

VANITA VISHRAM WOMEN'S UNIVERSITY

(Managed By: Vanita Vishram, Surat)

1st Women's University of Gujarat



VANITA VISHRAM
WOMEN'S UNIVERSITY

SURAT

SCHOOL OF SCIENCE AND TECHNOLOGY

DEPARTMENT OF BIOTECHNOLOGY

B.SC. BIOTECHNOLOGY

SEMESTER 3

SYLLABUS

AS PER **NEP-2020**

W.E.F 2023-24



VANITA VISHRAM WOMEN'S UNIVERSITY, SURAT
SCHOOL OF SCIENCE AND TECHNOLOGY

Department of Biotechnology

BSc Biotechnology Program

SY B.Sc.

Semester III

BTM205-1C: Biomolecules: Metabolism

Credit 3 + 1

Contact Hour per week 3+2

Outline of the Course:

Course type	Theory/Practical
Purpose of Course	Provide insights of reactions that occur within cells of living organisms to sustain life. It will also provide the basic fundamentals of process of metabolism which involves many interconnected cellular pathways to ultimately provide cells with the energy required to carry out their function.
Course Objective	CO 1. To introduce students about metabolic pathways of biomolecules ranging from carbohydrates to nucleic acid. CO 2. To make the students understand the chemical processes that takes place inside the cells of living organisms which are necessary to maintain life. CO 3. To make the students aware about the disorders associated with abnormal metabolism.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	June 2023
Pre-requisite	Basic knowledge of biochemistry.
Teaching Methodology	Class Room Teaching, Discussion and Assignment
Evaluation Method	50% Comprehensive Continuous Evaluation (CCE) 50% Semester End Examination (SEE)

**Course Content**

Units	Particulars	% Weightage of Unit	Minimum Nos. of Hours
1	Introduction: <ul style="list-style-type: none">• Introduction to Metabolism: Types (Anabolism, catabolism), Integration of metabolism.• Gibb's free energy and redox potential• ATP and reducing powers• Oxidative Phosphorylation• Electron Transport Chain• Glycolysis• Pentose phosphate pathway• Citric acid cycle• Gluconeogenesis	27	12
2	Nucleic acid & Protein metabolism <ul style="list-style-type: none">• Purine metabolism: Purine biosynthesis - Denovo pathway & Salvage pathway, catabolism of purine nucleotides.• Pyrimidine metabolism: Pyrimidine biosynthesis – Denovo pathway, catabolism of Pyrimidine nucleotides. Protein Metabolism <ul style="list-style-type: none">• Introduction to protein metabolism - Transamination and deamination.• Metabolism of aromatic amino acids (Phenyl alanine, tyrosine & tryptophan).• Metabolism of sulphur-containing amino acids (cysteine, cystine & methionine)• Metabolism of glycine, lysine, serine, glutamine, histidine.	45	20
3	Lipid Metabolism <ul style="list-style-type: none">• Introduction to lipid metabolism. Fatty acid biosynthesis: synthesis of• palmitic acid, Fatty acid synthase complex and its significance.• Synthesis of triacylglycerol and glycerophospholipids.• Metabolism of cholesterol. β Oxidation of Fatty acids & α Oxidation of Fatty acids.• Metabolism of ketone bodies & regulation Lipoprotein metabolism.	28	13

Reference books

- Naik, P., 2011. Essentials of Biochemistry (for Medical Students). JP Medical Ltd.
- Satyanarayana, U., 2013. Biochemistry. Elsevier Health Sciences.
- Fisher, M., 2001. Lehninger principles of biochemistry, ; by David L. Nelson and Michael M.



- Cox. The Chemical Educator, 6, pp.69-70.
- Kogut, M., 1975. Biochemistry: by Lubert Stryer WH Freeman and Company; San Francisco,
- Murray, K., Rodwell, V., Bender, D., Botham, K.M., Weil, P.A. and Kennelly, P.J., 2009.
- Harper's illustrated biochemistry. 28. Citeseer, New York, United States.

