DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, CHHATRPATI SAMBHAJINAGR.

CIRCULAR NO.SU/NEP/B.Sc. Honor's/Model College/38/2024

It is hereby inform to all concerned that, the syllabi prepared by the Ad-hoc Boards and recommended by the Dean, Faculty of Science & Technology, the Hon'ble Vice-Chancellor has accepted the **following syllabi under National Education Policy-2020 as per Guidelines of UGC** run at Model College, Ghansawangi Dist.-Jalna in his emergency powers under section 12(7) of the Maharashtra Public Universities Act, 2016 on behalf of the Academic Council as appended herewith.

Sr.No.	Courses	Semester
1.	Honours Degree of B.Sc. Biotechnology	IIIrd & IVth
2.	Honour's Degree of B.Sc. Biochemistry	IIIrd & IVth
3.	Honour's Degree of B.Sc. Computer Science	IIIrd & IVth

This is effective from the Academic Year 2024-25 and onwards.

All concerned are requested to note the contents of this circular and bring the notice to the students, teachers and staff for their information and necessary action.

University Campus,
Chhatrapati Sambhajinagar
431 004.
REF.NO.SU/2024/ 7081-89
Date:- 10.09.2024

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Deputy Registrar,
Academic Section

Copy forwarded with compliments to :-

1] **The Principal, Model College, Ghansawangi Dist. Jalna**
Dr. Babasaheb Ambedkar Marathwada University,

2] **The Director, University Network & Information Centre, UNIC, with a request to upload this Circular on University Website.**

Copy to :-

1] The Director, Board of Examinations & Evaluation, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

2] The Section Officer,[B.Sc.Unit] Examination Branch, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

3] The Programmer [Computer Unit-1] Examinations, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

4] The Programmer [Computer Unit-2] Examinations, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

5] The In-charge,[E-Suvidha Kendra], Rajarshi Shahu Maharaj Pariksha Bhavan, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

6] The Public Relation Officer, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

7] The Record Keeper, Dr.Babasaheb Ambedkar Marathwada University, Chhatrapati Sambhajinagar.

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Dr. Babasaheb Ambedkar Marathwada University
Chhatrapati Sambhajinagar - 431004 (MS) India.

Structure and Syllabus for B.Sc. (Biotechnology)

(Four Years Multidisciplinary Degree Program with Multiple Entry and Exit Option)

FOUR YEAR BACHELOR OF SCIENCE (B.Sc.)
Biotechnology

(For Model College Ghansawangi Dist. Jalna)

Under the Faculty of
Science and Technology

Effective from Academic year 2024 – 2025

(As per NEP-2020)

Chairperson,
BOS in Biotechnology & Bioinformatics.

Dean,
Faculty of Science & Technology,

B. Sc. Biotechnology Second Year (Semester III)

Teaching Scheme

Year/ Semester and Level		Section	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs/ week)	
					Theory	Practical	Total	Theory	Practical
Second Year Semester III	Major	**DSE-5**	NBT301T	Central Dogma	03	--	03	03	--
			NBT301P	Lab based on Central Dogma	…	02	02	--	04
		DSE-6	NBT302T	Introductory Physiology	03	--	03	03	--
			NBT302P	Lab based on Introductory Physiology	---	02	02	---	04
	Supportive	**Minor-1** Select any one course from Basket 1	NBT303T1	Introductory Enzymology	02	--	02	02	--
			NBT303T2	Gene Expression	02	--	02	02	--
			NBT303T3	Environmental Biotechnology	02	--	02	02	--
		Generic Elective Select any one pool of courses offered as a major	NB304T1	Nutrition and Health	02	--	02	02	
			NBT304T2	Microbial diversity, food and dairy microbiology	02	--	02	02	
			NBT304T3	Intellectual Property Rights	02	--	02	02	
	Applied	SEC (Choose any one from pool of	NBT303P1	Lab based on Introductory Enzymology		02	02		04

		major)							
			NBT303P2	Lab based on Gene Expression		02	02	--	04
			NBT303P3	Lab based on Environmental Biotechnology		02	02	---	04
		VSC-3	NBT305T	Food processing and Preservation	02	-----	02	02	--
	AES,VEC, IKS/ Language Curriculum	English	NBT-ENG-303	English	04				
		L1-MIL	NBT-MIL-303	Marathi/Hindi	04				
	VEC/Life Skill Curriculum	JOC-1/FP	NBT306P	Field Project	02	----	02	02	---
		CC-3	NBT307T	Cultural Activities /NSS/NCC	02	----	02	02	---

B. Sc. Biotechnology Second Year (Semester III)

Evaluation/Examination Scheme

Year/ Semester and Level		Section	Course Code	Course Name	Credit		Evaluation Method		Total Marks	Max mark	Min Mark
					Theory	Practical	CA	UA			
Second Year Semester III	Major	**DSE-5**	NBT301T	Central Dogma	03		20	30	50	50	20
			NBT301P	Lab based on Central Dogma	.....	02	--	50	50	50	20
		DSE-6	NBT302T	Introductory Physiology	03		20	30	50	50	20
			NBT302P	Lab based on Introductory Physiology	-----	02	---	50	50	50	20
	Supportive	**Minor-1** Select any one course from Basket 1	NBT303T1	Introductory Enzymology	02	---	20	30	50	50	20
			NBT303T2	Gene Expression							
			NBT303T3	Environmental Biotechnology							
		Generic Elective Select any one pool of courses offered as a major	NB304T1	Nutrition and Health	02	---	20	30	50	50	20
			NBT304T2	Microbial diversity, food and dairy microbiology							
			NBT304T3	Intellectual Property Rights							
	Applied	SEC (Choose any one from pool	NBT303P1	Lab based on Introductory Enzymology	---	02	---	50	50	50	20
			NBT303P2	Lab based on Gene							

		of major)		Expression							
			NBT303P3	Lab based on Environmental Biotechnology							
		VSC-3	NBT305T	Food processing and preservation	02	--	20	30	50	50	20
	AES,VEC, IKS/ Language Curriculum	AEC-1 English	NBT-ENG-303	English	04	---	40	60	100	100	40
		L1-MIL	NBT-MIL-303	Marathi/Hindi	04	---	40	60	100	100	40
	VEC/Life Skill Curriculum	JOC-1	NBT306P	Field Project	02	---	20	30	50	50	20
		CC-3	NBT307T	Cultural Activities /NSS/NCC	02	---	20	30	50	50	20
								Total Marks	700	700	280

