DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY, CHHATRPATI SAMBHAJINAGR.

NAAC- 'A $^{+}$' Grade

CIRCULAR NO.SS/NEP/B.Sc. Honor's/Model College/18/2025

It is hereby inform to all concerned that, the syllabus recommended by the Board of Deans, the Academic Council at its meeting held on 21st July 2025 has been accepted the **following syllabi *under the Faculty of Science & Technology* as per *National Education Policy – 2020*** run at the Model College, Ghansawangi Dist.-Jalna as appended herewith.

This is effective from the Academic Year 2025-26 and onwards.

Sr.No.	Courses	Semester
1.	**Honor's Degree of B.Sc. Biotechnology**	Vth & VIth
2.	**Honor's Degree of B.Sc. Biochemistry**	Vth & VIth
3.	**Honor's Degree of B.Sc. Computer Science**	Vth & VIth

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.SS/B.SC.HONOR'S/ MODEL COLLEGE/ NEP/2025/ 1451-56
Date:- 31/07/2025

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Deputy Registrar
Syllabus Section

Copy forwarded with compliments to :-

1] **The Principal, Model College, Ghansawangi Dist. Jalna**
2] The Director, Board of Examinations & Evaluation,
3] The Director, University Network & Information Centre, UNIC,
with a request to upload this Circular on University Website.
Dr. Babasaheb Ambedkar Marathwada University,
Chhatrapati Sambhajinagar.

Copy to :-

1] PA to the Hon'ble Vice-Chancellor, Office
2] PA to the Pro. Vice-Chancellor, Office
3] PA to the Registrar, Office
Dr. Babasaheb Ambedkar Marathwada University,
Chhatrapati Sambhajinagar.

JD*31072025/-

-=**=-

Dr. Babasaheb Ambedkar Marathwada University,
Aurangabad (M.S.), India

Structure and Syllabus for B.Sc. (Biochemistry)

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

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

(For Model College Ghansawangi Dist. Jalna)

Under the Faculty of
Science and Technology

Effective from Academic year 2025 – 2026

(As per NEP-2020)

B. Sc. Biochemistry Third Year (Semester V)

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 V	Major	**DSC-9**	NBC501T	Industrial Biochemistry	03	--	03	03	--
			NBC501P	Lab Based on Industrial Biochemistry	...	02	02	--	04
		DSE-1	NBC502T	Pharmaceutical Biochemistry	03	--	03	03	--
			NBC502P	Lab based on Pharmaceutical Biochemistry	---	02	02	---	04
	Supportive	**Minor-5** Select any one course from Basket 1	NBC503T1	Genetic Engineering	02	--	02	02	--
			NBC503T2	Bioinformatics	02	--	02	02	--
		Generic Elective Select any one pool of courses offered as a major	NB504T1	Endocrinology	02	--	02	02	
			NBC504T2	Introduction to Drug Discovery	02	--	02	02	
	Applied	SEC (Choose any one from pool of major)	NBC503P1	Lab based on Genetic Engineering		04	04		04
			NBC503P2	Lab based on Bioinformatics		04	04	--	04

		VSC-5	NBC505T	Genomics & Proteomics	04	-----	04	04	--
	VEC/Life Skill Curriculum	JOC-1/FP	NBC506P	JOC	04	----	04	04	---
		VOC-1	NBC507T	VOC	04	----	04	04	---

B. Sc. Biochemistry Third Year (Semester V)
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			
Semester V	Major	**DSC-5**	NBC501T	Industrial Biochemistry	03		20	30	50	50	20
			NBC501P	Lab Based on Industrial Biochemistry	.....	02	--	50	50	50	20
		DSE-1	NBC502T	Pharmaceutical Biochemistry	03		20	30	50	50	20
			NBC502P	Lab based on Pharmaceutical Biochemistry	-----	02	---	50	50	50	20
	Supportive	**Minor-1** Select any one course from Basket	NBC503T1	Genetic Engineering	02	---	20	30	50	50	20
			NBC503T2	Bioinformatics							
		Generic Elective Select any one pool of courses offered as a major	NB504T1	Endocrinology	02	---	20	30	50	50	20
			NBC504T2	Introduction to Drug Discovery							
	Applied	SEC (Choose any one from pool	NBC503P1	Lab based on Genetic Engineering	---	04	---	50	50	50	20
			NBC503P2	Lab based on Bioinformatics							

		of major)										
		VSC-3	NBC505T	Genomics & Proteomics	04	--	20	30	50		50	20
	VEC/Life Skill Curriculum	JOC-1	NBC506P	JOC	04	---	20	30	50		50	20
		VOC	NBC507T	VOC	04	---	20	30	50		50	20
								Total Marks	500		500	200

B. Sc. Biochemistry Third Year (Semester VI)

Teaching Scheme

Year/ Semester and Level		Section	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs/ week)	
					Theory	Practical	Total	Theory	Practical
Semester VI	Major	**DSC-10**	NBC601T	Clinical Biochemistry	03	--	03	03	--
			NBC601P	Lab based on Clinical Biochemistry	…	02	02	--	04
		DSE-2	NBC602T	Drug Metabolism	03	--	03	03	--
			NBC602P	Lab based Drug Metabolism	---	02	02	---	04
	Supportive	**Minor-6** Select any one course from Basket 1	NBC603T1	Analytical Biochemistry	02	--	02	02	--
			NBC603T2	Nanotechnology and Biosensor	02	--	02	02	--
		IKS-2	NBC604T1	IKS in Biochemistry	02	--	02	02	
	Applied	SEC-6 (Choose any one from pool of major)	NBC603P1	Lab based on Analytical Biochemistry		04	04		04
			NBC603P2	Lab based on Nanotechnology and Biosensor		04	04	--	04
		VSC-6	NBC605T	Diagnostic Biochemistry	04	-----	04	04	--
	VEC/Life Skill Curriculum	JOC-4	NBC606T	JOC	04	----	04	04	---
		OJT/Project	NBC607T	Project	04	----	04	04	---

