MODERN EDUCATION SOCIETY'S

Nowrosjee Wadia College, Pune (Autonomous)

S.Y.B.Sc Biotechnology

Syllabus

As per

NATIONAL EDUCATION POLICY2020

To be implemented from academic

Year 2024-2025

S.Y.B.Sc Biotechnology
SEMESTER III

Syllabus B.Sc. Biotechnology

Semester III (Second Year)

Course Type	Course	Course / Paper Title	Hours /Week	Credit	CIA	ESE	Total
Major Mandatory (6+ 2)	Major Paper 7 (Theory)	BTMJ 231 **Cell Biology-II**	2	2	15	35	50
	Major Paper 8 (Theory)	BTMJ 232 **Molecular Biology-I**	2	2	15	35	50
	Major Paper 9 (Theory)	BTMJ 233 M**etabolism**	2	2	15	35	50
	Major Paper 10 (Practical)	BTMJ 234 **Practicals in Cell biology, Molecular Biology metabolism**	4	2	15	35	50
Major Electives	---	---	---	---	---	---	---
Minor (4)	Minor Paper 3 (Theory) Minor Paper 4 (Practical)	(Students will select this subject from Arts/commerce subjects)	2 4	2 2	15 15	35 35	50 50
OE (2)		(Students will select this subject from Arts/ commerce subjects)	2	2	15	35	50
VSC (2)	VSC 3	BTVSC235 **Genetics (Theory)**	2	2	15	35	50
SEC (2)	---	---	---	---	---	---	--
AEC(2),	MIL	Marathi / Hindi (Any one)	2	2	15	35	50
VEC (2)	---	---	----		---		
IKS (2)	---	---	---	---	---	---	---
FP/CEP (2)	FP –I	BTFP236 **Field Project***	6	2	15	35	50
CC(2)	CC III	Physical Education / Cultural Activities, NSS/NCC and Fine/ Applied/ Visual/ Performing Arts Course	2	2	15	35	50

Field project*

Field project is to be completed in any recognized institute / laboratory / research laboratory/ academic institution / Wet lab training for 120 contact hours.

	MODERN EDUCATION SOCIETY'S **Nowrosjee Wadia College, Pune** **(Autonomous)NEP**	
Bachelor of Science (Hons.) in Biotechnology		
SEMESTER –III Major Paper 7 (Theory)		
Year - Second year	**Paper No- BTMJ 231**	**Credits 2**
Semester- III	**Name of Paper- Cell Biology II**	**Hours 30**

Course Outcomes (COs)
On completion of the course, the students will be able to:

1. Discuss about evolution diversity and replication of cell.
2. Emphasize on cell division , cell Signaling, and Cell Death.

Sr No.	COURSE CONTENT / SYLLABUS	Lectures
Unit I	**Cell Cycle** • Introduction to cell cycle • Phases and Check points of cell cycle	4
Unit II	**Cell Division in Plant & Animal** • Mitosis • Meiosis	7
Unit III	**Cell Signaling** • Signaling molecules • Signaling receptors: Cell surface receptors • Autocrine, syncrine & paracrine signaling • G-protein signaling (one example) Calcium Signaling	12
Unit IV	**Cell Death** • Aging, Apoptosis and Necrosis • Neoplasia • Autophagy • Ferroptosis • Pyroptosis	**7**

References books

1. Molecular Cell Biology. 7th Edition, (2012) Lodish H., Berk A, Kaiser C., KReiger M., Bretscher A., Ploegh H., Angelika Amon A., Matthew P. Scott M.P., W.H. Freeman and Co., USA
2. Molecular Biology of the Cell, 5th Edition (2007)BruceAlberts, Alexander Johnson,Julian Lewis, Martin Raff, Keith Roberts, Peter Walter. Garland Science, USA
3. Cell Biology, 6th edition, (2010) Gerald Karp. John Wiley & Sons., USA

4. The Cell: A Molecular Approach, 6th edition (2013), Geoffrey M. Cooper, Robert E. Hausman, Sinauer Associates, Inc. USA
5. Karp, G. 2010. Cell and Molecular Biology: Concepts and Experiments. 6th Edition. JohnWiley & Sons. Inc.
6. De Robertis, E.D.P. and De Robertis, E.M.F. 2006. Cell and Molecular Biology. 8th edition.Lippincott Williams and Wilkins, Philadelphia
7. https://ncert.nic.in/textbook/pdf/kebo110.pdf
8 .https://youtu.be/wkWLmlSUlqg?si=Yl6AjAkbrucltoS0
9 .https://youtu.be/7_UwZTGpOv0?si=xOSZvEuliQ2x2qoh

	MODERN EDUCATION SOCIETY'S **Nowrosjee Wadia College, Pune** **(Autonomous)NEP**	
Bachelor of Science (Hons.) in Biotechnology		
SEMESTER –III Major Paper 8 (Theory)		
Year - Second year	**Paper No- BTMJ 232**	**Credits 2**
Semester- III	**Name of Paper- Molecular Biology-I**	**Hours 30**

Course Outcomes (COs)

On completion of the course, the students will be able to:

1. Know about historical concept and structure of DNA.
2. Learn Prokaryotic and Eukaryotic organization of Genome.
3. Gain knowledge of DNA replication.
4. Know the cause and mechanism of DNA Damage and Repair.