B. Sc. Biotechnology Second Year (Semester IV)

Teaching Scheme

Year/ Semester and Level		Section	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs/ week)	
					Theory	**Practical**	**Total**	**Theory**	**Practical**
Second Year Semester IV	Major	**DSE-7**	NBT401T	Developmental Biology	03	--	03	03	--
			NBT401P	Lab based Developmental Biology	…	02	02	--	04
		DSE-8	NBT402T	Applied Enzymology	03	--	03	03	--
			NBT402P	Lab based Applied Enzymology	---	02	02	---	04
	Supportive	**Minor-2** Select any one course from Basket 1	NBT403T1	Basic Immunology	02	--	02	02	--
			NBT403T2	Chromosome Structure and Inheritance	02	--	02	02	--
			NBT403T3	Emerging technologies in Biotechnology	02	--	02	02	--
		Generic Elective /OE-2 Select any one pool of courses offered as a major	NBT404T1	Cancer Biology	02	--	02	02	
			NBT404T2	Applications of Biotechnology	02	--	02	02	
			NBT404T3	Fundamentals of nanoscience	02	--	02	02	
	Applied	SEC-2 (Choose any one from pool of major)	NBT403P1	Lab based on Basic Immunology		02	02		04
			NBT403P2	Lab based on Chromosome Structure and Inheritance		02	02	--	04
			NBT403P3	Lab based on Emerging technologies in Biotechnology		02	02	---	04

		VSC-4	NBT405T	Chromatographic and electrophoretic techniques	02	-----	02	02	--
	AES,VEC, IKS/ Language Curriculum	AEC-2 English	NBT-ENG-401	English	04				
		L2-MIL	NBT-MIL-401	Marathi/Hindi	04				
	VEC/Life Skill Curriculum	VOC-2	NBT406T	Medical Biotechnology	02	----	02	02	---
		CC-4	NBT407T	Fine/Applied/Visual/Performing Arts	02	----	02	02	---

B. Sc. Biotechnology Second Year (Semester IV)

Evaluation/Examination Scheme

Year/ Semester and Level		Section	Course Code	Course Name	Credit		Evaluation Method		Total Marks	Max mark	Min Mark
					Theory	Practical	CA	UA			
Second Year Semester IV	Major	DSE-7	NBT401T	Developmental Biology	03		20	30	50	50	20
			NBT401P	Lab based Developmental Biology	……	02	--	50	50	50	20
		DSE-8	NBT402T	Applied Enzymology	03		20	30	50	50	20
			NBT402P	Lab based Applied Enzymology	-----	02	---	50	50	50	20
	Supportive	Minor-2 Select any one course from Basket 1	NBT403T1	Basic Immunology	02	---	20	30	50	50	20
			NBT403T2	Chromosome Structure and Inheritance							
			NBT403T3	Emerging technologies in Biotechnology							
		Generic Elective /OE-2 Select any one pool of courses offered as a major	NBT404T1	Cancer Biology	02	---	20	30	50	50	20
			NBT404T2	Applications of Biotechnology							
			NBT404T3	Fundamentals of nanoscience							
	Applied	SEC-2	NBT403P1	Lab based on Basic Immunology	---	02	---	50	50	50	20

		(Choose any one from pool of major)	NBT403P2	Lab based on Chromosome Structure and Inheritance							
			NBT403P3	Lab based on Emerging technologies in Biotechnology							
		VSC	NBT405T	Chromatographic and electrophoretic techniques	02	--	20	30	50	50	20
	AES,VEC, IKS/ Language Curriculum	AEC-2 English	NBT-ENG-401	English	04	---	40	60	100	100	40
		L2-MIL	NBT-MIL-401	Marathi/Hindi	04	---	40	60	100	100	40
	VEC/Life Skill Curriculum	VOC-1	NBT406T	Medical Biotechnology	02	---	20	30	50	50	20
		CC-2	NBT207T	Fine/Applied/Visual/Performing Arts	02	---	20	30	50	50	20
								Total Marks	**700**	**700**	**280**

Curriculum of Semester –III

B.Sc. Biotechnology Honours (Semester III)

NBT301T: Central Dogma

Paper: DSC-5
Contact Hours: 45 (Clock Hours)

Total Credit: 03
Marks: 30

Unit 1. Replication

Replication in Prokaryotes –*Escherichia coli* replication as role model, DNA polymerases – with reference to their functional properties, formation of replication fork, primer formation, replication on leading and lagging strand, termination of replication. **Eukaryotic DNA replication**: Origin Recognition Complex, Licensing factor, components of replicase and other polymerases. Replication fork –experimental proof for multiple replication forks in eukaryotes. Process of replication, initiation, elongation and termination. Replication of Extra chromosomal material

Unit 2. Transcription

Transcription in *Escherichia coli* -a role model for prokaryotes –RNA polymerase:structural components and assembly of core and holoenzyme. **Transcrition initiation** Bacterial transcription; RNA Polymerase, transcription initiation, transcription elongation, transcription termination and antitermination. **Eukaryotic transcription:** RNA polymerases,Transcription initiation; Transcription elongation; Transcription termination

Unit 3 Translation

Prokaryotic translation –translation initiation, ribosome assembly, RBS – Shine Dalgarno sequence, initiation codon, initiation complex, initiator tRNA, P site,A site and E site –their relevance in translation, translocation,**Translation elongation** structural different between initiator tRNA and methionine tRNA during elongation, transpeptidation and chain elongation. Translation fidelity.**Translation termination** factors and release of ribosomes and their recycling.

Eukaryotic translation: translation initiation ; Formation of initiation complex, P site, A site and E site, their role during mRNA translation. **Translation elongation;** comparative studies of elongation with *E. coli*.

Translation termination; factors, release of ribosomes and recycling, regulation.

References:

1. Molecular Biology –David Frifelder
2. Genes IX –Benjamin Lewin
3. Molecular biology of the gene J. D. Watson and *et. al.,*
4. Molecular Biology of the Cell –Bruce Alberts and *et. al.,*
5. Genetics: Conceptual approach by Benjamin Pierce
6. i-Genetics: A molecular approach 3rd edition, -Peter J. Russel.

NBT301P : Lab Based on Central Dogma

Paper: Lab Course
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 50

1. Demonstration of Mitosis –onion root tips experiment
2. Meiosis slide demonstration (permanent slides)
3. Plasmid DNA isolation
4. Plasmid Curing
5. Isolation of total proteins from bacterial cell.