B. Sc. Biochemistry Third Year (Semester VI)

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			
Semester VI	Major	**DSE-7**	NBC601T	Clinical Biochemistry	03		20	30	50	50	20
			NBC601P	Lab based on Clinical Biochemistry	.....	02	--	50	50	50	20
		DSE-8	NBC602T	Drug Metabolism	03		20	30	50	50	20
			NBC602P	Lab based Drug Metabolism	-----	02	---	50	50	50	20
	Supportive	**Minor-2** Select any one course from Basket 1	NBC603T1	Analytical Biochemistry	02	---	20	30	50	50	20
			NBC603T2	Nanotechnology and Biosensor							
		IKS-2	NBC604T1	IKS in Biochemistry	02	---	20	30	50	50	20
	Applied	SEC-2 (Choose any one from pool of major)	NBC603P1	Lab based on Analytical Biochemistry	---	04	---	50	50	50	20
			NBC603P2	Lab based on Nanotechnology and Biosensor							

		VSC	NBC605T	Diagnostic Biochemistry	04	--	20	30	50	50		20
	VEC/Life Skill Curriculum	JOC	NBC606T	JOC	04	---	20	30	50	50		20
		OJT/Project	NBC607T	Project	04	---	-	50	50	50		20
								Total Marks	**500**	**500**		**200**

Curriculum of Semester –V

B.Sc. Biochemistry Honours (Semester V)

NBC501T: Industrial Biochemistry

Paper: DSC
Contact Hours: 45 (Clock Hours)

Total Credit: 03
Marks: 30

Unit 1. Introduction to Industrial Biochemistry

Overview of industrial biotechnology and its applications. Historical development and milestones in industrial biochemistry. Role of enzymes, microorganisms, and bioreactors in industrial processes. Biopharmaceuticals: production of recombinant proteins,

Unit 2. Industrial Enzymes

Sources of industrial enzymes: microbial, plant, and animal sources. Production, purification, and immobilization of enzymes. Applications of enzymes in food processing, detergent industry, and biocatalysts. Wastewater treatment using biological methods: activated sludge process, anaerobic digestion, and phytoremediation.

Unit.3 Industrial Production

Principles of fermentation: aerobic and anaerobic processes. Microbial fermentation: production of ethanol, organic acids, and amino acids. Industrial-scale fermentation: bioreactor design, operation, and optimization. Bioremediation of pollutants: microbial degradation of organic polluta Production of biopolymers: polysaccharides, proteins, and polyhydroxyalkanoates (PHA). Biopolymer modification and functionalization for industrial applications. Biodegradable plastics, biomaterials, and their environmental impact. Production of biofuels: biodiesel, bioethanol, and biogasnts, heavy metals, and xenobiotics.

Text Books and Reference Books:

1. Industrial Biotechnology: Principles and Applications" by Larry Erickson

2. Industrial Enzymes: Structure, Function, and Applications" edited by Julio Polaina and Andrew P.

MacCabe

3. Bioprocess Engineering: Basic Concepts" by Michael L. Shuler and Fikret Kargi

4. Biopolymers: Applications and Trends" edited by Michael Niaounakis

5. Biofuels: Production, Application, and Development" edited by Marco Aurelio Dos Santos Bernardes

6. Industrial Microbiology: An Introduction" by Michael J. Waites, Neil L. Morgan, and John S. Rockey

7. Pharmaceutical Biotechnology: Fundamentals and Applications" edited by Daan J. A. Crommelin,

Robert D. Sindelar, and Bernd Meibohm

8. Bioremediation: Principles and Applications" edited by Ronald L. Crawford and Don L. Crawford

9. Food Biotechnology" edited by Kalidas Shetty and Gopinadhan Paliyath

10. Handbook of Industrial Chemistry: Organic Chemicals" edited by Michael Ash and Irene Ash

NBC501P : Lab Based on Industrial Biochemistry

Paper: Lab Course | Total Credit: 02
Contact Hours: 30 (Clock Hours) | Marks: 50

1. Extraction of enzymes from microbial, plant, or animal sources.
2. Purification techniques such as ammonium sulfate precipitation, dialysis, and chromatography (e.g., ion exchange, gel filtration)
3. Quantitative measurement of enzyme activity using spectrophotometric methods.
4. Determination of kinetic parameters (Km and Vmax) using Michaelis-Menten kinetics.
5. Techniques for immobilizing enzymes on various supports (e.g., agarose, alginate beads).
6. Analysis of the stability and activity of immobilized enzymes.
7. Investigation of competitive, non-competitive, and uncompetitive inhibition.
8. Cultivation of microorganisms (e.g., bacteria, yeast) in batch, fed-batch, and continuous modes.
9. Monitoring of growth parameters (e.g., optical density, dry cell weight).
10. Fermentative production of ethanol, lactic acid, citric acid, or antibiotics.
11. Downstream processing for product recovery and purification.
12. Production of biodiesel from vegetable oils or animal fats using transesterification.
13. Synthesis of biodegradable plastics (e.g., polyhydroxyalkanoates) from microbial sources.
14. Use of microorganisms or enzymes to degrade environmental pollutants.
15. Agarose gel electrophoresis for nucleic acid analysis.