Sr No.	COURSE CONTENT / SYLLABUS	Lectures
Unit I	**Historical and conceptual Background-** • Molecular basis of heredity & Central dogma of Molecular Biology • Discovery of DNA as genetic material: Griffith's experiment, Avery, McCarty and Macleod experiment,Hershey and Chase warring blender experiment, Laderberg Tatum experiment, Laderberg Zinder experiment • Nucleic acids- structure, properties and function, Nucleoside and nucleotide • Structure of DNA: DNA forms; A, B & Z • Salient features of double helix, Chargaff's rule • Types and structure of RNA : tRNA, rRNA , mRNA and non-coding RNA (miRNA, SiRNA) •	**7**
Unit II	**Concept and Organization of Genome** • Definition of gene – introns/exons, Regulatory sequences, promoters, enhancers and suppressors • Prokaryotic Genome: Organization of genome in T4 and lambda phage, lytic and lysogenic cascade, Bacterial and viral genomes • Organelle DNA – mitochondria and chloroplast DNA • Eukaryotic genome-Chromosomal organization and structure. • Chromatin structure: Euchromatin, heterochromatin (nucleosomes)- histone, non-histone proteins • Horizontal gene transfer: conjugation, transformation, and transduction.	**7**

Unit III	**Replication of DNA** • DNA synthesis: general principles, bidirectional replication, Semiconservative nature of DNA replication, Rolling circle replication • Meselson and Stahl experiment • The replication complex: - • Enzymes involved in DNA replication, Unique aspects of eukaryotic & prokaryotic DNA Replication, Fidelity of replication.	**8**
Unit IV	**DNA damage and repair** • Causes and types of DNA damage • Mechanism of DNA repair: Photo reactivation, base excision repair, nucleotide excision repair, mismatch repair, SOS repair, recombination repair	**7**

Reference Books:

1. Genes X, 10th edition (2009), Benjamin Lewin, Publisher - Jones and Barlett Publishers Inc. USA
2. Molecular Biology of the Gene, 6th Edition (2008), James D. Watson, Tania Baker,
3. Stephen P. Bell, Alexander Gann, Michael Levine, Richard Lodwick, Pearson Education, Inc. and Dorling Kindersley Publishing, Inc. USA
4. Molecular Biology, 5th Edition (2011), Weaver R., Publisher-McGrew Hill Science. USA
5. Fundamentals of Molecular Biology, (2009), Pal J.K. and Saroj Ghaskadbi, Oxford University Press. India
6. Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition. John Wiley & Sons. Inc.
7. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology.VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
8. Molecular Biology of the Gene (VI Edition.). Cold Spring Harbour Lab. Press, Pearson Pub.
9. Principles of Gene manipulation and Genomics. - S.B. Primrose and R.M. Twyman. Blackwell Publication
10. Biotechnology - Fundamentals and applications. - S.S. Purohit and S.K. Mathur. Agrobotanica publications. Gene Cloning and DNA analysis. - T.A. Brown. Blackwell Publication.
11. Recombinant DNA - Genes and Genomes. - James D. Watson, Any A candy, Richard M.M, Jan A Witkowski. W.H. Freeman and Company Publication.

12 Genomes: T A Brown, John Wiley & Sons

13 https://www.youtube.com/watch?v=TNKWgcFPHqw

	MODERN EDUCATION SOCIETY'S **Nowrosjee Wadia College, Pune** **(Autonomous) NEP**	
Bachelor of Science (Hons.) in Biotechnology		
SEMESTER –III Major Paper 9 (Theory)		
Year - Second year	**Paper No- BTMJ233**	**Credits 2**
Semester- III	**Name of Paper- Metabolism**	**Hours 30**

Course Outcomes (COs)

On completion of the course, the students will be able to:

1. Understand the different metabolic pathway of body.
2. Understand the regulatory steps of different metabolic pathway.
3. Able to calculate energy generation