NBT302T: Introductory Physiology

Paper: DSC-6 | Total Credit: 03
Contact Hours: 45 (Clock Hours) | Marks: 30

Unit 1. Elements of Animal Physiology

Definition of digestion, types of digestion – (extra and intracellular), general principles of digestion
Definition of excretion; Forms of nitrogenous waste material and their formation;
Types of respiration – external and internal respiration;
Transport of oxygen and CO_2
General structure and types of muscles, Ultra structure of skeletal muscle.
Structure of nerve cell; Nature and Properties of nerve impulse
Concept of Homeostasis and its basic working mechanism. (giving three illustrations viz., Hormonal control of glucose levels, Water and ionic regulation by freshwater and marine animals and temperature regulation in man.)

Unit 2. Photobiology of plants

Significance, site of photosynthesis, pigments, photochemical phase. Electron transport chain. Photophosphorylation, (cyclic and non cyclic). Biosynthetic phase, Calvin cycle, C3 and C4 pathways. Photorespiration, Crassulacean Acid Metabolism, factors affecting photosynthesis. function and mechanisms of action of phytochromes, cryptochromes and phototropins; photoperiodism and biological clocks. Brief account only.)

Unit 3. Elements of Plant Physiology

Plant Cell as a physiological unit. Osmosis, Imbibition. Diffusion, D.P.D. Water potential,

Absorption of water, (active & passive). Plasmolysis, cohesion, tension and transpiration pull theory. Significance, factors affecting transpiration,

Phases of growth, growth curve. Plant growth regulators Auxins, Gibberillins, Cytokinins Ethylene, Absisic acid physiological functions only. Senescence brief account only.

Responses of plants to biotic (pathogen and insects) and abiotic (water, temperature and salt) stresses; mechanisms of resistance to biotic stress and tolerance to abiotic stress

Reference books

1. 'Essentials of Animal Physiology' by S.C.Rastogi'
2. 'Animal Physiology' by H.C. Nigam.
3. 'Biology' by Campbell & Reece.
4. 'Animal Physiology' – Agarwal, R.A. Srivastava, Kaushal, Anil and Kumar.
5. 'Animal Physiology and Biochemistry' by Dr. B.Annadurai.
6. 'Principles of Animal Physiology' by Christopher D.Moyes, Patricia M Schulte.
7. 'Biology: The Science of Life' by R.A. Wallace, G.P. Sanders & R.J. Ferl.
8. 'Biology: Concepts and Applications' by Starr
9. Bilgrami K.S & Dube A text book 0n Modern Plant Pathology. Vikas Publishing House, New Delhi.

NBT302P : Lab Based on Introductory Physiology

Paper: Lab Course
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 50

1. Effect of P^H on amylase
2. Effect of Temperature on amylase
3. Estimation of Salivary Amylase
4. Estimation of urine constituents
5. Effect of stomata number on rate of transpiration. (Cobalt Chloride test)
6. Imbibition
7. Osmosis
8. Extraction of photosynthetic pigments (Paper Chromatography)

NBT303T1: Introductory Enzymology

Paper: Minar-1 Total Credit: 02
Contact Hours: 30 (Clock Hours) Marks: 30

Unit 1 Introduction to enzymes

Introduction & Definition of Enzymes, Historical Development in Enzymology, Enzyme Vs Chemical Catalysts Coenzymes, Cofactors, Apoenzymes, Holoenzyme, .Isoenzymes and multiple forms of enzymes , Characteristics of enzymes, Concept of active centre, binding sites, Enzyme mechanism & Activation Energy, Enzyme Specificity, , Fischer and Koshland Models Classification - IUB system, rationale, overview and specific examples. Characteristics of enzymes,

Unit 2 enzyme kinetics

ES complex formation Michaelis - Menten Equation - form and derivation, steady state enzyme kinetics. Significance of Vmax and Km, Graphical procedures in enzymology - advantages and disadvantages of alternate plotting.

Enzyme inhibition - types of inhibitors - competitive, noncompetitive and uncompetitive, their mode of action and experimental determination ,

Unit 3: Enzyme isolation and purification

Introduction, Criteria for selection of tissue/ organism, Enzyme solubilization techniques,Techniques used for enzyme isolation, Methods of enzyme purification, Fractionation of the proteins on the basis of solubility in aqueous solutions of salts or organic solvents, Chromatographic separation of the enzymes (brief discussion on applications of Ion exchange chromatography Adsorption chromatography Gel filtration (Molecular sieve) chromatography Affinity chromatography in enzyme separation)

Miscelleneous methods: Electrophoretic techniques, Ultrafiltration Dialysis Crystallization Criteria of purity of the enzymes, Preparation of purification table, Characterization of enzymes Determination of molecular weight of the enzyme protein, Sodium dodecyl sulfate (SDS) polyacrylamide gel electrophoresis for subunit molecular weight determination,

References

1. Dixon & Webb –Enzymes; Academic press New York
2. A.L. Lehninger- Biochemistry
3. A.L. Lehninger, D. L. Nelson & M M Cox – Principles of Biochemistry.
4. Cohn & Stump – Outline of Biochemistry; Wiley Eastern Ltd.
5. Lubert Stryer – Biochemistry
6. R.L. Foster – The nature of Enzymology; Croom-Helm London
7. Harpers -Review of biochemistry –;Prentice HallNew york
8. R.A. Copeland -Enzymes: A Practical Introduction to Structure, Mechanism and Data Analysis,; John Wiley and Sons Inc.

NBT303T2: Gene Expression

Paper: Minar-1 Total Credit: 02
Contact Hours: 30 (Clock Hours) Marks: 30

Unit 1: Basics of Gene Expression

Regulatory elements/factors: (Inculcate concepts with suitable examples for; Cis-acting elements,Trans-acting factors. Exceptional proteins behaving Cis-acting).Regulation of transposition of Tn3 and Tn9. Modifications of Cis-acting elements to influence and to affect regulation. Influencing or affecting gene expression as a presence/or absence of functional form of protein factor. Concept of Activator, Co- activator, Repressor (with suitable examples). Examples with mechanisms; specific regulator and global regulator.

DNAproteininteractions,RNAproteinInteractions– conditions favoring and affecting these interactions (to be dealt with ref to Motifs).

Unit 2: Bacterial Gene Expression and regulation

Concept of Operon, Regulation of gene expression; **positivecontrol**–the *ara* operon,**negativecontrol**–paradigm the *lac* operon and **attenuation mediated control** or post-transcriptional regulatory control–the *trp* operon. (Mustinclude structural organization of above operons, functional relevance of genes within, regulatory circuit,modes by which the operon can be regulated other than above mentioned mode.) Concept of Catabolite Repression. Examples of non-catabolite sugars and their regulation, catabolite repression in amino acid metabolism–examples at molecular level.