NBC502T: Pharmaceutical Biochemistry

Paper: DSE-1
Contact Hours: 45 (Clock Hours)

Total Credit: 03
Marks: 30

Unit 1. Introduction to Pharma. Biochemistry

Overview of biochemistry and its relevance to pharmacy. Structure and properties of water.pH and buffers in biological systems. Enzyme kinetics and inhibition

Unit 2. Biochemical Basis of Drug Action

Drug-receptor interactions.Signal transduction pathways. Mechanisms of drug action: agonists and antagonists .Allosteric regulation of enzymes

Unit.3.Pharmacogenomics and Drug metabolism

Genetic variation and its impact on drug response.Personalized medicine and pharmacogenomics.Biochemical basis of genetic disorders and their treatment . Role of enzymes in drug metabolism. Phase I and Phase II drug metabolism 4.2 Cytochrome P450 enzyme system.Biotransformation and elimination of drugs. Mechanisms of drug-induced toxicity

Text Books and Reference Books:

1. Harper's Illustrated Biochemistry" by Robert K. Murray, David A. Bender, Kathleen M. Botham, Peter
J. Kennelly, Victor W. Rodwell, and P. Anthony Weil
2. Lehninger Principles of Biochemistry" by David L. Nelson and Michael M. Cox
3. Biochemistry" by Jeremy M. Berg, John L. Tymoczko, and Lubert Stryer
4. Textbook of Biochemistry with Clinical Correlations" by Thomas M. Devlin
5. Biochemical Pharmacology" by Michael Palmer
6. Goodman & Gilman's: The Pharmacological Basis of Therapeutics" by Laurence L. Brunton, Randa
Hilal-Dandan, and Bjorn Knollmann
7. Lippincott Illustrated Reviews: Biochemistry" by Denise R. Ferrier
8. Pharmaceutical Biochemistry" by Jayaveera K.N., Vrushabendra Swamy B.M.
9. Essentials of Medical Biochemistry: With Clinical Cases" by Chung Eun Ha and N. V. Bhagavan
10. Clinical Biochemistry and Metabolic Medicine" by Martin Crook
11. Principles of Biochemistry" by H. Robert Horton, Laurence A. Moran, Gray Scrimgeour, Marc Perry,
and David Rawn
12. Medical Biochemistry: An Illustrated Review" by Sankhavaram R. Panini

NBC502P : Lab Based on Pharmaceutical Biochemistry

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

Total Credit: 02
Marks: 50

1. Determination of drug solubility in various solvents and pH conditions.
2. Evaluation of drug dissolution rates using dissolution apparatus.
3. Study of enzyme kinetics using spectrophotometric or fluorometric assays.
4. Evaluation of drug dissolution profiles using dissolution apparatus.
5. Cell viability assays (e.g., MTT assay) to evaluate drug cytotoxicity and cellproliferation.
6. Metabolite identification and characterization using TLC
7. Determination of the absorption spectra of pharmaceutical compounds.
8. Quantification of the concentration of a compound using Beer-Lambert's law.
9. Analysis of protein and nucleic acid concentrations using absorbance measurements.
10. Separation and quantification of pharmaceutical compounds in a mixture.
11. Determination of the purity and content of active ingredients in pharmaceutical formulations.
12. Measurement of enzyme activity using spectrophotometric assays.
13. Determination of Michaelis-Menten kinetics parameters such as Vmax andKm.
14. Analysis of enzyme inhibition using reversible and irreversible inhibitors.
15. Determination of protein concentration using Bradford or Lowry assays.

NBC503T1: Genetic Engineering

Paper: Minar
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 30

Unit 1: DNA modifications and DNA cutting Systems

safeguarding DNA –in detail. Concept of restriction endonuclease action with reference to DNA modification. DNA cutting enzymes: Type I, Type II, and Type III with reference to properties, essential co-factors, mode of action –specificity and limitations of their applications. DNA modifying enzymes with reference to their structure, function, requirements, reaction and applications: Exonucleases, Endonucleases acting on both single strand and double strand, Polymerases, phosphorylating enzymes, Phosphate removing enzymes, Enzyme adding base/s to the end. Nucleic acid Joining Enzymes: RNA ligase, DNA ligases.

Unit 2: Vectors

Concept and types of vectors for genetic engineering, Review of plasmids and modifying natural plasmids to construct a plasmid vector –example of pBR322 –applications, versatility and limitations, cloning of DNA with gene disruption strategy. The pUC18/ pUC19 vectors –with reference to their desing, potential also as an inducible vector system. Viral vectors: M13 life cycle and use of M13 as vector, M13mp1 and M13mp2 design, potential and limitations. Single strand preparations for sequencing reactions. Study of λ-genome to estimate potential as vector system. Concept of insertion and replacement vectors –Two examples with design and application

Unit 3: Cloning and Sequencing

Shotgun cloning; with reference to use of plasmid as vector, mean of cloning foreign piece of DNA (Construction of Chimera), mean to construct genomic library, mean to select recombinant with the use of antibiotic marker –a direct selection example. Generalized strategy of obtaining cDNA from mRNA as a template for PCR (do not teach PCR) or piece of DNA to be cloned in desired vectors. DNA sequencing by chemical method, by Enzymatic method and Chemical synthesis of DNA.

References:

1. An introduction to Genetic Engineering –Desmond S T Nicholl

,Cambridge university press, 2nd Ed.

2. Recombinant DNA: A short Course, Watson J.D, CSHL press

3. Short course in Bacterial Genetics –J. H. Miller

4. Molecular Biochemistry Principles & Applications of Recombinant

DNA, Bernard R Glick & Jack J Pasternak, ASM press.

5. Old R.W & Primrose S.B., Principles of Gene manipulations, Blackwell

Scientific publications.

6. Ausbel S.M , Brent R, Current Protocols in Molecular Biology., Wiley

International New York.

7. Maniatis I, Fritchh E.F ,& Sambrook J, Molecular cloning.

8. D.M Glover , DNA cloning, A practical approach.

9. Methods in Enzymology series, vol 152, 185, Academic press inc,

Sandiego.

