾਣਗੇ। ਤਕਨੀਕੀ ਸ਼ਬਦਾਵਲੀ ਵਾਲੇ ਭਾਗ ਵਿਚ ਪਾਠਕ੍ਰਮ ਵਿਚ ਦਰਜ ਅੰਗਰੇਜ਼ੀ ਸ਼ਬਦਾਂ ਦੇ ਪੰਜਾਬੀ ਅਨੁਵਾਦ ਦੀ ਉਚਿੱਤਤਾ, ਉਨ੍ਹਾਂ ਦੇ ਸੰਭਵ ਬਦਲ, ਸ਼ਬਦਜੋੜਾਂ ਬਾਰੇ ਸਵਾਲ ਪੁੱਛੇ ਜਾ ਸਕਦੇ ਹਨ। ਵਿਦਿਆਰਥੀ ਨੇ ਸਾਰੇ ਪ੍ਰਸ਼ਨਾਂ ਦੇ ਸੰਖੇਪ ਉੱਤਰ ਦੇਣੇ ਹੋਣਗੇ। ਹਰੇਕ ਪ੍ਰਸ਼ਨ ਦੇ 2 ਅੰਕ ਹੋਣਗੇ।

11x2=22 ਅੰਕ

ਬੀ.ਐੱਸ.ਸੀ ਬਾਇਓਟੈਕ ਆਨਰਜ਼ ਦੇ ਵਿਦਿਆਰਥੀਆਂ ਲਈ, ਪੇਪਰ: ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ, ਭਾਗ-ਪਹਿਲਾ, ਸਮੇਸਟਰ 1 ਅਤੇ 2

For B.Sc. Biotechnology (Hons.) students, Paper: Punjabi Compulsory, Part-1, (Semester 1&2)

ਸੈਸ਼ਨ:2023-24,2024-25,2025-26

### ਸਹਾਇਕ ਪਾਠ ਸਮੱਗਰੀ

ਵਿਗਿਆਨਕ ਸ਼ਬਦਾਵਲੀ ਕੋਸ਼, ਭਾਸ਼ਾ ਵਿਭਾਗ, ਪੰਜਾਬ, ਪਟਿਆਲਾ

#### ਕੁਦਰਤੀ ਵਿਗਿਆਨਾਂ ਨਾਲ ਸੰਬੰਧਿਤ ਮੁੱਢਲੀ ਸ਼ਬਦਾਵਲੀ

1. Mammary glands: ਦੁੱਧ ਗੁੰਥੀਆਂ
2. Mass: ਪੁੰਜ
3. Maxwell's equations: ਮੈਕਸਵੈੱਲ ਸਮੀਕਰਨ
4. Mechanics: ਮਕੈਨਿਕਸ
5. Mega-sporangium: ਗੁਰੂਬੀਜਾਣੂਕੋਸ਼
6. Menstrual cycle: ਮਾਸਿਕ ਚੱਕਰ
7. Metallic solids: ਧਾਤਵੀ ਠੋਸ
8. Metallurgy: ਧਾਤਕਰਮਕੀ
9. Microscope: ਖੁਰਦਬੀਨ
10. Microscopic and Macroscopic: ਸੂਖਮ ਅਤੇ ਸਥੂਲ
11. Microsporangium: ਲਘੂਬੀਜਾਣੂਕੋਸ਼
12. Minerals: ਖਣਿਜ
13. Mitosis: ਸਮਸੂਤਰੀ ਵਿਭਾਜਨ
14. Molecular Asymmetry: ਅਣਵੀ ਅਸਮਮਿਤਾ
15. Molecular orbit theory: ਅਣਵੀ ਆਰਬਿਟਲ ਸਿਧਾਂਤ
16. Molecular solids: ਅਣਵੀ ਠੋਸ
17. Molecular: ਅਣਵਿਕ
18. Multiple fission: ਬਹੁਖੰਡਨ
19. Natural Sciences: ਕੁਦਰਤੀ ਵਿਗਿਆਨ
20. Newtonian mechanics: ਨਿਊਟਨ ਦਾ ਯੰਤਰਕੀ ਸਿਧਾਂਤ
21. Non polar molecular solids: ਅਪੁਰਵੀ ਅਣਵੀ ਠੋਸ
22. Non-ideal solutions: ਅਣ-ਆਦਰਸ਼ਕ ਘੋਲ
23. Nuclear Model: ਨਾਭਿਕੀ ਮਾਡਲ
24. Octahedra voids: ਅੱਠਫਲਕੀ ਵਿੱਖਾਂ
25. Oestrus cycle: ਮਦ ਚੱਕਰ
26. Optics: ਪ੍ਰਕਾਸ਼ਕੀ
27. Osmotic pressure: ਪਰਾਸਰਣ ਦਾਬ
28. Ostwald process: ਓਸਟਵਾਲਡ ਪ੍ਰਕਿਰਿਆ
29. Outbreeding devices: ਬਾਹਰੀ ਪ੍ਰਜਣਨ ਢੰਗ
30. Ovaries: ਅੰਡਕੋਸ਼
31. Ovary: ਅੰਡਕੋਸ਼
32. Oviparous: ਅੰਡੇ ਦੇਣ ਵਾਲੇ ਜੀਵ
33. Ovulation: ਅੰਡ-ਉਤਸਰਜਨ
34. Ovule: ਅੰਡਾਣੂ
35. Oxidation number: ਔਕਸੀਕਰਣ ਸੰਖਿਆ
36. Oxidation state: ਔਕਸੀਕਰਣ ਅਵਸਥਾ
37. Ozone: ਓਜ਼ੋਨ
38. Para magnetism: ਅਨੁਚੁੰਬਕਤਾ
39. Parthenogenesis: ਨਿਸ਼ੇਚਨ ਰਹਿਤ