Practicals:

1. Qualitative test for amino acids by Sakaguchi reactions.
2. Qualitative test for amino acid by Hopkins-Cole test
3. Estimation of blood glucose by oxidase method.
4. Determination of proteins by Bradford method
5. Qualitative test for the presence of fatty acids by titrimetric method.



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Semester III

BTM206-1C: Enzymology

Credit 3 + 1

Contact Hour per week 3+2

Outline of the Course:

Course type	Theory/Practical
Purpose of Course	Provide strong fundamentals of structures, functions and organizations of Enzymes in biological systems, Industries and our day to day life.
Course Objective	CO 1. The catalysts and enzymes; their working patterns, mode of actions, inhibition, kinetics, etc. CO 2. Demonstrate knowledge and understanding of the regulation of Enzyme activity. CO 3. Demonstrate the strategies for the extraction and purification of enzymes & the overview on applications of enzymes.
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	June 2023
Pre-requisite	Elementary knowledge of Biology.
Teaching Methodology	Class Room Teaching, Discussion and Assignment
Evaluation Method	50% Comprehensive Continuous Evaluation (CCE) 50% Semester End Examination (SEE)

**Course Content**

Units	Particulars	% Weight age of Unit	Minimum Nos. of Hours
1	Introduction to Enzymes <ul style="list-style-type: none">• Historical perspectives• General characteristics of Enzymes. Chemical nature and properties of enzymes• Nomenclature and classification• Working of enzymes: Activation energy and transition state• Specificity of Enzyme Action• Mechanism of Enzyme Action• Factors affecting enzyme activity	27	12
2	Enzyme Kinetics <ul style="list-style-type: none">• Derivation of Michaelis-Menten equation for unisubstrate reactions• K_m and its significance• Measurement of K_m and V_{max} by Lineweaver-Burk plot and other linear transformations of MM equation• Bi-substrate reactions: Sequential and ping-pong mechanisms with examples and determination of K_m and V_{max} for each substrate (derivations excluded) Regulation of Enzyme Activity & Enzyme Inhibition <ul style="list-style-type: none">• Reversible (competitive, non-competitive, and uncompetitive) and irreversible (affinity labels and suicide inhibitors) enzyme inhibitors; Determination of K_i.	45	20
3	Extraction and Purification of Enzymes <ul style="list-style-type: none">• Sources for enzyme production• Factors affecting source selection of enzyme• Extraction of soluble, membrane bound enzymes (intracellular and extracellular enzymes)• Methods of cell disruption• Extraction of soluble, membrane bound enzymes• Purification of enzymes: preliminary and advanced methods Application of Enzymes <ul style="list-style-type: none">• Enzyme utilization in Industry: Food and Drink industries, Artificial kidney machines, other industries (pharmaceutical industry; washing powder manufacturing industries)• Immobilization of Enzymes: Methods and Applications• Biosensors	28	13



List of References & Text Books:

- Cox, M.M and Nelson, D.L. (2008). Lehninger's Principles of Biochemistry, Sixth Edition, W.H. Freeman and Co., New York.
 - Voet D and Voet J(2012) Biochemistry . Fifth edition, Wiley.
 - Murray, R.K., Bender, D.A., Botham, K.M., Kennelly, P.J., Rodwell, V.W. and Well, P.A. (2009). Harper's Illustrated Biochemistry, XXVIII Edition, International Edition, The McGraw-Hill Companies Inc.
 - "Enzymes: Biochemistry, Biotechnology, Clinical Chemistry" by Palmer T and P L Bonner
 - Applications of Enzyme Biotechnology by Kelly, Jeffrey W., Baldwin, Thomas O. (Eds.)
 - Nature of Enzymes by L. Foster
 - Keith Wilson and John Walker. 2006.Principles and Techniques of Biochemistry and Molecular Biology 6th edition .Cambridge University Press New York,pp.571-594
 - Lubert Stryer.2007. Biochemistry 6th Edition W.H. Freeman, and Company. New York
 - Fundamentals of Enzymologist: Nicholes C. Price and Lewis Stevens, Oxford Univ. Press.
- List of Open Source Software/learning website:
- <http://silveroakuni.ac.in/video-lecture>
 - <https://nptel.ac.in/>