10. Genes V –Benjamin Lewin

NBC503T2: Bioinformatics

Paper: Minar
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 30

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

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

UNIT III Sequence and Phylogeny analysis, Detecting Open Reading Frames, Outline of sequence Assembly, Mutation/Substitution Matrices, Pairwise Alignments, Introduction to BLAST, using it on the web, Interpreting results, Multiple Sequence Alignment, Phylogenetic Analysis. Searching Databases: SRS, Entrez, Sequence Similarity Searches-BLAST, FASTA, Data Submission. Genome Annotation: Pattern and repeat finding, Gene identification tools

References:

1. Developmental Biology-Gilbert
2. Foundations of Embryology – Patten
3. Cell and Developmental Biochemistry – Raj NarianDesikar
4. Text book of Bryophytes, Pteridophytes , Gymnosperms and Paleobotany - Subramurti
5. Plant Anatomy and Embryology- S.N. Pandey, A. Chadha
6. Teresa K Attwood and David J. Parry-Smith, Introduction to Bioinformatics, Pearson Education Asia, 2001
7. Bexavanis& Francis, Bioinformatics-A practical guide to the analysis of genes and proteins, John Wiley and Sons, 2001

8. Rushidi, Basics of Bioinformatics, CRC Publications, 2001

9. Irfan Khan and AtiyaKhanum, Emerging trends in Bioinformatics, Ukaaz Publishers, 2002

10. David M. Hill, Craig Martiz and Barke Mable, Molecular systematics

11. Khan Imtiyazalam ,Rai University, Hydrabad:- Elementry Bioinformatics

12. N. Gautam Bioinformatics- Databases and algorithm

13. Bioinformatics: A practical guide to the analysis of genes and proteins A.D. Baxevanis and B.F.F. Ouellette (Eds). 2002 John Wiley and Sons.

14. Bioinformatics: Sequence and Genome Analysis by D.W. Mount, 2001, Cold Spring Harbor Laboratory Press.

NBC504T1: Endocrinology

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

Total Credit: 02
Marks: 30

Unit.1 General Characteristics of hormones, chemistry, structure and metabolism Hormones biosynthesis, regulation of hormone secretion, transport and clearance

Unit.2 Hormones receptors, secondary messengers and their mode of action and intracellular signaling Mechanism of action of hormones of hypothalamus, pituitary, thyroid, pancreas, Adrenals glands.

Unit.3 Gastro intestinal hormones, parathyroid hormone, calcitonin, calcium and phosphate metabolism, vitamin D, bone, and teeth Disorders related to hormones and target cells insensitivity

References

1.Stem Cell Biology, Daniel Marshak, Richard L. Gardener and David Gottlieb, Cold Spring Harbour Laboratory Press

2. Stem cell biology and gene therapy, Booth C., Cell Biology International, Academic Press

3. Stem Cell and Gene-Based Therapy: Frontiers in Regenerative Medicine, Alexander Battler, Jonathan Leo, Springer,

NBC504T2: Introduction to Drug Discovery

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

UNIT I: FUNDAMENTALS OF DRUG DISCOVERY

Overview of Drug Discovery Process and development process. Importance and challenges in the field. Historical Perspective and Milestones in Drug Discovery Key Players in Drug Discovery: Pharma Industry, Academia, and Government Agencies, Drug Targets and Therapeutic Areas.

UNIT II: DRUG TARGET IDENTIFICATION AND VALIDATION

Understanding Molecular Targets: Identification of potential drug targets, such as specific proteins, enzymes, or receptors. Validation of the biological relevance of these targets in the context of a particular disease. Hit discovery and lead optimization: Screening methods to identify initial compounds High-throughput Screening (HTS) Techniques.

UNIT III: DRUG DESIGN AND OPTIMIZATION

Validation Criteria for Drug Targets. Importance of Biomarkers in Target Validation. Computational methods and structure-activity relationship (SAR) studies for designing new drug candidates. Rational Drug Design vs. High-throughput Screening. structure-Activity Relationship (SAR) Studies, Computer-Aided Drug Design (CADD) and Molecular Modelling, Medicinal Chemistry Approaches to Optimization.

REFERENCE BOOKS:

1. Young D and Marron TK, "Principles of Drug Discovery", Publisher: John Wiley & Sons (2005).

2. Williams AM, "Introduction to Medicinal Chemistry: How Drugs Act and Why", Publisher: Wiley-Blackwell (2014).

3. Walter Sneader "Drug Discovery: A History", Publisher: John Wiley & Sons (2005).

4. Peter GMW and Thomas WG, "The Drug Development Process: Increasing Efficiency and Cost Effectiveness", Publisher: Wiley (2008).

SUGGESTED READING:

1. Thomas NT and Malcolm Rowland, "Introduction to Pharmacokinetics and Pharmacodynamics: The Quantitative Basis of Drug Therapy", Publisher: Lippincott Williams & Wilkins (2015).

2. Duolao Wang, Ameet Bakhai, and Shein-Chung Chow, "Clinical Trials: A Practical Guide to Design, Analysis, and Reporting", Publisher: Remedica (2006).

3. Milo Gibaldi and Donald Perrier, "Biopharmaceutics and Clinical Pharmacokinetics", Publisher: Lea & Febiger (1982).

NBC503P1: Lab Based on Lab based on Genetic Engineering

Paper: SEC
Contact Hours: 30 (Clock Hours)

Total Credit: 04
Marks: 50

1. Isolation of plasmid DNA from resistant clinical isolates
2. Transformation of resistance from clinical strain to laboratory strain (sensitive)
3. Blue-white selection assay
4. Study of restriction fragments of -DNA
5. Study of impact of methylation on restriction activity.
6. Shotgun cloning –demonstration of plasmid resistance transfer
7. Shotgun cloning –to introduce chimeric construct
8. Preparation and demonstration of cDNA
9. Shotgun cloning –cloning of cDNA
10. Cloning of DNA with gene disruption strategy

NBC503P2: Lab Based on Bioinformatics

Paper: SEC
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 50

1. Sequence information resource

2. Understanding and use of various web resources: EMBL, Genbank, Entrez, Unigene, Protein information resource (PIR)

3. Understanding and using: PDB, Swissprot, TREMBL

4. Using various BLAST and interpretation of results

NBC505T: Genomics and Proteomics

Paper: VSC | Total Credit: 04
Contact Hours: 30 (Clock Hours) | Marks: 30

Unit-I

Concept of Genomics-Mutagenesis, Regulated vectors for controlled expression of multiple genes to study gene function in different hosts. Recombinant DNA strategies to study protein interactions. (Yeast 2-hybrid system, Phage display, Protein fragment complementation). Determining the Function of Individua l genes (Gene deletion, over-expression and complementation, Genome-wide insertional mutagenesis).