ਬੀ.ਐੱਸ.ਸੀ ਬਾਇਓਟੈਕ ਆਨਰਜ਼ ਦੇ ਵਿਦਿਆਰਥੀਆਂ ਲਈ, ਪੇਪਰ: ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ, ਭਾਗ-ਪਹਿਲਾ, ਸਮੈਸਟਰ 1 ਅਤੇ 2

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| 40. Penetrating ray: ਪਰਵੇਸ਼ਕੀ ਕਿਰਨ                           | 64. Scrotum: ਪਤਾਲੂ ਥੈਲੀ                                |
| 41. Photoelectric effect: ਪ੍ਰਕਾਸ਼ ਬਿਜਲ<br>ਪ੍ਰਭਾਵ             | 65. Semiconductors: ਅਰਧਚਾਲਕ                            |
| 42. Photoelectric effect: ਫੋਟੋਇਲੈਕਟ੍ਰਿਕ<br>ਪ੍ਰਭਾਵ            | 66. Seminiferous tubules: ਸੁਕਰਾਣੂਜਣਨ<br>ਨਾਲੀਆਂ         |
| 43. Physical quantities: ਭੌਤਿਕ ਰਾਸ਼ੀਆਂ                       | 67. Semipermeable membrane: ਅਰਧ<br>ਪਾਰਗਮਨ ਝਿੱਲੀ        |
| 44. Physics: ਭੌਤਿਕੀ  | 68. Semisynthetic polymers: ਅਰਧ<br>ਸੰਸਲਿਸ਼ਤ ਬਹੁਲਕ      |
| 45. Pollen grain: ਪਰਾਗਕਣ                                     | 69. Sexual reproduction: ਲਿੰਗੀ ਪ੍ਰਜਣਨ                  |
| 46. Pollen-pistil interaction: ਪਰਾਗ-<br>ਇਸਤਰੀਕੋਸਰ ਅੰਤਰ-ਕਿਰਿਆ | 70. Shape selective catalysts:<br>ਆਕਾਰਚੋਣਾਤਮਕ ਉਤਪ੍ਰੇਰਕ |
| 47. Pollination: ਪਰਾਗਣ                                       | 71. Solid state: ਠੋਸ ਅਵਸਥਾ                             |
| 48. Poly-embryony: ਬਹੁਭਰੂਰਣਤਾ                                | 72. Solubility: ਘੁਲਣਸ਼ੀਲਤਾ                             |
| 49. Positron: ਪਾਜ਼ੀਟਰਾਨ                                      | 73. Sound waves: ਧੁਨੀ ਤਰੰਗਾਂ                           |
| 50. Pre fertilization: ਨਿਸ਼ੇਚਨ ਪੂਰਵ                          | 74. Spermatogenesis: ਸੁਕਰਾਣੂਜਣਨ                        |
| 51. Pregnancy: ਗਰਭ ਧਾਰਨ                                      | 75. Sporulation: ਬੀਜਾਣੂਜਣਨ                             |
| 52. Primary valence: ਪ੍ਰਾਇਮਰੀ ਸੰਯੋਜਕਤਾ                       | 76. Statistical mechanics: ਅੰਕੜਾ ਯੰਤਰਕੀ                |