Unit3 Eukaryotic Gene Expression and regulation

Activators:-gene specific and generalized type of activator.Domains of activators, proteinand DNA/or RNA binding domain. Modification of activator.Enhancer mediated gene expression – examples. Gene expression of metallothionin egeneexpression. Response elements suchas; steroid hormone response elements, metal response elements, Basal Expression response elements.Regulation of gene expression at a step of activation of basal apparatus, Postinitiation gene expression– mechanism of relieving roadblock (stuttering of RNA polymerase) with example.Regulation of mRNA molecules involving both nonstop and nonsense mechanisms Gene regulation with example–posttranscriptional–yeastand *Drosophila* genes, insulators in genomic imprinting–concept and example.

References:

1. Biochemistry–Lehninger
2. PrinciplesofBiochemistry–NelsonandCox
3. Microbialgenetics–DavidFrifelder
4. MolecularBiology–DavidFrifelder
5. Genes –IX
6. Genes -X
7. Principlesofgenemanipulations–OldandPrimrose
8. Biochemistry–JeremyM.Berg,JohnL.Tymoczko,andLubertStryer
9. PrinciplesofGeneManipulationsLPEPearson-Watson
10. Genetics–Strickberger

NBT303T3: ENVIRONMENTAL BIOTECHNOLOGY

Paper: Minar-1
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 30

Unit: 1

Introduction to Ecology and ecosystem. Environmental pollution (Water, soil and Air), noise and thermal pollution, their sources and effects. Waste water (sewage and industrial effluents) treatments: anaerobic and aerobic treatment, conventional and advanced treatment technology, methanogenesis, methanogenic, acetogenic and fermentative bacteria - technical process and condition, emerging biotechnological processes in waste- water treatment.

Unit: 2

Solid waste management: Landfills, composting, earthworm treatment, recycling and processing of organic residues.

Unit: 3

Biodegradation of xenobiotic compounds, organisms involved in degradation of chlorinated hydrocarbons, substituted simple aromatic compounds, polyaromatic hydrocarbons, pesticides, surfactants and microbial treatment of oil pollution.

References:

1. Environmental Microbiology; W D Grant & P E Long, Blakie, Glasgow and London

2. Microbial Gene Technology: H Polasa (ED) South Asian Publishers, New Delhi.

3. Biotreatment Systems, Vol. 22, D L Wise (Ed) CRC Press, INC

4. Standard Methods for the examination of water and waste water (14th Education) 1985. American Public Health Association

NBT304T1: Nutrition and Health

Paper: Generic Elective
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 30

Unit-1: Introduction:

Introduction Concepts of nutrition and health. Definition of Food, Diet and nutrition, Food groups. Food pyramids. Functions of food. Balanced diet. Meal planning. Eat right concept. Functional foods, Probiotics, Prebiotics, and antioxidants.

Unit-II: Nutrients

Macro and Micronutrients - Sources, functions and deficiency. Carbohydrates, Proteins, Fats – Sourcesand calories. Minerals–Calcium,Iron,Iodine. Vitamins – Fat soluble vitamins –A, D, E& K. Water soluble vitamins – Vitamin C, Thiamine,Riboflavin,Niacin. Water– Functionsandwaterbalance.Fibre Functions and sources.RecommendedDietaryAllowance,BodyMassIndexand Basal Metabolic Rate

UNit III : Nutrition and Health

Methodsofcookingaffectingnutritionalvalue.Advantagesanddisadvantages.Boiling,steaming, pressure cooking. Oil/Fat – Shallow frying, deep frying. Baking. Nutrition andlifestyle.Nutritionalrequirement,dietaryguidelines:Adulthood,Pregnancy,Lactation,Infancy Complementaryfeeding,Pre-school,Adolescence,geriatric.Nutritionrelatedmetabolicdisorders diabetes and cardiovascular disease

References

1. SriLakshmiB, (2007),Dietetics.NewAgeInternationalpublishers.NewDelhi

2 SriLakshmiB, (2002),NutritionScience.NewAgeInternationalpublishers.NewDelhi

3 SwaminathanM.(2002),AdvancedtextbookonfoodandNutrition.VolumeI.Bappco

4Gopalan.C.,RamaSastryB.V.,andS.C.Balasubramanian(2009),NutritivevalueofIndianFoods.NIN. ICM R.Hyderabad.

5MudambiSRandRajagopalMV,(2008),FundamentalsofFoods,Nutrition&diettherapybyNewAgeIntern ational Publishers, NewDelhi

NBT304T2: Microbial diversity, food and dairy microbiology

Paper: Generic Elective | Total Credit: 02
Contact Hours: 30 (Clock Hours) | Marks: 30

Unit I :Algae, Fungi and Protozoa, eubacteria, Gram positive aerobic, Gram positive anaerobic, Gram negative facultative anaerobic, Gram negative anaerobic.

Units II –Dairy Microbiology; milk definition, sources of contamination, Microbial count, pasteurization, milk products.

Unit III –Food preservations, radiation, low temperature, high temeperature, chemicals, antimicrobials, FDS, ISI, and EPA.

Reference

1. Brocks Biology of Microorganisms. 8th Edition by Michael T. Madigan, John M. Martinko. Jack Parker.
2. Microbiology by Pelczar.
3. Microbial Diversity by Colwd, D. 1999, Academic Press.
4. Microbiology: Dynamics and Diversity by Perry.
5. Microbial Ecology. Fundamentals and Applications by Ronald M. Atlas and Richard
6. Food Microbiology. 2nd Edition By Adams
7. Basic Food Microbiology by Banwart George J.
8. Food Microbiology: Fundamentals and Frontiers by Dolle
9. Dairy Microbiology by Robinson.
10. Applied dairy Microbiology, by Elmer H. Marth , James L. Steele
11. Text book of modern pathology by Dube H.C. and Bilgrami. K.S.(1976) Vikas publishing house. New Delhi

NBT304T3: Intellectual Property Rights

Paper: Generic Elective
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 30

Unit1:IPR

Genesisandscope.TypesofIntellectualpropertyrights Patent,Trademarks,Copyright,Design,Trade secret,Geographicalindicators,Plantvarietyprotection .NationalandInternationalagencies – WIPO, World Trade Organization (WTO), Trade-Related Aspects of IntellectualPropertyRights (TRIPS),GeneralAgreement onTariffsand Trade(GATT).