Unit-II

Fundamentals of Whole-Genome Sequencing. Sequencing of Phage, Viral and Bacterial Genomes, Human Genome sequencing, and comparative genomics. High throughput genome-wide cloning and protein expression strategies and applications. Antibody gene cloning and engineering, humanization and Human antibodies.

Unit-III

Introduction to proteome, proteomics technology, types and kinds of proteomics investigation, importance of proteomics. Principles and applications of the separation technology (Electrophoresis, Centrifugation, Chromatography) in proteomics. Mass spectrometry (Ionizers, analyzers and detectors) technology and its application in proteomics.General workflow for the 2-D Gel Electrophoreses, sample preparation, evolution of 2D PAGE, experimental details for the 2-D gel and high throughput 2-D PAGE. Application of two-dimension gel electrophoreses in proteomics and biomarker discovery. Importance of 2-D fluorescence difference gel electrophoresis for comparative proteomics.

SUGGESTED READING

1. Molecular Biotechnology: Principles and Applications of Recombinant DNA (2010) 4th ed., Glick B.R., Pasternak, J.J. and Patten, C.L., ASM Press (Washington DC).

2. Protein-Protein Interactions: A Molecular Cloning Manual. Erica Golemis and Peter D. Adams (2005) Cold Spring Harbor Laboratory Press,

3. Molecular cloning, A Laboratory Manual Vol. I-III. (Fourth edition), M.R.Green and J. Sambrook (2012) Cold Spring Harbor Laboratory Press.

4. Current Protocols in Molecular Biology. Fred M. Ausubelet al. (2015) John Wiley and Sons, Inc.

5. Recombinant DNA, Genes and Genomes – A Short Course (3rd edition). James D. Watson, Richard M. Myers, Amy A. Caudy and Jan Witkowski. (2007). Cold Spring Harbor Laboratory Press.

6. Principles of Genome Analysis and Genomics. (7th edition), S.B. Primrose and R.M. Twyman. (2006) Blackwell Publishing.

NBC506T: JOC: Computer Networking

Paper:JOC | Total Credit: 04
Contact Hours: 30 (Clock Hours) | Marks: 30

Unit I **Introduction**

1.1 LAN
1.2 MAN
1.3 WAN
1.4 Topologies

Unit II **Physical Layer**

2.1 Transmission Media
2.2 Method of Communication.

Unit III **Medium Access Sublayer**

3.1 Cabling
3.2 Straight through and Cross Over.
3.3 Standard Color Coding – RJ-45, UTP.
3.4 Crimping Tools.

Unit IV **Network Layer**

4.1 Switches
4.2 Bridge
4.3 Router
4.4 WIFI Router

Unit V **Internetworking**

5.1 TCP/IP Addressing, MAC Address, Subnet.
5.2 Creating LAN, Set up WAN (Wi-Fi Router).
5.3 ICMP ping Command for Connection Verification.
5.4 Share and Access file/folders over network.

Reference Books:

- Guide to Network by Tamara Dean 6th Edition, Cengaye Leasnicey, June14, 2012.
- Computer Network, A. Tanenbaum, 5th Edition, Tata McGraw Hill Publication.

NBC507T: VOC: Project Report Writing

Paper:VOC
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 30

Unit I **Introduction to Project Report Writing**

1.1 Meaning and Definition of Project Report.
1.2 Steps of Ideal Project Report Writing.
1.3 Characteristics and Objectives of Project Report Writing.
1.4 Importance of Project Report Writing.

Unit II **Nature of Project Report Writing**

2.1 Selection of Project Title.
2.2 Issues and Challenges of Project Report Writing.
2.3 Outcomes of Project Report Writing.
2.4 Summery of Project Report.

Unit III **Basic of Project Report Writing**

3.1 Types of Project Report.
3.2 Duration of Project Report and Financial Support.
3.3 Format of Micro and Macro Project Report Writing.
3.4 Skills and Management of Project Writing.

Unit IV **Components of Project Report Writing**

4.1 Specification.
4.2 Use the various techniques.
4.3 Collection of Data and Facts.
4.4 Readability.

Unit V **Government Funding**

5.1 Introduction to Central and State Government Funding Institutions.
5.2 UGC
5.3 ICSSR
5.4 RUSA
5.5 Other Funding Institutions.

Reference Books:

- Garg R. K., Handbook on Project Reports, Bharat Law House, Delhi, 2017.
- Kalpesh Ashar, Project Management Essentials, 5th Edition, Vibrant Publishers, 2022.

Curriculum of Semester –VI

NBC601T: Clinical Biochemistry

Paper: DSC
Contact Hours: 45 (Clock Hours)

Total Credit: 03
Marks: 30

Unit-I

Introduction to laboratory principles and instrumentation in Clinical Biochemistry. Biological samples -types, collection, processing, stability and storage; phlebotomy; serum and serum separator devices;chemical composition of biological fluids - blood, urine and cerebrospinal fluid; reference ranges. Quality assurance; accuracy and precision; factors influencing the accuracy of results

Unit-II

Disorders of Metabolism: Diabetes mellitus; Ketone bodies; Glycogen storage diseases; Galactosemia.Diagnostic tests for apolipoproteins, HDL cholesterol, LDL-cholesterol and triglycerides disorders. Phenylketonuria, homocystineuria, tyrosinemia and related disorders, aminoacidurias.

Unit-III

Electrolytes, Blood Gases and Acid Base Balance: Electrolytes, blood gases, respiration, acid-base balance and acid-base disorders, respiratory and renal mechanism of acid balance disorders. Disorders of Mineral Metabolism: Hypercalcemia, hypocalcemia, normocalcemia, hypophosphatemia , hyperphosphatemia..

Suggested readings:

1. Clinical Biochemistry (2018) 6th Edition. Murphy M, Srivastava R and Deans K, Elsevier,

ISBN:978-0702072987.