Sr No.	COURSE CONTENT / SYLLABUS	Lectures
Unit I	**Introduction to Metabolism**, • Basic concept Anabolism and Catabolism • ATP energy cycle, • Chemistry of Metabolism: Oxidation–reduction reaction, Group transfer reactions etc. Concept of Bioenergetics, • Calculation of free energy change in biochemical reactions, • Basic concept of Exergonic and endergonic reactions	7
Unit II	**Lipid Metabolism** – • Outline of lipid synthesis, • Catabolism of Fatty acid: beta oxidation, Oxidation of unsaturated fatty acids, Oxidation of odd chain fatty acids, Cholesterol, ketone bodies	7
Unit III	**Carbohydrate Metabolism** – • Aerobic & Anaerobic glycolysis, sequence of reactions in glycolysis, regulation in glycolysis, • Pyruvate metabolism, citric acid cycle & its regulation, • glycogenesis, glycogenolysis (sequence of reactions &regulation), Pentose-phosphate pathway (sequence of reactions &regulation)	8

Unit IV	**Amino acid Metabolism** – • Essential & non-essential amino acids, • Catabolism of Amino acids, Transamination, • Urea Cycle, • glucogenic & ketogenic amino acid **Nucleotide Metabolism** – • Biosynthesis of purine & pyrimidine (de novo &salvage pathway); Degradation of purine & pyrimidine.	8

Reference books:

1. Conn EE and Stump PK. 2010. Outlines of Biochemistry. 5th Ed. John Wiley Publications.
2. Voet D and Voet JG. 2011. Biochemistry. 4th Ed. John Wiley and Sons, Inc. NY, USA
3. Nelson DL and Cox MM. 2012. Lehninger‟s Principles of Biochemisry, 6th Ed. Macmillan Learning, NY, USA.
4. Berg JM, Tymoczko JL, Stryer L and Gatto GJ. 2002. Biochemistry, 7th Ed. W.H. Freemanand Company, NY, USA
5. https://www.ncbi.nlm.nih.gov/books/NBK482303/
6. https://www.ncbi.nlm.nih.gov/books/NBK556032/
7. https://www.ncbi.nlm.nih.gov/books/NBK513323/

	MODERN EDUCATION SOCIETY'S **Nowrosjee Wadia College, Pune** **(Autonomous)NEP**	
Bachelor of Science (Hons.) in Biotechnology		
SEMESTER- III Major Paper 10 **(Practical)**		
Year - Second year	**Paper No- BTMJ234**	**Credits 2**
Semester-III	**Practicals in Cell Biology, Molecular biology, and metabolism**	**Hours 60**

Course Outcomes (COs)

On completion of the course, the students will be able to:

1. Understand and observe different stages of mitosis and meiosis in detail.
2. Observe and understand different mutations.
3. Isolate and estimate the DNA and RNA.
4. Learn different analysis techniques.
5. Analyze metabolic problems and will be able to approach research problem specifically
6. Acknowledge significance of biochemical tests
7. Carry bimolecular estimation based on the coloration reaction.

15 Practicals	**COURSE CONTENT / SYLLABUS**	**No of Practicals**
	Practicals in Cell Biology	
1	Study of different stages of Mitosis using onion root tip.	1
2	Effect of colchicine on mitosis in onion root tip.	2
3	Study of different stages of Meiosis in Flower Ovule of Tradescantia	1
4	Study of polytene chromosomes (Drosophila/Chironomus larva)	1
	Practicals in Molecular Biology	
1	Determination of melting temperature of DNA	1
2	Bacterial DNA isolation by alkaline lysis/lysozyme method and purity check by using A260/280	2
3	Bacterial DNA agarose gel electrophoresis.	1
4	Estimation of DNA by Diphennylamine method.	1
	Practicals in Metabolism	
1	Estimation of glucose by Benedict's method	1
2	Estimation of reducing sugar by DNSA (dinitrosalicylic acid)	1
3	Method	
4	Estimation of Chlorophyll from plant source	1
5	Estimation of cholesterol	1
6	Estimation of reducing sugar by Nelson –Somogyi method.	1

	MODERN EDUCATION SOCIETY'S **Nowrosjee Wadia College, Pune** **(Autonomous)NEP**	
Bachelor of Science (Hons.) in Biotechnology		
SEMESTER –III VSC 3		
Year - Second year	**Paper No- BTVSC235**	**Credits 2**
Semester- III	**Name of Paper- Genetics (Theory)**	**Hours 30**

Course Outcomes (COs)

On completion of the course, the students will be able to:

1. Describe the fundamentals of Genetics.
2. Distinguish between Mendelian genetics and modern genetics.
3. Determine the need for understanding chromosomal aberrations and techniques Inter gene .
4. Learn linkage in developing linkage maps, finding distances between thegenes and determining their correct order.