Unit 2 :Patenting,process,andinfringement

Basics of patents - Types of patents; Patentable and Non-Patentable inventions, Process andProduct patent. Indian Patent Act 1970; Recent amendments; Patent Cooperation Treaty (PCT)and implications. Process of patenting. Types of patent applications: Provisional and completespecifications;Conceptof"priorart",patentdatabases(USPTO,EPO,India).Financialassist ance, schemes, and grants for patenting. Patent infringement- Case studies on patents(Basmatirice, Turmeric,Neem)

Unit3: Trademarks,Copyright,industrial Designs

Trademarks- types, Purpose and function of trademarks, trademark registration, Protection oftrademark.Copyright Fundamentalsofcopyrightlaw,Originalityofmaterial,rightsofreproduction ,industrialDesigns: Protection,Kind ofprotection provided byindustrial design

References

1 ManishArora.2007.Universal'sGuidetoPatentsLaw(English)4thEdition)-Publisher:UniversalLawPublishingHouse
2 KalyanC.Kankanala.2012.FundamentalsofIntellectualProperty.AsiaLawHouse
3Ganguli,P.2001.IntellectualPropertyRights:Unleashingtheknowledgeeconomy.NewDelhi:TataM cGra w-HillPub
4 Worldtradeorganization -http://www.wto.org 5 WorldIntellectualPropertyorganization–www.wipo.int OfficeofthecontrollergeneralofPatents,Design&Trademarks -www.ipindia.nic.in

NBT303P1: Lab Based on Introductory Enzymology

Paper: SEC
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 30

1. Extraction of Amylase.
2. Purification of Amylase.
3. Assay of α Amylase.
4. Extraction of Urease.
5. Effect of temperature on Enzyme activity

NBT303P2: Lab Based on Gene Expression

Paper: SEC
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 30

1 Isolationof Lactose negative mutants

2 Study of catabolite repression with the example of gal operon

3 Study of non-catabolite repression.

4 Study of impact of catabolite repression on amino acid metabolism

5 Yeastâ-galactosidase assay.

6 Two-hybrid system demonstration (demonstration thru kit–could be asked in examination).

7 Isolation of Trptophan negative mutant and theoretical mapping.

8 Isolation of Arabinose negative mutant and theoretical mapping.

9 Study of the β-galactosidase assay of the lacY and lacZ mutants.

10 Study of mutants isolated with mutagen with reference to differential- galactosidase Activiy

NBT105P3: Lab Based on Environmental Biotechnology

Paper: SEC
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 30

1. Isolation of rhizosphere microflora
2. Isolation of phylloplane
3. Isolation of actinomycetes from soil
4. Isolation of Rhizobium and Agrobacterium
5. Vessicular Arbuscular Mycorhiza (VAM)
6. Isolation of sporocarp by sieve method
7. Isolation of air microflora- exposure plate method, rotorod sampler method
8. Water Microbiology Testing for quality of water (coliform test), H2S strip method

NBT303T: Food processing and preservation

Paper: VSC-3 Total Credit: 02
Contact Hours: 30 (Clock Hours) Marks: 30

Unit I : Food Processing:

•Definition and Difference between Food Processing and Food Preservation; Functions, Benefits and Drawbacks of Food Processing •Primary Processing Techniques – dicing, slicing, mincing, macerating, liquefaction, emulsification •Novel Food Processing – mushrooms, algae, leaf protein concentrates, protein from yeast, food analogues, edible insects. • Microbial processing of milk- Curd, Yogurt, Butter, Kefir, Cheese.

Unit II

Role of microorganisms in food spoilage: Food Spoilage: Microbial, physical, chemical and miscellaneous. Factors affecting growth of microbes in food (intrinsic and extrinsic factors), Spoilage of meat and poultry, Fruits and vegetable, canned food and spoilages of milk and milk products

Unit III

Food Preservation: Introduction to food preservatives: Introduction and historical developments of food preservation. Heat Preservation and Processing: canning of foods, canning process Dehydration: **Dehydration:** water activity, drying process, types of dryers, dehydration effect in food. Concentration: Technology of concentration, equipment, process, and changes in food during concentration. Intermediate Moisture (IM) Foods: Principles, characteristics, advantages

Storage and it's type: Refrigeration Storage: Requirements of refrigeration storage, changes in foods during refrigeration storage. Freezing and Frozen Storage: factors determining freezing rate, types of freezers, and changes in food during freezing. Ionizing Radiation: Source; equipment; mechanism of preservation, effect on food. Microwaves: equipment and its effect on food. Household Preservation Methods: Salt curing, oiling and smoking. Chemical Preservation: types, uses and effects of class I and class II preservatives in foods.

References Books :

1. Food Microbiology, Frazier & Westhoff, 4th edition, Tata McGraw Hill Publications
2. Modern Food Microbiology, James Jay, 7th edition, Springer Publications
3. Advances in Biotechnology, S. N. Jogdand, Himalaya Publishing House
4. Milk & Milk Products, C. Eckles, 4th edition, Tata McGraw Hill Publications

NBT306P: Field Project

Paper:VEC
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 30

Project : Guidelines

1) Project should be NOT less than 10000 word

2) One copy of the project should be hand-written

3) Other 3 copy typed and submit to Collage/ Institute / Department

4) Project should be written in International standard with at least or not less than

30 references.

5) References quoted should be from peer reviewed international journals, available on Scopus/ Research Gate/ Or Pubmed and should not be merely from www.google.com.

6) The dissertation preparation must be as per research article published in "CELL" http://www.cell.com/cell/authors . Please avoid guidelines provided for Resource article, Theory articles matters arising article or review.

7) Your dissertation may include figures and tables more than in number prescribed by Cell for a Research article. This is because, you are not additionally providing "Supplement information" all data is to be included in the dissertation.

8) Project may pertain to the above mentioned themes or relevant to any course studied during last year.

Curriculum of Semester –IV

NBT401T: Developmental Biology

Paper: DSC-7
Contact Hours: 45 (Clock Hours)

Total Credit: 03
Marks: 30

Unit 1 :Developmental Biology an overview

Introduction of animal development:Development among unicellular eukaryotes– *Acetabularis*,*Naegleria*.The origins of sexual reproduction. Fertilization: structure of gamets, recognition of sperm and egg–action at distance and contact of gametes. Cleavage: Patterns of embryonic cleavage, radial holoblastic cleavage, spiral holoblastic cleavage, mechanisms of cleavage–regulation of cleavage cycles.