2. Clinical Biochemistry: Metabolic and Clinical Aspects (2014) 3rd Edition. Marshall WJ, Churchill Livingstone, ISBN: 978-0702051401.

3. Clinical Biochemistry (Lecture Notes) (2017) 10th Edition. Rae P, Crane M and Pattenden R, Wiley-Blackwell, ISBN:111924868X.

4. Lecture Notes: Clinical Biochemistry (2010) 8th Edition. Becket G, Walker SW, Race Pand Ashby P, Wiley-Blackwell, ISBN: 978-1405193054.

5. Principles of Medical Biochemistry (2016) 4th Edition. Meisenberg G and Simmons WH, Elsevier, ISBN: 978-03232 96168.

6. Tietz Fundamentals of Clinical chemistry and Molecular diagnostics. (2014) 7th Edition. Burtis CA and Bruns DE, Elsevier, ISBN: 978-8131238851.

NBC601P: Lab Based on Clinical Biochemistry

Paper: DSC
Contact Hours: 45 (Clock Hours)

Total Credit: 03
Marks: 50

1. Qualitative analysis of urine for abnormal constituents.
2. Determination of blood creatinine.
3. Determination of blood sugar.
4. Determination of serum total cholesterol.
5. Electrolytes determination

NBC602T: Drug Metabolism

Paper: DSE | Total Credit: 03
Contact Hours: 45 (Clock Hours) | Marks: 30

UNIT I. Introduction to Drug Metabolism.

Overview of drug metabolism: phases, enzymes, and pathways.Role of drug metabolism in pharmacokinetics and pharmacodynamics. Genetic factors: pharmacogenomics, genetic polymorphisms, and drug metabolism phenotyping. Physiological factors: age, gender, ethnicity, and disease states.

Unit.2. Metabolism

Oxidation, reduction, and hydrolysis reactions catalyzed by cytochrome P450 enzymes. Other Phase I reactions: dealkylation, deamination, and ring oxidation. Factors influencing Phase I metabolism: genetic polymorphisms, enzyme induction/inhibition, and environmental factors. Impact of drug metabolism on drug efficacy, toxicity, and therapeutic drug monitoring. Conjugation reactions: glucuronidation, sulfation, methylation, acetylation, and glutathione conjugation. Enzymes involved in Phase II metabolism: UDPglucuronosyltransferases (UGTs), sulfotransferases (SULTs), methyltransferases, and others. Role of Phase II metabolism in drug elimination and detoxification. Relationship between drug metabolism and pharmacokinetics/pharmacodynamics.

Unit 3. Factors Influencing Drug Metabolism

Genetic factors: pharmacogenomics, genetic polymorphisms, and drug metabolism phenotyping. Physiological factors: age, gender, ethnicity, and disease states. Environmental factors: diet, smoking, alcohol, and drug interactions. Mechanisms of drug-drug interactions: enzyme induction, inhibition, and competition.

References:

1. Drug Metabolism: Chemical and Enzymatic Aspects" by Bernard Testa and Urs A. Meyer

2. Introduction to Drug Metabolism" by G. Gordon Gibson and Paul Skett

3. Principles of Drug Metabolism" edited by Emilio Díaz and Michael J. Mulvihill

4. Drug Metabolism and Pharmacokinetics Quick Guide" by Johannes Kirchmair and Maike Windshügel

5. Handbook of Drug Metabolism" edited by Paul G. Pearson and Larry C. Wienkers

6. Drug Metabolism in Pharmaceuticals" edited by Abd El-Galil E. Amr

7. Drug Metabolism Handbook: Concepts and Applications" edited by John W. Harlow and Rodney R.Dietert

8. Practical Pharmacology for the Pharmaceutical Sciences" by K. D. Tripathi

9. Pharmacogenomics and Precision Medicine: An Issue of the Clinics in Laboratory Medicine" edited byIssam Makhoul and Daniel J. Weisenberger

10. Clinical Pharmacokinetics: Concepts and Applications" by Malcolm Rowland and Thomas N. Tozer

NBC602P: Lab Based on Drug Metabolism

Paper: DSE | Total Credit: 03
Contact Hours: 45 (Clock Hours) | Marks: 50

1. Measuring the activity of specific cytochrome P450 enzymes (e.g., CYP3A4,CYP2D6) using substrate-specific reactions.
2. Determination of kinetic parameters (Km and Vmax) for drug metabolism.
3. Investigating the effects of potential inducers (e.g., rifampicin) or inhibitors (e.g., ketoconazole) on cytochrome P450 enzyme activity.
4. Quantification of induction/inhibition effects using enzyme assays.
5. Assays for conjugation reactions, such as glucuronidation (using UDPglucuronosyltransferases) and sulfation (using sulfotransferases).
6. Measuring the formation of conjugated drug metabolites.
7. Quantitative and qualitative analysis of drug metabolites in biological samples (e.g., blood, urine).
8. 8. Evaluating the inhibitory effects of drugs on specific metabolic enzymes.
9. IC50 determination using competitive, non-competitive, or mixed inhibition models.
10. Development and validation of LC-MS methods for the detection and quantification of drugs and their metabolites.

NBC603T1: Analytical Biochemistry

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

Total Credit: 02
Marks: 30

Unit-I

Microscopy; principle, resolving, magnification power, Lens defects, application of compound microscopy, Factors affecting resolution, Fluorescence microscopy, phase contrast microscopy, confocal microscopy, atomic force microscopy (AFM) and electron microscopy (SEM, TEM and STEM). Sample preparation for SEM and TEM.

Unit-II

Agarose gel electrophoresis, polyacrylamide gel electrophoresis (native and SDS-PAGE), Blotting (Western, Southern, Northern), iso-electric focusing (IEF), 2-Dimensional gel electrophoresis, pulse field electrophoresis, principle and applications of centrifugation, Rotor types, differential centrifugation, density gradient centrifugation (rate zonal and isopycnic), and ultracentrifugation.