Sr No.	COURSE CONTENT / SYLLABUS	Lectures
Unit I	**Mendalism and Mendalian Genetics:** • Genetic basis of Inheritance: Variations, Heridity, Pre-Mendelian Concept, Importance of Genetics • Mendelian Genetics: Mendel Experiments • Mendel's Law: Law of Dominance Law of Segregation, Mono Hybrid. cross Law Of Independent Assortment- Di Hybrid and Tri Hybrid • Deviation From Mendel's Law- Partial or Incomplete Dominance, Co Dominance, Epistasis • Penetrance and expressivity-Pleiotropism • Gene Interaction-Modified Di Hybrid Ratio, Multiple Allele • Problems related to Mendel and non-Mendel inheritance	**8**

Unit II	**Chromosomal aberrations and Mutations. :** • Variation in chromosome number – types, dosage compensation • Barr bodies (Human). • Variation in chromosome structure – types, generation of variation, • Mutations Classification and types, molecular basis of mutations, • Mutagens and their action, hot spot mutations.	**7**

Unit III	**Sex Determination and Recombination:** • Linkage and Recombination- Discovery of Linkage, Complete and incomplete linkage, crossing over, Cytological Proof of Crossing Over, • Three point cross • Recombination Frequency and Map Distance • Coincidence and interference, • X-Linked Inheritance • Pedigree Analysis • Problems related to Linkage, Gene mapping, X linked Inheritance, karyotype analysis	**8**
Unit IV	**Genetic Disorders** • Sickle Cell Anemia, Hemophilia, Colour Blindness, Albinism, Down's syndrome, Kleinfelter's Syndrome • Genetic Counseling	**7**

Reference books:

1. Genetics, by Strickberger M W (2006) (Prentice Hall, India)
2. Fundamentals of Genetics. B.D Singh
3. Genetics: analysis of genes and genomes by Hartl DL, Jones EW (2001) –(Jones and Bartlett,Massachusetts)
4. Introduction to genetic analysis by Griffiths AJ, Wessler SR, Carroll SB, Doebley J (2012)(Freeman & Co, New York) tenth edition.
5. Molecular genetics of bacteria (ASM Press, Washington) Snyder L, Champness W (2007)
6. Textbook of Cell Biology, Genetics, molecular biology , Ecology and Evolution.: P.S. Verma andV.KAgarwal (2001)
7. Principals of Genetics: Robert H. Tamarin, 7th Edition.
8. GENES IX (2006): Benjamin Lewin.
9. Concepts of genetics (2011) : Robert Brooker.
10. Genetics: A Mendelian Approach (2006) :Peter J. Russell
11. https://youtu.be/K7eLudDXA0w?si=wzdsUisD0nw0wzjS
12. https://ncert.nic.in/textbook/pdf/kebt106.pdf

S.Y.B.Sc Biotechnology
SEMESTER IV

Syllabus B.Sc. Biotechnology

Semester IV(Second Year)

Course Type	Course	Course / Paper Title	Hours /Week	Credit	CIA	ESE	Total
Major Mandatory (6 + 2)	Major Paper 11 (Theory)	BTMJ 241 **Medical Microbiology**	2	2	15	35	50
	Major Paper 12 (Theory)	BTMJ 242 **Molecular Biology-II**	2	2	15	35	50
	Major Paper13 (Theory)	BTMJ243 **Biodiversity**	2	2	15	35	50
	Major Paper 14 (Practical)	BTMJ 244 **Practicals in Medical microbiology, Molecular biology and Biodiversity**	4	2	15	35	50
Major Electives							
Minor (4)	Minor Paper 3 (Theory) Minor Paper 4 (Practical)	(Students will select this subject from Arts/commerce subjects)	2 4	2 2	15 15	35 35	50 50
OE (2)		(Students will select this subject from Arts/ commerce subjects)	2	2	15	35	50
VSC (2)	---	---	---	---	---	---	---
SEC (2)	SEC 3	BTSEC245 **Pathology**	2	2	15	35	50
AEC(2)	MIL	Marathi /Hindi (Any one)	2	2	15	35	50
VEC (2)	---	---	---		---		
IKS (2)	---	---	---	---	---	---	---
FP/CEP (2)	CEP IV	Community Engagement and Service*	6	2	15	35	50
CC(2)	CC IV	Physical Education / Cultural Activities, NSS/NCC and Fine/ Applied/ Visual/ Performing Arts Course	2	2	15	35	50