Unit 2 :Early Embryonic Development ,Cell death and regeneration Gametogenesis,Fertilization,Embryo sac development and double fertilization in plants, blastula formation, Types of Cleavage, Gastrulation and formation of germlayers in animals. Study of extra-embryonic membrane in chick, concept of regeneration programmed cell death and aging and senescence

Unit 3 :Morphogenesis and organogenesis in animals

Cell aggregation and differentialin *Dictyostelium;* axes and pattern formation in *Drosophila,*organogesis–vulva formation in *Caenorhabditis elegans;* eyelens induction, limb development invetebrates, neuron differentiation,-larval formation, metamorphosis; environmental regulation of normal development.

References

1. Developmental Biology by Scott Gilbert-9th edition
2. Balinsky–An introduction to embryology CBScollege Publishers
3. LodishH,*et.al.,* Molecular Cell Biology
4. Alberts Bruce, *et.al.,* MolecularBiologyoftheCellSinauer
5. 5. Grant–Biology of Development systems, Holt.Reihart,Winston.
6. Developmental Biology website companion to Gilbert- http://www.devbio.com/contents.php

NBT401P: Lab Based on Developmental Biology

Paper: DSC-7 Total Credit: 03
Contact Hours: 45 (Clock Hours) Marks: 50

1. Study of meiosis in Grasshopper testis/ onion buds
2. Study of development of frog embryo from permanent slides (at least five)
3. Study of different types of cancer cell
4. Study of Pores of Chick Egg Shell
5. Study of Chick Egg Shell Membrane
6. Observation of Egg Chalazae
7. Antimicrobial Activity of Chick Egg
8. Observation of Blastodisc
9. Study of Totipotency in Plants

NBT402T: Applied Enzymology

Paper: DSC-8
Contact Hours: 45 (Clock Hours)

Total Credit: 03
Marks: 30

Unit 1: Regulatory Enzymes &Structure Function Relations:

Allosteric enzymes with their properties, Regulatory role of allosteric enzymes in metabolism, Mechanism of ALLOSTERIC INTERACTIONS:Protein ligand binding including measurements, analysis of binding isotherms, co-operativity Hill and Scatchard plots and kinetics of allosteric enzymes

Modes of enzyme regulation: Allosteric regulationProduct inhibition, feedback control, enzyme induction and repression and covalent modification.

Specific examples of enzymes with respect to Structure Function Relations

Lysozyme, ribonuclease, trypsin, carboxypeptidase, phosphorylase, aspartate transcarbamylase, : PFK-1, Fructose 1, 6 Bisphosphataseglutamine synthetase and phosphofructo kinase. Multi enzyme complexes - pyruvate dehydrogenase and fatty acid synthetase; Na - K ATPase.

Unit 2: Immobilized Enzymes:

Relative practical and economic advantage for industrial use, effect of partition on kinetics and performance with particular emphasis on charge and hydrophobicity (pH, temperature and Km). Various methods of immobilization - ionic bonding, adsorption, covalent bonding (based on R groups of amino acids) , microencapsulation and gel entrapment. Immobilized multienzyme systems

Biosensors - glucose oxidase, cholesterol oxidase, urease and antibodies as biosensors

Unit 3: Enzyme DisoredersIn Humans

Enzyme involved, diagnostics, physiological effects, physical impact (if any), treatment and cure, prevention of manifestation of following disordersTay-Sachs Disease, Gaucher's Disease, Galactosemia, MethylmalonicAcidemia, Propionic Acidemia, Alkaptonuria, Phenylketonuria G6PD Deficiency,Congenital Adrenal Hyperplasia, Pyruvate Kinase Deficiency.

References

1. Dixon & Webb –Enzymes; Academic press New York
2. A.L. Lehninger- Biochemistry
3. A.L. Lehninger, D. L. Nelson & M M Cox – Principles of Biochemistry.
4. Cohn & Stump – Outline of Biochemistry; Wiley Eastern Ltd.
5. LubertStryer – Biochemistry
6. R.L. Foster – The nature of Enzymology; Croom-Helm London
7. Harpers -Review of biochemistry –;Prentice Hall New york
8. R.A. Copeland -Enzymes: A Practical Introduction to Structure, Mechanism and Data Analysis,; John Wiley and Sons Inc.
9. Zuby,Parson, and Vanse –principles of Biochemistry; Wm.C. Brown Publishers

NBT402P: Lab Based on Applied Enzymology

Paper: DSC-8 Total Credit: 03
Contact Hours: 45 (Clock Hours) Marks: 50

1. Production of bacterial / fungal – alpha amylase.
2. Partial purification of – amylase by salt precipitation method.
3. Assay of alpha amylase in terms of reducing sugar produced & calculation of Enzyme unit.
4. Extraction of unease from horse gram seed / jack bean meal & estimation of its Activity in terms Ammonia.
5. Extraction of papain form papaya leaves. Estimation of its activity in terms of Ammonia.
6. Characterization of alpha Amylase, invertase using PAGE.
7. extraction urease and its assay

NBT403T1: Basic Immunology

Paper: Minar-1 Total Credit: 02
Contact Hours: 30 (Clock Hours) Marks: 30

1. **Types of immunity**: innate, acquired, active and passive. Elements of immune system: Hematopoiesis, T-cells, B-cells, myeloid cells, antigen presenting cells, cell mediated subset of T-Cells, helper and suppressor cells, cell medicated and humor immunity, antibody dependent cell mediated cytotoxicity, natural killer cells. Primary and Secondary organs of immune system

2. Cellular and molecular aspects:

Antigens :- Immunogenicity Vs antigenicity, factors affecting antigenicity, epitopes, haptens, adjuvants. Antigen antibody interactions: - forces of antigen antibody interaction, principle, methods and applications of precipitation and agglutination. Antibody structure, function and diversity antigen-antibody reactions, T-Cells receptors, cell activation complement, lymphokines, regulation of immune response, immunological tolerance. Recognition of antigen: MHC, antigen processing and presentation, T-cell and B - cell activation.

3. Hypersensitivity: An allergy, types of hypersensitivity. Immunology of hypersensitivity. Secondary immune response. Autoantibodies – Autoimmune diseases. Examples such as; Rheumatoid Arthritis, Myasthenia Gravis, Systemic LupesErythematus, Rhesus incompatibility, Protection of fetus from immune response. Immunotechniques: Immuno diffusion, immunoelectrophoresis ELISA, RIA, fluorescence activated cell sorter, PBMC, immunoblotting.