Practicals:

1. To determine Alkaline phosphatase enzyme activity from sprouted mung bean.
2. To study effect of temperature on Alkaline Phosphatase enzyme activity.
3. To study effect of pH on Alkaline Phosphatase enzyme activity.
4. To study kinetics (K_m and V_{max}) of alkaline phosphatase enzyme/To study effect of time and substrate concentration on Alkaline Phosphatase enzyme activity.
5. Isolation of egg lysozyme by ion exchange chromatography (Demonstration).

**VANITA VISHRAM WOMEN'S UNIVERSITY, SURAT
SCHOOL OF SCIENCE AND TECHNOLOGY****Department of Biotechnology****BSc Biotechnology Program****SY B.Sc.****Semester III****BTM207-2C: General Genetics****Credit 3 + 1****Contact Hour per week 3+2****Outline of the Course:**

Course type	Theory/Practical
Purpose of Course	Provide strong fundamentals of general genetics including Mendel's law of inheritance their application and genomic organization of prokaryotes and eukaryotes.
Course Objective	CO 1. To give information and knowledge about basic components of Genetics. CO 2. To make students aware about principle of inheritance and its characteristics. CO 3. To explain the students about various mendelian principles. CO 4. To make students understand about genetic linkage and inheritance. CO 5. To differentiate prokaryotic and eukaryotic chromosome arrangement
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	June 2023
Pre-requisite	Basic knowledge of biology.
Teaching Methodology	Class Room Teaching, Discussion and Assignment
Evaluation Method	50% Comprehensive Continuous Evaluation (CCE) 50% Semester End Examination (SEE)



Course Content

Units	Particulars	% Weightage of Unit	Minimum Nos. of Hours
1	<p>Introduction:</p> <ul style="list-style-type: none"> • Historical developments in the field of genetics; • Mendelian genetics: Mendel’s experimental design, monohybrid and di-hybrid crosses, Law of segregation & Principle of independent assortment. • Test and back crosses. • Allelic interactions: Concept of dominance, incomplete dominance, co-dominance, pseudo-allele, essential and lethal genes. • Importance and application of mendelian genetics. 	33	14
2	<p>Chromosome and genomic organization:</p> <p>Eukaryotic nuclear genome nucleotide sequence</p> <ul style="list-style-type: none"> • composition –unique & repetitive DNA, satellite DNA. Centromere and telomere DNA, genes, noncoding DNA. • Genetic organization of prokaryotic and viral genome. • Chromosome morphology: concept of euchromatin and heterochromatin. packaging of DNA molecule into chromosomes, chromosome banding pattern, • Concept of cistron, exons, introns and genetic code 	34	16
3	<p>Mutation, sex determination and crossing over</p> <ul style="list-style-type: none"> • Definition and types of mutations, causes of mutations • Variations in chromosomes structure - deletion, duplication, inversion and translocation. • Sex determination and sex linkage: Mechanisms of sex determination, Environmental factors and sex determination, • Phenomenon of Linkage and crossing over, Cytological basis of crossing over, Molecular mechanism of crossing over, Crossing over at four strand stage, Multiple crossing overs and organelle heredity. 	33	15
<p>Reference books</p> <ul style="list-style-type: none"> • Snustad, D.P., Simmons, M.J. (2009). Principles of Genetics. V Edition. John Wiley and Sons Inc. • Klug, W.S., Cummings, M.R., Spencer, C.A. (2009). Concepts of Genetics. IX Edition. Benjamin Cummings. • Gardner, E.J., Simmons, M.J., Snustad, D.P. (2006). Principles of Genetics. VIII Edition John Wiley & Sons. 			