| 53. Pseudo solutions: ਆਭਾਸੀ ਠੋਸ                              | 77. Stimulated emission: ਉਦੀਪਤ<br>ਉਤਸਰਜਨ               |
| 54. Pyro metallurgy: ਤਾਪ ਧਾਤਕਰਮ                              | 78. Super cooled liquids: ਅਤਿਸੀਤਿਤ ਦ੍ਰਵ                |
| 55. Qualitative: ਗੁਣਤਾਮਕ                                     | 79. Superconductivity: ਅਤੀਚਾਲਕਤਾ                       |
| 56. Quantitative: ਮਾਤਰਾਤਮਕ                                   | 80. Syngamy: ਯੁਗਮਕ ਸੁਮੇਲ                               |
| 57. Quantum Mechanics: ਕੁਆਂਟਮ ਭੌਤਿਕੀ                         | 81. Telescope: ਦੂਰਬੀਨ                                  |
| 58. Reduction: ਨਿਊਨੀਕਰਨ                                      | 82. Temperature: ਤਾਪਮਾਨ                                |
| 59. Reproduction: ਪ੍ਰਜਣਨ                                     | 83. Terrestrial: ਧਰਤ-ਸੰਬੰਧੀ                            |
| 60. Reverse osmosis: ਉਲਟ-ਕ੍ਰਮ ਪਰਾਸਰਣ                         | 84. Testes: ਪਤਾਲੂ                                      |
| 61. Rigid and deformable bodies: ਦ੍ਰਿੜ ਤੇ<br>ਵਿਰੂਪਣਸ਼ੀਲ ਪਿੰਡ | 85. Thalamus: ਪੁਸ਼ਪਆਸਨ ਜਾਂ ਪੁਸ਼ਪਦਲ                     |
| 62. Rocket propulsion: ਰਾਕੇਟ ਨੈਦਨ                            |  |
| 63. Scientific Method: ਵਿਗਿਆਨਕ ਵਿਧੀ                          |  |

ਬੀ.ਐੱਸ.ਸੀ ਬਾਇਓਟੈਕ ਆਨਰਜ਼ ਦੇ ਵਿਦਿਆਰਥੀਆਂ ਲਈ, ਪੇਪਰ: ਪੰਜਾਬੀ ਲਾਜ਼ਮੀ, ਭਾਗ-ਪਹਿਲਾ, ਸਮੈਸਟਰ 1 ਅਤੇ 2

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86. Theory of relativity: ਸਾਪੇਖਕਤਾ ਦਾ ਸਿਧਾਂਤ
87. Thermodynamics: ਥਰਮੋਡਾਇਨਾਮਿਕਸ
88. Transfer of heat: ਤਾਪ ਸਥਾਨਾਂਤਰਨ
89. Ultrafiltration: ਅਤਿਸੂਖਮ ਫਿਲਟਰੀਕਰਨ
90. Unification: ਏਕੀਕਰਨ
91. Unit cell: ਯੂਨਿਟ ਸੈੱਲ
92. Uterus: ਗਰਭਕੋਸ਼
93. Vagina: ਯੋਨੀ
94. Vapor pressure: ਵਾਸ਼ਪ ਦਾਬ
95. Viviparous: ਬੱਚੇ ਦੇਣ ਵਾਲੇ ਜੀਵ
96. Water hyacinth: ਜਲਕੁੰਭੀ
97. White phosphorous: ਸਫੇਦ ਫਾਸਫੋਰਸ
98. Womb: ਬੱਚੇਦਾਨੀ
99. Zoospores: ਅਲਿੰਗੀ ਚਲ ਬਿਜਾਣੂ
100. Zygote: ਗੁਗਮਜ