REFERENCE BOOKS

1. Immunology Kuby, R.A. Goldsby, T.J. Kind 1997, 4th Edition B.A. Osborne. 2. Essential of immunology Ivan Riot-Blakswel 1997, 4th Edition B.A. Osborne

3. Fundamentals of Immunology Paul W.E. (Eds.) 1998 Raven press, New York.

4. Text Book of Microbiology by Panikar and Anantnarayan 2009.

5. General Microbiology by Davis

6. Medical Microbiology by Duguid and Cruikshank

NBT403T2: Chromosome Structure and Inheritance

Paper: Minar-1 Total Credit: 02
Contact Hours: 30 (Clock Hours) Marks: 30

Unit 1. Genetic material: structural organization

Discovery of genetic material –Experimental evidences. Genomes of bacteria, viruses and eukaryotic cell. Genome complexity in terms of C-value paradox, Denaturation –Renaturation kinetics –Cot Values, repetitive and non-repetitive DNA, Subcellular genomes, extrachromosomal genoems, Organelle genome, DNA topology and manipulation of DNA topology –Feulgen reaction, Structure of DNA and forms of DNA. Chromosome: Structure of a typical circular and linear chromosomes, molecular nature and functioning of centromeres and teleomeres, Giant chromosome, Polytene chromosome. Chromatin Organization: Euchromatin, Heterochromatin, Nucleosome as a subunit of chromatin, organization of hisotone octamer, acetylation and deacetylation of histones, roles of methylation and demethylation of DNA in CpG islands.

Unit 2. Transmission and Dominance of Genetic Material

Mendelian Principles: I Segregation; Mendels experiment, terminology, testing phenotypes, examples of gene differences and segregation. Mendelian Principles II: Independent Assortment; Genotypes of dihybrid crosses, testing dihybrid genotypes, crosses involvling three or more gene differences, history of Mendel's Discovery, Correspondence between Mendelian factors and chromosome symbols, segregation and Assortment in haploid organisms. Tetrad analysis : Neurospora crassa, Saccharomyces cerevisiae –gene conversion. Modern Evaluation of Mendels Conclusion. Dominance relations and multiple alleles: Incomplete dominance,overdominance, codominance and blood types, multiple alleles, Multiple-Allelic Blood-Group systems, RH and ABO incompatibility, Histocompatibility genes and antibodyformation. Gene interaction and Lethality: Epistasis, Additivity, Interaction between morethan two gene pairs, modifiers, lethality, segregation distortion.

Unit 3. Sex determination and cytoplasmic heredity

Sex determination: Simple mechanisms: one or a few genes. The XX-XY mechanism of sex determination, species with heterogametic females.The Sex Chromosome, The Y chromosome: dominant male determinants, but few other genes, compound sex chromosomes, sex determination, meiotic behavior of sex chromosomes and Nondisjunction. The balance concept of sex determination in Drosophila. Haplodiploidy and sex determination in Hymenoptera, mosaics and gynandromorphs. Sex linked dominance, sex limited gene expression and sex linked inheritance. Sex linkage, Bridges' demonstration of Nondisjunction, attached-X, Sex Linkage in Moths and Birds, Reptiles (Snake), Detection of Sex linked diseases in humans, Sex ratio, X-inactivation, dosage compensation. X-linked disorder –females as carriers, hemophilia, sickle cell anemia, fragile-X-syndrome, Huntingtons disease, (only introductory). Maternal Effect and Cytoplasmic heredity: Maternal effect –P element, Pila genetics, mitochondrial DNA (mtDNA), chloroplast DNA (cpDNA), Streptomycin resistance in chlamydomonas, respiratory deficiencies, cytoplasmic DNA criteria for extrachromosomal inheritance, infectious heredity.

References:

1. Genetics, Third edition by Monroe W. Strickberger First Indian Impression

2006.

2. Principles of Genetics, Eighth edition, Gardner, Simmons and Snustad.2001.

3. Molecular Genetics An introductory Narrative. Second edition, by Gunther S.

Stent and Richard Calendar –University of California Berkley 1986 first

Indian edition and reprint 2004.

4. Principles of Genetics, Temin Baltimore.

5. Genetics By Wintergreen.

NBT403T3: Emerging technologies in Biotechnology

Paper: Minar-1 Total Credit: 02
Contact Hours: 30 (Clock Hours) Marks: 30

UNIT - I

Stem cell technology: Unique properties of stem cells, embryonic stem cells, Adult stem cells: occurrence and functions, tests, cell differentiation and stem cell plasticity and transdifferntiation, medical applications of stem cells, Advantages and disadvantages of stem cell technology, Recent trends in stem cell technology.

UNIT - II

Introduction to Nanoscience: Definition of Nanoscience and its applications, Nanotechnology – History – Kinds of nanomatter, Biosynthesis of nanomaterials. Safety aspect of Nanobiotechnology. Nano biochips and devices. Biomedical applications of Nanomaterials. Nanoparticles in food and cosmetic application.

UNIT – III

The role of transducer and its applicability. Role of antibodies in biosensing; Nano biosensors applications of biosensors in medicine, food industry and environmental monitoring. RNAi Technology: History and discovery, Cellular mechanism- dsRNA cleavage, micro RNA, RNA induced silencing complex (RISC), activation and catalysis, transcriptional silencing, variation among organisms, biological functions, technological applications- gene knock down, functional genomics, medicine, and biotechnology

REFERENCE BOOK

1. Sasidhara R, Animal Biotechnology, MJP Publishers, Chennai, 2006.

2. M.M. Ranga, Animal Biotehnology, Student Edition, Chennai.

3. Geoferey M. Cooper, The Cell, A molecular approach, 3rd Edition, ASM press, Washington, D.C. 2004.

4. Gregory J. Hannon, RNAi – A guide to gene silencing, Cold Spring Harbor Press, 2003.

NBT404T1: Cancer Biology

Paper: Generic Elective
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 30

Unit I

Fundamentals of cancer biology: Introduction to Cancer Biology, Tumor suppressor genes, modulation of cell cycle in cancer, Different forms of cancers, Cancer screening and early detection, Detection using biochemical assays, tumor markers, molecular tools for early diagnosis of cancer

Unit II

Principles of carcinogenesis: Theory of Carcinogenesis, Chemical carcinogenesis, principles of physical carcinogenesis, X-ray radiation-mechanisms of radiation carcinogenesis, Diet and cancer.