- Griffiths, A.J.F., Wessler, S.R., Lewontin, R.C. and Carroll, S.B. IX Edition. Introduction to Genetic Analysis, W. H. Freeman & Co.
- Russell, P. J. (2009). Genetics- A Molecular Approach. III Edition. Benjamin Cummings.

Practicals:

1. Study of mitosis with the help of temporary mount of onion root tip.
2. Karyotyping with the help of photograph.
3. Mendel's experiment on pea.
4. Monohybrid and dihybrid cross and their deviations.
5. Pedigree charts of some common characters like blood group and color blindness.
6. Study of polyploidy in onion root tip by colchicine treatment.
7. Demonstration of chromosome map of human.



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Semester III

IKS202-2C: Indian Knowledge System: Vigyan

Credit 2

Contact Hour per week 2

Outline of the Course:

Course type	Theory/Practical
Purpose of Course	The course is intended to provide undergraduates with a foundational guide to the history, culture and philosophy of India and introduce them to the main themes and debates relating to that history.
Course Objective	CO 1. To provide a general introduction to Indian Knowledge System (IKS) and sensitize the students to the contributions made by ancient Indians in the field of Science, Philosophy and related applications and concepts. CO 2. Understanding the scientific value of the traditional knowledge of Bharata CO 3. Promoting the youths to do research in the various fields of Bhartiya knowledge system CO 4. Converting the Bhartiya wisdom into the applied aspect of the modern scientific paradigm
Minimum weeks per Semester	15 (Including Class work, examination, preparation, holidays etc.)
Last Review / Revision	June 2023
Pre-requisite	Eagerness to learn our ancient culture, our tradition.
Teaching Methodology	Class Room Teaching, Discussion and Assignment
Evaluation Method	40% Continuous Assessment (CA) 60% End Semester Examination (ESE)

**Course Content**

Units	Particulars	% Weightage of Unit	Minimum Nos. of Hours
1	Scientific Approaches of IKS-I <ul style="list-style-type: none">• Khagol/jyotish Vigyan (Astronomy): Panchaang, Celestial coordinate system, Prediction of monsoon rains• Vastukala (Architecture):	25	8
2	Scientific Approaches of IKS-II <ul style="list-style-type: none">• Krishi Vigyan (Agricultural Practices): Agricultural heritage of India, Ancient agricultural practices, Plant protection through indigenous traditional knowledge during harvesting, threshing and storage• Paryavaran Vigyan (Environmental Sciences)	25	7
3	Scientific Approaches of IKS-III <ul style="list-style-type: none">• Rasa Shastra Evam Dhatu Vigyan (Chemistry and Metallurgy): Vedic references to metals and metal working, Mining and ore extraction, Wax casting of idols and artefacts	25	8
4	Scientific Approaches of IKS-IV <ul style="list-style-type: none">• Ganita: Mathematics in India• Water Management & Transportation: Harappan and Traditional Water Management System: Tank, Lakes, and Stepwells, Communities Involved in Water Management, Modes of Transportations and Reforms	25	7

Reference books

1. Introduction to Indian Knowledge System: Concepts and Applications, Archak, K.B. (2012). Kaveri Books, New Delhi. ISBN-13:978-9391818203
2. Introduction To Indian Knowledge System: Concepts and Applications, Mahadevan, B.Bhat, Vinayak Rajat, Nagendra Pavana R.N.PHI, ISBN: 9789391818203
3. Glimpse into Kautilya's Arthashastra Ramachandrudu P. (2010), Sanskrit Academy, Hyderabad ISBN:9788380171074
4. "Introduction" in Studies in Epics and Purāṇas, (Eds.), KM Munshi and N Chandrashekara Aiyer Bhartiya Vidya Bhavan