



# Shri Vaishnav Vidyapeeth Vishwavidyalaya, Indore

## Shri Vaishnav Institute of Science Department of Life Science B.Sc. (Major - Biotechnology)

### SEMESTER IV

COURSE CODE	Category	COURSE NAME	TEACHING & EVALUATION SCHEME								
			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
<b>BSCBT401</b>	<b>Major</b>	<b>Genetics and Molecular Biology</b>	60	20	20	30	20	4	-	4	6

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;

**\*Teacher Assessment shall be based following components: Quiz / Assignment / Project / Participation in Class, given that no component shall exceed more than 10 marks.**

### Course Objectives:

1. Knowledge of basics in genetics and classical genetics covering prokaryotic / phage genetics to yeast and higher eukaryotic domains.
2. Concepts of Mendelian genetics, population genetics, quantitative genetics encompassing complex traits, clinical genetics and genetics of evolution.
3. Study of Genome Organization and its dynamics
4. Study of DNA replication, damage and repair
5. Study of transcription and translation


### Course Outcomes:


1. Understanding of fundamental molecular principles of genetics and the relationship between phenotype and genotype.
2. Understanding the basics of genetic mapping and regulation of gene expression.
3. Understanding the basic genetic mechanisms at the molecular level
4. Understanding the molecular mechanism of mutation
5. Understanding the process of transcription and translation


### Unit – I


#### A. Genetics

Mendelian Laws of genetics, Dominance, Segregation, Independent Assortment; Epistasis, Complementary ratio and supplementary ratio, Cytoplasmic inheritance; plastid and kappa particles.

  
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**BSCBT401 Genetics and Molecular Biology**

Linkage and crossing over (Coupling and repulsion hypothesis) Mechanism of crossing over and its significance.

Mechanism of sex determination (Chromosomal theory), sex linked inheritance.

**Unit-II**

Chromosome morphology, classification, karyotyping; Specialized chromosomes-Polytene and Lamp brush chromosome,

Structural and numerical chromosomal aberrations.

Chromosome related disorders: Klinefelter's syndrome, Turner's syndrome, Down's syndrome and Cri-du-chat syndrome

Mutations- Spontaneous and induced, Chemical and physical mutagens, Molecular basis of mutation.

**Unit-III**

**B. Molecular Biology**

Transformation, Conjugation and transduction in bacteria; Gene mapping in bacteria;

Prokaryotic and eukaryotic DNA replication and Transcription, Processing of m-RNA, Splicing, DNA and RNA polymerases

**Unit-IV**

Prokaryotic and Eukaryotic Translation - Mechanism of initiation, elongation and termination.

Gene regulation in Eukaryotic system – Promoters, enhancers elements and gene amplification.

**Unit –V**


Genetic Code and Translation


Correspondence of amino acid sequence in proteins; Properties of genetic code- universal code, degeneracy and redundancy, Wobble hypothesis;


Co- and post-translational modifications- Antisense RNA.

**PRACTICAL II [Genetics + Molecular Biology]**

1. Solving problems on monohybrid and dihybrid ratios, multiple alleles, epistasis.
2. Solving problems on quantitative inheritance.
3. Inheritance patterns in human – Pedigree analysis.
4. Solving problems on localization of genes

  
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**BSCBT401 Genetics and Molecular Biology**


5. Isolation of plasmid DNA.
6. Isolation of DNA from plant cells.
7. Isolation of DNA from human whole blood.
8. Determination of purity and concentration of DNA - Spectrophotometric method.

**BOOKS:**

1. Gardner, E. J., Simmons, M. J., & Snustad, D. P. (2006). Principles of Genetics. (8th Ed.). John Wiley & Sons.
2. Griffiths, A. J.F., Doebley, J., Peichel, C., & Wassarman, D. A. (2020). An introduction to Genetic Analysis. (12th Ed.). W.H. Freeman publication.
3. Hartl, D. L., & Jones, E. W. (1998). Genetics: Principles and Analysis. (4th Ed.). Sudbury, MA: Jones and Bartlett.
4. Alberts, B., Johnson, A. D., Lewis, J., Morgan D., Raff, M., Roberts, K., & Walter, P. (2015). Molecular Biology of the Cell. (6th Ed.). New York: Garland Science.
5. Brown, T. A. (2017). Genomes 4. (4th Ed.). Wiley Publishers (Asia Pvt Ltd).
6. Freifelder, D. (2012). Molecular Biology. (5th Ed.). Narosa Publishing House, India.
7. Krebs, J. E., Goldstein, E. S., & Kilpatrick, S. T. (2017). Lewin's Genes XII. (12th Ed.). Jones and Barlett Inc. USA.

  
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			THEORY			PRACTICAL		Th	T	P	CREDITS
			END SEM University Exam	Two Term Exam	Teachers Assessment*	END SEM University Exam	Teachers Assessment*				
BSCCH401	Minor	Applied Chemistry	60	20	20	30	20	4	-	4	6

**Legends:** L - Lecture; T - Tutorial/Teacher Guided Student Activity; P – Practical; C - Credit;

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### Course Educational Objectives (CEOs):

After completion of this course the students are expected to demonstrate the following skills, knowledge, and attitudes.