Community engagement and service: * This course requiring students to participate in field-based learning/projects generally under the supervision of faculty. The curricular component of 'community engagement and service' will involve activities that would expose students to

the socio-economic issues in society so that the theoretical learnings can be supplemented by actual life experiences to generate solutions to real-life problems. 60 hours of contact along with 30 hours of activities such as preparation for community engagement and service, preparation of reports, etc., and independent reading and study. Thus, the total learner engaged time would be 90 hours

	MODERN EDUCATION SOCIETY'S **Nowrosjee Wadia College, Pune** **(Autonomous)NEP**	
Bachelor of Science (Hons.) in Biotechnology		
SEMESTER – IV Major Paper 11(Theory)		
Year -II	**Paper No –BTMJ241**	**Credits 2**
Semester-IV	**Name of Paper- Medical Microbiology**	**Hours 30**

Course Outcomes (COs)

On completion of the course, the students will be able to:

1. Clear basic concepts of Medical Microbiology.
2. Learn nature and importance of pathogens.
3. Importance of Epidemiology of disease.
4. Learn Laboratory Diagnosis of diseases.

Sr. No.	COURSE CONTENT / SYLLABUS	Lectures
Unit I	**General Aspects of Medical Microbiology:** • Basics of development of Microbial diversity • The History of Infectious Diseases • The Past and The Present of medical microbiology • The Henle–Koch Postulates • Human micro biome in health and disease, • Normal flora of human body, Host pathogen interactions. **Epidemiology:** • Epidemiological Terminology • Transmission, Sources of Infection • Sources of Infection • The Fight against Infectious Diseases • Mortality and morbidity rates.	**8**
Unit II	**Principles of Sterilization and Disinfection:** • Physical and Chemical Methods of Sterilization and Disinfection • The Kinetics of Pathogen Killing • Practical Disinfection -surgical hand disinfection, disinfection of excretions, Surface disinfection, Instrument disinfection, Hospital disinfection.	**7**

Unit III	**Laboratory Diagnosis**: • Sampling and Transport of Test Material, Microscopy, • Culturing Methods, Identification of Bacteria, • Molecular Methods, Direct Detection of Bacterial Antigens, • Diagnostic Animal Tests, Bacteriological Laboratory Safety.	**8**
Unit IV	**Study of Pathogens and its diagnosis by conventional and advanced methods:** **Types of Pathogens** • Bacterial pathogens: *Staphylococcus aureus*, *Clostridium botulinum*, • Fungal pathogens: *Candida, Aspergillosis*. • Viral pathogens: HIV, Polio virus, • Parasites: *Plasmodium, Entamoeba* **Immunological Test Methods to detect microbial infections:** • Antigen and Antibody Assays • Immunoprecipitation in Liquids and Gels • Agglutination Reactions • Complement Fixation Test (CFT) • Direct and Indirect Immunofluorescence • Radioimmunological and Enzyme Tests **Basics of Artificial intelligence and use of Artificial intelligence in microbial diagnosis.**	**7**

References books:

1. Tortora, G.J., Funke, B.R., Case, C.L, 1992. Microbiology: An introduction 5th Edition, Benjamin Pub. Co. NY.
2. Roitt, P.I: Mims, C.J. Medical Microbiology.
3. Ananthnarayana, R. and C.E, Jayaram Panikar, 1996 Text book of Microbiology, 5thedition, Orient Longman
4. Medical Microbiology edited by Samuel Baron. Fourth edition. (University of TexasMedical Branch of Galvesion).
5. Dey, N.C and Dey, TK. 1988, Medical Bacteriology, Allied Agency, Calcutta, 17thEdition.
6. Mims' Medical Microbiology by Richard Goering, Hazel Dockrell, Mark Zuckerman, andPeter L. Chiodini (2018). Publisher: Elsevier; 6thedition. ISBN: 978-0-7020-7154-6. 7.Kayser, Medical Microbiology © 2005 Thieme
7. https://dth.ac.in/medical/courses/pathology/6/3/index.php
8. https://www.digimat.in/nptel/courses/medical/microbiology/MB11.html

	MODERN EDUCATION SOCIETY'S **Nowrosjee Wadia College, Pune** **(Autonomous)NEP**	
Bachelor of Science (Hons.) in Biotechnology		
SEMESTER –IV Major Paper12 (Theory)		
Year - Second year	**Paper No- BTMJ 242** **Name of Paper- Molecular Biology-II**	**Credits 2**
Semester- IV		**Hours 30**

Course Outcomes (COs)

On completion of the course, the students will be able to:

1. Know the synthesis of RNA and Protein.
2. Learn the concept and properties of genetic code.
3. Know the regulation of gene and gene products.