Unit-III

Principle and types of Chromatography; Planner chromatography (paper, Thin layer chromatography, column chromatography (gel filtration, ion exchange, affinity), principle and application of High performance liquid chromatography (HPLC) and gas chromatography (GC). Radioactivity; Geiger-Müller and, Scintillation counter, autoradiography, non-radiolabeling, Safety measures of radioisotopes handling. Beer-Lambert's Law, principle and instrumentation of UV-visible, infrared (IR), Florescence, AAS, NMR spectroscopy, Mass spectrometry (MS), electrospray ionization mass spectrometry (ESI-MS), MALDI, tandem MS for protein identification, Circular Dichroism (CD), flow cytometry, and ELISA. SDS-PAGE

Suggested readings:

1. Principles and Techniques of Biochemistry and Molecular Biology (2018) 8th ed. Wilson K and

Walker J, Cambridge University Press, ISBN No. 131661476X.

2. Physical Biochemistry: Principles and Applications (2010) 2nd ed., Sheehan, D., Wiley

Blackwell (West Sussex), ISBN: 978-0-470-85602-4 / ISBN: 978-0-470-85603-1.

3. Physical Biochemistry: Applications to Biochemistry and Molecular Biology (1982) 2nd ed., Freifelder D, W.H. Freeman and Company (New York), ISBN:0-7167-1315-2 /ISBN:0-7167-1444-2.

4. Principles of Instrumental Analysis (2018) 7th ed., Douglous A. Skoog, F. James Holler, Stanley R Crouch, Singapore: Cengage Learning Asia Pte Ltd.

NBC603T2: Nanotechnology and Biosensor

Paper: Minar
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 30

Unit 1. Introduction to NanoBiochemistry -Nanotechnology and nanoBiochemistry, History, -Broad perspective, and Today's World, -Significance of Nanoscale materials. - Synthesis and characterization of nanomaterials - One, two, and three dimensional structure of nanomaterials - Bio-mimetics

Unit.2. Application of Nanomaterials in medicine- -Drug delivery -Drug encapsulation -Tissue repair and implantation -Nanocoatings - Miniaturized devices/ Lab on a chip Toxic effects of nanomaterials.

Unit.3. Biosensors: -History of biosensors discovery - Components of a typical biosensor - Types of biosensors (Calorimetric, Potentiometric, amperometric, optical, Piezo-electric, Immuno based sensors) - Applications related to healthcare, bio-defense, food and water safety, agriculture and environment

BOOKS RECOMMENDED:

1. Biosensors and Nanotechnology, (Editors; Zeynep Altintas) John Wiley & Sons Inc, 2017, ISBN: 9781119065159, 9781119065159

2. Biosensors and Bioelectronics: D. Dharaneeshwara Reddy, O.M Hussain, DVR. Sai Gopal, Muralidhara Rao, and K.S Sastry. I. K International Publishing House Pvt. Ltd, New Delhi. ISBN 978-93-82332-19-0, Year?

3. C. M. Niemeyer, "NanoBiochemistry: Concepts, Applications and Perspectives", Wiley – VCH, 2006

4. David S Goodsell, "Bionanotechnology", John Wiley & Sons, 2004

5. Understanding Nanomedicine: An Introductory Textbook, Rob Burgess, Publisher: Pan Stanford Publishing; ISBN-13: 978-9814316385, year?

6. Introduction to Nanoscience, S.M. Lindsay, Oxford universal Press, First Edition, 2010

Nanotechnology: Understanding small system, Ben Rogers, SumitaPennathur and Jesse Adams, CRC Press, Second edition, 2011

7. NanoBiochemistry: Bioinspired Devices and Material of Future by Oded Shoseyov and Ilan levy, Human Press, First edition, 2007. The NanoBiochemistry Handbook (Editor; Yubing Xie) CRC press.

NBC604T: IKS in Biochemistry

Paper: IKS
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 30

Unit I

Origin of cultivated crops: Concepts of centre of origin, their importance with reference to Vavilov's work. Examples of major plant introductions; crop domestication and loss of genetic Diversity; evolution of new crops/ varieties, importance of germplasm diversity. • Cereals: Rice and wheat (origin, morphology, processing and uses) • Legumes: Origin, morphology and uses of gram and mung bean. Importance to man andEnvironment. • Drug-yielding plants: Therapeutic and habit forming drugs with special reference to Cinchona, Digitalis, Papavar, Cannabis and Tobacco (morphology, processing, uses and health hazards)

Unit II

General account about the microbes used as biofertilizers- Rhizobium- isolation, identification, Mass multiplication, carrier based inoculants, actinorrhizal symbiosis. • Organic farming- green manuring and organic fertilizers, recycling of biodegradable municipal, Agricultural and industrial wastes- biocompost making methods, types and methods of Vermicomposting- field application.

Unit III

Pharmacognosy- General account : Pharmacognosy and its importance in modern medicine, Crude drugs, Classification of Drugs- chemical and pharmacological, Drug evaluation– organoleptic, microscopic, chemical, Physical and biological. Major pharmacological groups of plant drugs and their uses. Secondary metabolites: Definition of secondary metabolites and difference with primary metabolites ,Interrelationship of basic metabolic pathways with secondary metabolite biosynthesis (outlines only), Major types–terpenoids, phenolics, flavonoids, alkaloids and their protective action against Pathogenic microbes and herbivores.