1. Enable the students to apply basic concepts, and applications of Heavy inorganic chemicals.
2. To study the preparation and applications of different types of catalysts and solvents.
3. To provide the theoretical understanding of applied industrial techniques as Bio-transformation, MAOS and their practical applications.
4. The purpose of the course is to make the students to understand the determination of cations, anions, analysis of Water quality as DO, BOD, COD, and analysis of Oils, Fats, Paint.

### Course Outcomes (COs):

After completion of this course the students are expected to demonstrate the following skills, knowledge, and attitudes. Student will be able to understand:

1. Theoretical understanding of microwave induced reactions, sonochemistry and applications
2. The preparation and industrial application of different catalysts and solvents.
3. The industrial manufacturing process, and applications of economically important heavy inorganic chemicals.
4. Sampling and analytical procedure of water and wastewater, oils, fats, paints.


### Syllabus


#### Unit I: Heavy Inorganic Chemicals


Basic concept of heavy inorganic chemicals and manufacture of following with reference to: (i) Raw material, (ii) Production process, (iii) Quality control, (iv) Hazards and safety, of the following chemicals - Ammonium phosphates, super phosphate, triple super phosphate, carbon blacks, manufacture of graphite and carbon, calcium carbide, silicon carbide, sodium thiosulphate, borax and boric acid.

#### Unit II: Catalysts and Solvents

Introduction, preparation, synthetic application of the following catalysts - Raney Nickel,

  
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## Shri Vaishnav Institute of Science

### Department of Life Science

### B.Sc. (Major - Biotechnology)

#### BSCCH401 Applied Chemistry

Palladium, Copper chromate, Vanadium, and Platinum-based catalyst. Aluminium alkoxides, and Titanium tetrachloride. Industrial solvents (specialty): Synthesis, properties, and uses of Dimethyl-formamide (DMF), Dimethyl sulfoxide (DMSO), Tetrahydrofuran (THF), and Chlorinated hydrocarbons

#### Unit III: Analysis of Oils, Fats, and Paint:

Introduction, classification of oils and fats, physical and chemical properties of oils and fats. Determination of viscosity, density, thermal properties, and flash point, saponification number, iodine number and acid number. Introduction to paints, definition, varnishes, enamels, lacquers and thinners, formulation and manufacturing of paints, different types of paints, surface coatings, analysis of paints and varnishes, applications of paints.

#### Unit IV: Assessment of Water Quality:

Sources of water, sampling procedure of water and wastewater, classification of water for different uses, types of water pollutants and water quality standards for drinking water. Analytical methods for the determination of the following ions in water: Anions:  $\text{CO}_3^{2-}$ ,  $\text{HCO}_3^-$ ,  $\text{F}^-$ ,  $\text{Cl}^-$ ,  $\text{SO}_4^{2-}$ ,  $\text{PO}_4^{3-}$ ,  $\text{NO}_3^-$ ,  $\text{NO}_2^-$ , Cations:  $\text{Fe}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Ca}^{2+}$ ,  $\text{Mg}^{2+}$ ,  $\text{Cr}^{3+}$ . Determination of Dissolved Oxygen (DO), Biochemical Oxygen Demand (BOD) and Chemical Oxygen Demand (COD).

#### Unit V: Applied industrial techniques:


Introduction of Bio-transformations, types and examples, enzyme catalyzed reactions, different types, examples, mechanism of Bio-transformations with examples, industrial applications of Biotransformation, advantages, and limitations. Microwave induced reactions- theory, principle, advantages, mechanism, examples. MAOS-Industrial applications. Sonochemistry - theory, examples, industrial applications.


#### Guidelines for Practical:


A two-credit lab is to be conducted by covering the most relevant and useful topics from above mentioned syllabus.

#### References

1. Admson, A.W., Physical Chemistry of Surfaces, 4<sup>th</sup> Edition, Pubs: John Wiely & Sons, New York.
2. Austin H. T., Shreve's Chemical Process Industries, Pubs: McGraw Hill Book Co., New York.
3. Rao, C. N. R, Muller, A and Cheetam, A.K. (Eds) : The Chemistry of Nanomaterials, Vol.1, and 2, Wiley-VCH, Weinheim.
4. Poole, C.P. & Owens, Jr: F.J.: Introduction to Nanotechnology Wiley Interscience, New Jersey
5. Shreve R.N., Chemical process industries, 5<sup>th</sup> Ed., McGraw Hill Book Company, New York.
6. Sharma, B.K., Industrial chemistry 7<sup>th</sup> Edition, Krishan Prakashan, 2014
7. Rells, K.M., Courtney, T., and Wulff, J., Introduction to material science and engineering, 9<sup>th</sup> Edition, Wiley Eastern Pvt. Ltd., New Delhi, 2016.

  
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