Sr No.	COURSE CONTENT / SYLLABUS	Lectures
Unit I	**Synthesis of RNA: Transcription:** • Transcription in prokaryotes: Prokaryotic RNA polymerase, role of sigma factor, promoter, Initiation,elongation and termination • Transcription in Eukaryotes: Eukaryotic RNA polymerases, transcription factors, promoters, enhancers, mechanism of transcription initiation, promoter clearance and elongation RNA splicing and processing: processing of pre-mRNA: 5' cap formation, polyadenylation, splicing. • Splicing mechanisms, Splicing of tRNA precursors, Splicing of rRNA precursors	**8**
Unit II	**Synthesis of Protein: Translation** • Structure of ribosome and assembly • Protein Synthesis in Prokaryotes: properties of the prokaryotic Initiator tRNA-fMet, Charging of tRNA,amino acyl tRNA synthetases • Protein Synthesis in Eukaryotes: Mechanism of initiation, elongation and termination of polypeptides, • Fidelity of translation, Inhibitors of translation. Posttranslational modifications of proteins	**7**
Unit III	**Genetic Code** • Concept of codon, reading frame, frame shift, Major scientific contributions to decipher genetic code • Properties of genetic code • Nirenberg and Matthaei experiment	**7**
Unit IV	**Regulation of activity of Genes and Gene products in Prokaryotes:** • General aspects of gene Regulation: inducible and repressible system • The lactose operon : Catabolite repression	**8**

	• The Arabinose operon: Positive , negative regulation • The Tryptophan operon: Regulation by attenuation.	

Reference Books:

1. Genes X, 10th edition (2009), Benjamin Lewin, Publisher - Jones and Barlett Publishers Inc. USA
2. Molecular Biology of the Gene, 6th Edition (2008), James D. Watson, Tania Baker,
3. Stephen P. Bell, Alexander Gann, Michael Levine, Richard Lodwick, Pearson Education, Inc. and Dorling Kindersley Publishing, Inc. USA
4. Molecular Biology, 5th Edition (2011), Weaver R., Publisher-McGrew Hill Science. USA
5. Fundamentals of Molecular Biology, (2009), Pal J.K. and Saroj Ghaskadbi, Oxford University Press. India
6. Karp, G. (2010). Cell and Molecular Biology: Concepts and Experiments. VI Edition. JohnWiley & Sons. Inc.
7. De Robertis, E.D.P. and De Robertis, E.M.F. (2006). Cell and Molecular Biology.VIII Edition. Lippincott Williams and Wilkins, Philadelphia.
8. Molecular Biology of the Gene (VI Edition.). Cold Spring Harbour Lab. Press, Pearson Pub.
9. Principles of Gene manipulation and Genomics. - S.B. Primrose and R.M. Twyman. Blackwell Publication
10. Biotechnology - Fundamentals and applications. - S.S. Purohit and S.K. Mathur. Agrobotanica publications.Gene Cloning and DNA analysis. - T.A. Brown. Blackwell Publication.
11. Recombinant DNA - Genes and Genomes. - James D. Watson, Any A candy, RichardM.M, Jan AWitkowski. W.H. Freeman and Company Publication.
12 Genomes: T A Brown, John Wiley & Sons
13 https://www.youtube.com/watch?v=_Zyb8bpGMR0
14 https://www.youtube.com/watch?v=5bLEDd-PSTQ

	MODERN EDUCATION SOCIETY'S **Nowrosjee Wadia College, Pune** **(Autonomous)NEP**	
Bachelor of Science (Hons.) in Biotechnology		
SEMESTER –IV Major Paper 13 (Theory)		
Year - Second year	**Paper No- BTMJ243**	**Credits 2**
Semester- IV	**Name of Paper- Biodiversity**	**Hours 30**

Course Outcomes (COs)

On completion of the course, the students will be able to:

1. Learn key scientific concepts for species and ecosystem conservation
2. Study the importance and uses of biodiversity
3. Know the types of biodiversity

Sr No.	COURSE CONTENT / SYLLABUS	Lectures
Unit I	**Biodiversity** • Introduction to biodiversity, concept, definition, species diversity, ecosystem diversity, genetic diversity, diversity gradients **Global Biodiversity** • Major biodiversity areas of the world, Biodiversity Hot Spots **Population ecology** • Population dynamic, Population density & relative abundance, Population age distribution, Growth forms & carrying capacity, Survivorship curves, **Population structure** • Isolation & territoriality	7
Unit II	**Habitat Ecology:** • Habitat & niche, Types of Habitats, Insular habitats, and their flora & fauna, Extreme Habitats, and their flora & fauna • Ecological equivalence, Indices of biodiversity analysis, Basic behavioral patterns, **Urban Biodiversity:** • Biodiversity in cities & towns, Concept of opportunistic species. Biomimetics, Species adapted to Human environment **Uses of Biodiversity:** Source of food, medicine, raw material, aesthetic, cultural and ecosystem services, strategies for sustainable exploitation of biodiversity.	8