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

NBC603P1: Lab Based on Analytical Biochemistry

Paper: SEC
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 50

1. Separation of amino acid mixture by Paper chromatography
2. Estimation of amino acid by Ninhydrin method
3. Estimation of protein by Biuret method
4. Estimation of protein by Lowry method.
5. Estimation of protein by Bradford method
6. Specific reactions for Amino acids
7. Estimation of sugar by Folin-wu method
8. Estimation of sugar by Ferricyanide method
9. Estimation of sugar by DNSA method
10. Identification of carbohydrate mixture with suitable tests.
11. Isolation of amino acid cystine from hair hydrolysate.
12. Isolation of Egg albumin and globulin.
13. Isolation of milk casein by isoelectric pH precipitation.
14. Isolation of Starch and characterization.
15. Alpha and Beta amylolysis.
16. Isolation of Cholesterol and lecithin from egg.
17. Estimation of Vitamin C from lemon fruits.
18. Determination of alpha amino nitrogen of amino acid.
19. Estimation of inorganic phosphorus by Fiske-Subbarow method.
20. Determination of saponification value of fat
21. Determination of acid value of fat
22. Determination of iodine number of fat

NBC603P2: Lab Based on Nanotechnology and Biosensor

Paper: SEC | Total Credit: 02

Contact Hours: 30 (Clock Hours) | Marks: 50

1. Preparation of silver nanoparticles using sodium
2. Green synthesis of silver nanoparticles using bacteria/plant/fungi
3. Characterization of nanomaterials using Scanning Electron Microscopy.
4. Evaluation of antimicrobial activity of silver nanoparticles against Gram Positive and Gram negative microorganisms
5. Increasing bioavailability of drugs using nanostructured Beta-cyclodextrin
6. Entrapment of silver nanoparticles in alginate beads for remediation of water.
7. Study of principle and working of glucose biosensor
8. Study of conductivity of DNA for use in biosensor

NBC606T: Diagnostics Biochemistry

Paper: VSC
Contact Hours: 30 (Clock Hours)

Total Credit: 04
Marks: 30

Unit.1. Overview of diagnostic biochemistry: principles, scope, and

Significance in clinical practice. Biochemical markers of disease: enzymes, proteins, lipids, carbohydrates, hormones, and metabolites. Role of food in the maintenance of good health Tumor-associated antigens and biomarkers: AFP, CA 19-9, CA 125, PSA, CEA. Introduction to Diagnostic Biochemistry

Unit.2.Laboratory Techniques in Diagnostic Biochemistry

Specimen collection and processing: blood, urine, cerebrospinal fluid, and other body fluids. Analytical techniques: spectrophotometry, chromatography, immunoassays, electrophoresis, and molecular diagnostics. Automation and instrumentation in diagnostic biochemistry laboratories. Molecular diagnostics in cancer: PCR, gene expression profiling, next-generation sequencing (NGS).

Unit.3. Biochemical Markers of Organ Function and Injury

Liver function tests: enzymes (ALT, AST), bilirubin, albumin, and Coagulation factors. Kidney function tests: creatinine, urea, electrolytes, and urinary biomarkers. Cardiac biomarkers: troponin, creatine kinase (CK), CK-MB, and B-type natriuretic peptide (BNP). Monitoring response to cancer therapy: chemotherapy, targeted therapy, immunotherapy. Thyroid function tests: TSH, T3, T4, thyroid antibodies. 4.2 Diabetes mellitus: glucose, glycated hemoglobin (HbA1c), insulin, C-peptide. 4.3 Lipid profile: total cholesterol, HDL cholesterol, LDL cholesterol, triglycerides. 4.4 Infectious disease markers: HIV, hepatitis viruses, syphilis, tuberculosis, and other infectious agents

Text Books and Reference Books:

1. Clinical Biochemistry: Techniques and Instrumentation - A Practical Approach" by Lynne S. M. Donald and Stuart A. Hunt

2. Practical Clinical Biochemistry: Methods and Interpretations" by Ranjna Chawla

3. Clinical Biochemistry: An Illustrated Colour Text" by Allan Gaw, Michael Murphy, Rajeev Srivastava,and Dennis R. St. J. O'Reilly

4. Clinical Chemistry: Principles, Techniques, and Correlations" by Michael L. Bishop, Edward P. Fody, and Larry E. Schoeff

5. Laboratory Guide to Clinical Biochemistry" by S. P. Kumar and K. S. Jiji

6. Tietz Fundamentals of Clinical Chemistry and Molecular Diagnostics" edited by Carl A. Burtis and David E. Bruns

7. Manual of Practical Medical Biochemistry" by Vidya Ratan

8. Clinical Laboratory Chemistry" by Robert L. Sunheimer and Linda Graves

9. Laboratory Techniques in Biochemistry and Molecular Biology" edited by Thomas Spence Work and E. Work

10. Practical Biochemistry: Principles and Techniques" by Keith Wilson and John Walker

NBC607T: JOC: Office Management

Paper: JOC
Contact Hours: 30 (Clock Hours)

Total Credit: 04
Marks: 30

Unit I **Office Management**

1.1 Introduction of Office Management.
1.2 Meaning and Concept of Office Management.
1.3 Importance of Office Management.
1.4 Essential factors of Ideal Office Management.

Unit II **Office Arrangement**

2.1 Seating and Machine Arrangement.
2.2 Record Management- Meaning and Objectives.
2.3 Commercial Correspondence- Meaning and Importance.
2.4 Various types of Commercial Correspondence- Sales Letter, Trade Order, Office Memorandum and Reminder.

Unit III **Supervision in Office**

3.1 Meaning and Concept of Supervision.
3.2 Rule and Regulation of Supervision.
3.3 Importance of Supervision.
3.4 Skills and Functions of Supervisor.

Unit IV **Leadership and Motivation**

4.1 Meaning, Concept and Characteristics of Leadership.
4.2 Importance of Leadership.
4.3 Qualities of a Leader.
4.4 Definition, Characteristics and Types of Motivation.

Unit V **Discipline**

5.1 Nature of Office Discipline.
5.2 Work Distribution in Office.
5.3 Role of Discipline in Office.
5.4 Importance and Manner of Office Control.

Reference Books:

- Ankita Bhatiya & Dr. R. K. Chopra, Office Management.
- Dr. P. Rizwan Ahmed, Office Management.
- R. S. N. Pillai, Office Management.
- Ghosh & Agrawal, Office Management, S. Chand & Company, New Delhi.
- Agrawal R. C. & Siyaram Jaiswal, Navyug Sahitya Sadan, Agra, UP.

NBC608P: Project

Paper: Project | Total Credit: 04

Contact Hours: 30 (Clock Hours) | Marks: 50

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.