Unit III

Principles of molecular cell biology of cancer: Signal targets and cancer, activation of kinases; Oncogenes, identification of oncogenes, retroviruses and oncogenes, detection of oncogenes, Oncogenes/proto oncogene activity, Growth factors related to transformation, Telomerases. Principles of cancer metastasis: Clinical significances of invasion, Metastatic cascade, Basement membrane disruption, proteinase and tumor cell invasion. New molecules for cancer therapy: Different forms of therapy, chemotherapy, radiation therapy, detection of cancers, prediction of aggressiveness of cancer, advances in cancer detection. Use of signal targets towards therapy of cancer; Gene therapy

References:

1. The Cell: Cooper
2. Principles Of Cancer Biology: Pearson New International Edition
3. Introduction to the Cellular and Molecular Biology of Cancer" by L M Franks
4. The Biology of Cancer" by Robert A Weinberg

NBT404T2: Applications of Biotechnology

Paper: Generic Elective
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 30

UNIT-I

History and scope of Biotechnology, Definition of Biotechnology, Old & Modern Biotechnology, Different areas of Biotechnology.

UNIT-II

Biotechnology and Agricultural, Micro propagation, (Cell and Tissue culture) Transgenic plants, Biofertilization, organic farming, Biopesticides.

UNIT-III

Application of Biotechnology in Animal sciences, Animal cell and tissue culture, production of transgenic animals, cloning of animals (IVF & ET) cryopreservation somatic production of animals, application of human vaccines in improving productivity. Biotechnology and Environment: Microbial agents and Biochemical methods of xenobiotic degradation, OEMs, Waste water and solid waste management.

Reference Books

1. Gene Cloning – Brown.

2. Concepts in Biotechnology- Balasubramanyam.D.

3. Basic Biotechnology - Colin Rotledge and Kristainsen.

4. Gene Biotechnology – Jogdan.

5. From Genes to Clones, Introduction to Gene.

6. Technology- Winnacker, Ernst.L.

7. Safety, Moral, Social and Ethical issues related to genetically modified foods - Smith J.E.

8. Molecular Biology and Biotechnology - Meyer R, A.

9. Environmental Biotechnology- Forster and wase.

10. Biotechnological Innovations in Environmental.

11. Management - Leach and Van Dam-mieras.

12. Industrial Microbiology and Biotechnology- Demain and Solomon.

NBT404T3: Fundamentals of Nanoscience

Paper: Generic Elective
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 30

Chapter I Introduction and History

Background, historical development of nanomaterials, units, Scaling laws: (in mechanics,electricity, electromagnetism, optics, heat transfer, fluids), organization of matter-atoms,molecules, clusters and supramolecular. Need based introduction to quantum effects. Structureand Bonding: Chemical bonds (types and strength), Intermolecular forces, Molecular andcrystalline structures- Bulk to surface transition and calculations, density of states, bandgap anddimensionality of nanomaterials, surface reconstruction, self-assembly structures. Conceptof 0D,1D, 2D and 3D nanostructures.

Chapter 2- Nanomaterial classification with examples

Different categories of nanomaterials with respect to methods and properties. Examples such assingle metal nanoparticles, binary and ternary systems. 2D materials, Carbon basedmaterials,aerogels, zeolites, self-assembled nanomaterials, types of core shell particles,Hollow coreshellmaterials, Nano Metals, Nano Ceramics, Nano Composites, other current interest nanomaterials,natural nanomaterials, polymeric nanomaterials

Chapter 3- Synthetic methods of Nanomaterials and Application

Introduction to Chemical methods: Chemical reduction method, Colloids in solution,Langmuir-Blodgett (L-B) method, micro emulsion, sol gel methods, electrochemical methods.Introduction to Bio inspired methods:Enzymes. Microorganisms, plant based, using proteinsand DNS templates, etc.Introduction to Physical Methods: Mechanical, evaporation, chemical vapor deposition, ionbeam techniques, molecular beam epitaxy, laser deposition. Photochemical synthesis with greenapproach. Comparative study for dispersion and size with properties.Nano-electronics (metal/organic Nano electronics), Nano-optics, Nano magnetic-, chemical- andbio-sensing, energy applications, textiles, cosmetics, biotechnology, medical, construction,Defence,

catalytic conversions, Nanoscience in plant protection and agriculture, drug carrier and drug delivery and other contemporary applications

References:

1. Nanotechnology: Principles and Practices Sulabha K. Kulkarni.

2. Nanomaterials Chemistry by Rao C. N., A. Muller, A. K. Cheetham, Wiley VCH , 2007.

3. Nanomaterials and Nanochemistry by Brechignac C., P. Houdy, M. Lahmani, Springer publication, 2007.

4. Nanoscale materials in chemistry by Kenneth J. Klabunde, Wiley Interscience Publications, 2001.

5. Nanochemistry by Sergeev G.B., Elseiver publication, 2006.

6. Nanostructures and Nanomaterials, synthesis, properties and applications by Guozhong Cao, Imperial College Press, 2004.

7. Nanomaterials – Handbook by Yury Gogotsi, CRC Press, Taylor & Francis group, 2006.

NBT403P1: Lab Based on Basic Immunology

Paper: SEC
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 50

1. Blood film preparation and identification of immune cells

2. Lumphoid organs and their microscopic organization

3. Immunization and collection of serum

4. Double Diffusion

5. Heamglutination

6. Detection of antigen

7.ELISA

8. WIDAL Test

9. Immunoelectrophoresis

NBT403P2: Lab Based on Chromosome Structure and Inheritance

Paper: SEC
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 50

1. Determination of nucleic acid by Feulgen reaction

2. Isolation of Giant chromosome

3. Isolation of Polytene chrosome

4. Estimation of temperature melting

5. Problems based on monohybrid and back cross

6. Problems based on di-hybrid

7. Problems based on tri-hybrid

8. Problems based on pedigree analysis

NBT403P3: Lab based on Emerging technologies in Biotechnology

Paper: SEC
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 50

1. Isolation of DNA

2. Isolation of RNA

3. Restriction Digestion

4. Synthesis of Nanoparticles:Silver,Gold,Copper

5. Characterization of Nanoparticles

NBT405T: Chromatographic and Electrophoretic Techniques

Paper: VSC-4 Total Credit: 02
Contact Hours: 30 (Clock Hours) Marks: 30

Unit 1:

Introduction to Chromatography, Basic Principle of Chromatography, Stationary Phase, Mobile Phase.Introduction to Electrophoresis: Basic Principle of Electrophoresis, type of Gel Use in Electrophoresis.

Unit 2

Chromatographic Techniques: Theory, Principle and applications of Thin

layer chromatography, paper chromatography, Ion exchange, chromatography,

affinity chromatography and HPLC

Unit 3:

Principle theory and applications of paper and gel electrophoresis.2D electrophoresis