Unit III	**Conservation of Biodiversity:** • Conservation strategies- in situ and ex situ methods - advantages, limitations and applications, Threats to biodiversity, major causes, extinction's, vulnerability of species to extinction, **Institutions and their role in conservation:** • Zoological survey of India, Botanical survey of India, Forest research Institute. **Role of NGO'S in conservation:** • Important NGOs in India & their contributions, Important NGO movements: Chipko movement, PaniPanchayats, Seed Movement. **Wild life Trade and Laws:** Wildlife protection Act of India, CITES, TRAFFIC, RED Data Book and its importance, IUCN threat categories	7
Unit IV	**Important Tools and techniques in systematics:** • Techniques in morphological, histological, embryology and anatomical Analysis, Molecular tools in taxonomy **Taxonomy:** Need for taxonomy and nomenclature, principles, and objective • Introduction to classification systems.	8

Reference books:

1. An Advanced Text Book On- Biodiversity- Principle and Practices (2004)
2. Krishnamurthy K V Oxford and IBH Publishing, Delhi
3. Biological Systematics: Principles And Applications (2002) Randall T. Schu Cornell University Press, USA
4. Ecology: Principles and Applications (1998) J. L. Chapman, M. J. Reiss Cambridge University Press, Cambridge
5. Environmental Science (2011) Santra S.C. New Central Book Agency, Kolkata
6. Fundamentals of Ecology (2009) (2014) Dash 3rd edition, Tata McGraw-Hill Education, New Delhi
7. Fundamentals of Plant Systematics (1986) Radford A E Harper and Row, New York
8. Global Biodiversity Strategies (1992) Courrier Kathleen (Editor) World Resource Institute, USA
9. Systematics And Biogeography (2010) David M. Williams, Malte C. Ebach Springer, New York
10. Text Book of Biodiversity (2003) Krishnamurthy KV Science Publishers, Jodhpur
11. Biodiversity conservation in managed and protected areas Katwal/Banerjee Agrobios, India2002
12. Biodiversity and its conservation in India Negi, S.S. Indus Publishing Co., New Delhi. 1993 (2008)
13. https://www.topper.com/guides/biology/biodiversity-and-conservation/types-of-biodiversity/
14. https://www.sciencedirect.com/topics/earth-and-planetary-sciences/conservation-of-biodiversity

	MODERN EDUCATION SOCIETY'S **Nowrosjee Wadia College, Pune** **(Autonomous)NEP**	
Bachelor of Science (Hons.) in Biotechnology		
SEMESTER –II Major Paper 14 (Practical)		
Year - First year	**Paper No- BTMJ 244**	**Credits 2**
Semester -I	**Name of Paper- Practicals in Medical Microbiology, Molecular biology and Biodiversity**	**Hours 60**

Course Outcomes (COs)

On completion of the course, the students will be able to:

1. Study the effect soap and disinfectant on micro flora.
2. Study the permanent slides of pathogens
3. Isolate and identification of pathogens.
4. Demonstrate immunological tests.
5. Estimate point count for Birds, Animals
6. Study quadrate and transact method for plant diversity
7. Estimate the RNA and protein
8. Isolate Eukaryotic DNA and analyzed by Agarose gel electrophoresis.

Sr No.	COURSE CONTENT / SYLLABUS	Practicals
	Practicals in Medical Microbiology	
1	Study of effect of washing of skin with soap and disinfectant on its micro flora.	2
2	Study of permanent slides of following microbial pathogens: • *Entamoeba histolytica* • *Giardia spp.* • *Plasmodium spp.* • *Mycobacterium tuberculosis* and *Mycobacterium leprae.*	2
3	Isolation, identification of following pathogens from clinical samples**:** • *Staphylococci, E. coli,* • *Klebsiella, Salmonella,* • *Shigella, Proteus, Pseudomonas, Bacillus* (Any two).	2
4	Demonstration of precipitation with reference to VDRL.	1
5	Demonstration of ODD (Ouchtlerlony Double Diffusion) test.	1
6	Testing sensitivity to antibacterial substance. (Antiseptics/ toothpaste/ mouthwashes).	1
7	Preservation and Maintenance of microbial cultures.	1
8	Testing sensitivity to antibacterial substance. (Antiseptics/ toothpaste/	1

	mouthwashes).	1
9	Visit to pathological lab and preparation of visit report.	
	Practicals in Molecular biology	
1	Isolation of Eukaryotic (Plant) DNA and analysis by Agarosegel electrophoresis.	2
2	Isolation of Eukaryotic (Animal) DNA and analysis byAgarose	2
3	gel electrophoresis.	
4	Estimation of RNA by Orcinol method.	1
5	Estimation of proteins by Bradford method.	1
	Practicals in Biodiversity	
1	To study Quadrate and transact methods for plant diversity analysis and Calculation of species diversity, richness, and abundance from the data	1
2	a) To study the phytogeographic map of India locate major sanctuaries, national parks. Botanical Gardens of India	2
	b) Reserve forest, protected areas of Pune and Maharashtra	
3	Point count for bird/butterfly/insect diversity	1
4	Prepare an audio-visual presentation to communicate conservation to the youth & public on some environment issues (e.g.: Destruction of local biodiversity site like mangrove or sea s shore or a forest patch, Human-wildlife conflict, Developmental activity that has potential threat tolocal biodiversity.)	1
5	To measure the species richness on the field in areas in which the grass/vegetation is regularly and irregularly cut .	1

	MODERN EDUCATION SOCIETY'S **Nowrosjee Wadia College, Pune** **(Autonomous)NEP**	
Bachelor of Science (Hons.) in Biotechnology		
SEMESTER –IV SEC 3		
Year - Second year	**Paper No- BTSEC245**	**Credits 2**
Semester- IV	**Name of Paper- Pathology**	**Hours 30**

Course Outcomes (COs)

On completion of the course, the students will be able to:

1. Learn the basics of pathology.
2. Determine techniques used for study of pathology along with moderndiagnostic aids.
3. Learn various infections and parasitic diseases caused by microbes

Sr No.	COURSE CONTENT / SYLLABUS	Lectures
Unit I	**General Pathology** – • Introduction and scope of pathology review of cell and tissues, • Definition of terms, Methods & techniques, Cellular & tissue changes, Infiltration and regeneration, Inflammations and infections, Wound healing and repair. • Nature of injuries, adaptive responses, reversible & irreversible cell injury • Cell accumulations, Vascular changes Cellular growth and neoplasms • Normal and cancer cell, Benign and malignant growths, *In situ* carcinoma Disturbances of fluid and electrolyte balance	7
Unit II	**Techniques for study of pathology-** • Autopsy pathology • Surgical pathology • Special stains (histochemistry) • Enzyme histochemistry • Basic microscopy, electron microscopy • Immunofluorescence • Immunohistochemistry • Cytogenetic • Diagnostic molecular pathology and other modern aids in diagnostic pathology	8

Unit III **Unit IV**	**Hemodynamics –** • Oedema, • Dehydration • Overhydration • Disturbances in the volume of circulating blood • Hemorrhage • Thrombosis • Embolism • Ischemia • Infarction **Disorders of Leucocytes** • Lymph nodes and WBCs –normal & reactive • Haematologic neoplasms • Myeloid neoplasms Lymphoid neoplasms	7 8

References

1. Harsh Mohan : Text book of Pathology, IV Edition Jaypee Brothers, New Delhi 2000.
2. Heller : Pathology: Comprehensive Review 1999 Edition.
3. Emanuel Rubin M D, John L Farber : Pathology , III Edition , Lippincott, Philadelphia 1999.
4. Carol Mattson Porth : Pathophisiology ,VII Edition Lippincott Philadelphia 2002.
5. Ramzi S Cotran etal : Robins Pathologic basib of disease, VI Edition, W B Saunders coy USA 1999.
6. JCE Underwood : General and systemic pathology , III Edition, Churchill liuvingstone , Philadelphia 2000.
7. Canjanov and Linder : Anderson's pathology, X Edition , Lippincott , Philadelphia 1996.
8. Vinay Kumar M D etal : Basic Pathology , VI Edition W B Saunders coy USA 1997.
9. Walter F Coulson : Surgical Pathology , II Edition J B Lippincott coy Philadelphia, 1988.
10. Parakrama Chandrasoma : Concise pathology, III Edition, Hall International, USA,1998.
11. Lynne's Gracia, M S & David A Brucker : Diagnostic medical parasitology , III Edition ASM press, Washington'2005.
12. Haber et al : Differential diagnosis in pathology , W B Saunders coy, Philadelphia, 2002.

https://www.youtube.com/watch?v=pteO6FRWo3g
https://www.youtube.com/watch?v=Z_SNpo0aW34
https://www.youtube.com/watch?v=R2qgvtGmSrU
https://www.youtube.com/watch?v=G1VnCQGEGuc
https://www.youtube.com/watch?v=bat0uVxNUJ4