

**DR. BABASAHEB AMBEDKAR MARATHWADA UNIVERSITY,
CHHATRPATI SAMBHAJINAGR.**



CIRCULAR NO.SU/B.Sc.Honors/Model College/43/2023

It is hereby inform to all concerned that, the syllabi recommendation of the Dean, Faculty of Science & Technology, the Hon'ble Vice-Chancellor has accepted the **following Revised 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.	Honors Degree of B.Sc. Computer Science.	Ist and IInd semester
2.	Honors Degree of B.Sc.Biotechnology	Ist and IInd semester
3.	Honors Degree of B.Sc. Biochemistry	Ist and IInd semester

This is effective from the Academic Year 2023-24 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,
Chhatrpati Sambhajinagar
431 004.

REF.NO.SU/2023/16415-24
Date:- 01.11.2023.

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Deputy Registrar,
Academic Section

Copy forwarded with compliments to :-

- 1] The Principal of Model College, Ghansawangi, Dist. Jalna
- 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.BAMU, Chhatrpati Sambhajinagar.
- 2] The Section Officer,[B.Sc.Unit] Examination Branch, Dr.Babasaheb Ambedkar Marathwada University, Chhatrpati Sambhajinagar.
- 3] The Programmer [Computer Unit-1] Examinations, Dr.Babasaheb Ambedkar Marathwada University, Chhatrpati Sambhajinagar.
- 4] The Programmer [Computer Unit-2] Examinations, Dr.Babasaheb Ambedkar Marathwada University, Chhatrpati Sambhajinagar.
- 5] The In-charge,[E-Suvidha Kendra], Rajarshi Shahu Maharaj Pariksha Bhavan, Dr. Babasaheb Ambedkar Marathwada University, Chhatrpati Sambhajinagar.
- 6] The Public Relation Officer, Dr. Babasaheb Ambedkar Marathwada University, Chhatrpati Sambhajinagar.
- 7] The Record Keeper, Dr. Babasaheb Ambedkar Marathwada University, Chhatrpati Sambhajinagar.

**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 2023 - 2024

(As per NEP-2020)

1. Preamble

B.Sc. (Hons) Biochemistry is a Four year course comprising of systematic and multidisciplinary curriculum involving theoretical and practical aspects with flexibility of multiple entry and exit as per NEP 2020. The various subjects in Biochemistry syllabus emphasizing distribution, morphology and physiology of microorganisms in addition to skills in aseptic procedures, isolation and identification. The course also includes sophomore level material covering immunology, cell biology, Molecular Biology, biochemistry, plant science, industrial Biochemistry, environmental Biochemistry and medical Biochemistry. The course aims at producing professionals, who can be furnished into true biotechnologist and can be capable enough to serve the nation.

The learning outcomes are designed to help learners understand the objectives of studying B.Sc (Honors) Biochemistry that is, to analyze, appreciate, understand the basic concepts of biomolecular processes and chemical reactions occurring in the living system. This course is fundamental to tackle many of the health – related challenges facing society. Considering the rapid and far-reaching advances in biological sciences in 21st century, it is imperative to have curriculum incorporating these updated emerging concepts of biochemistry. The current pattern is designed to impart concept based learning with emphasis on hands-on training, skill development and research. Aimed at multi-faceted development of a student, the curriculum includes courses encompassing core courses, intra and inter discipline specific courses, skill and ability enhancement courses to impart in-depth knowledge in biochemistry complemented with varied subjects and skills. The course seeks to discover and nurture typical attributes of a competent science graduate such as; spirit of inquiry, critical thinking, problem solving, analytical reasoning, aptitude to research/industry and entrepreneurial instincts.

The below mentioned objectives have been reflected in various features in this curriculum.

- 1. Holistic development of the students**
- 2. Flexibility**
- 3. Multiple entry and exit facility**
- 4. Academic bank of credits**
- 5. Multilingualism**
- 6. Research component**

2. Abbreviations

1. **GE/OE:** Generic / Open Elective
2. **VSEC:** Vocational Skill and Skill Enhancement Course
3. **VSC:** Vocational Skill Courses
4. **SEC :** Skill Enhancement Courses
5. **AEC :**Ability Enhancement Course
6. **IKS:** Indian Knowledge System
7. **VEC:** Values Education Courses
8. **OJT:** On job Training: Internship/ Apprenticeship
9. **FP:** Filed Project
10. **CEP:** Community Engagement and Service
11. **CC:** Co-Curricular Courses
12. **RM:** Research Methodology
13. **RP:** Research Project

Definitions of Key Words:

a. Academic Year: Two consecutive (one odd + one even) semesters constitute one academic year

b. Course: Usually referred to as 'paper', which is a component of a program. All courses need not carry the same weight. The courses should define learning objectives and learning outcomes. A course may be designed to comprise lectures/ tutorials/laboratory work/ field work/ project work/ vocational training/viva/ seminars/term papers / assignments / presentations/ self-study etc. or a combination of some of these.

c. Credit: A unit by which the course work is measured. It determines the number of hours of instructions required per week in a semester. One credit is equivalent to one hour of lecture or tutorial or two hours of practical work/field work per week in a semester.

d. Grade Point: It is a numerical weight allotted to each letter grade on a 10-point scale.

e. Credit Point: It is the product of grade point and number of credits for a course.

f. Letter Grade: It is an index of the performance of students in a said course. Grades are denoted by letters O, A+, A, B+, B, C, P and F.

g. Program: It is a study in a discipline leading to award of a Degree, diploma or certificate.

h. Semester: Each semester will consist of over 16 weeks of academic work equivalent to 90 actual teaching days. The odd semester may be generally scheduled from June to November and even semester from January to May.

i. Semester Grade Point Average (SGPA): It is a measure of performance of work done in a semester. It is the ratio of total credit points secured by a student in various courses registered in a semester and the total course credits taken during that semester. It shall be expressed up to two decimal places

j. Cumulative Grade Point Average (CGPA): It is a measure of overall cumulative performance of a student over all the semesters of a program. The CGPA is the ratio of total credit points secured by a student in various courses in all the semesters and sum of the total credits of all courses in all the semesters. It is expressed up to two decimal places.

3. Concepts:

1. Major Subject: A major subject/core subject is the subject that represents the main focus of a degree. A degree in major is permitted if the student opts and accrues courses with minimum of 50% credits corresponding to the major.

2. Minor Subject: A minor is secondary subject that may complement the major or can have interdisciplinary bandwidth. Minors are a bunch of courses and can be related or unrelated to the major. A university must declare the minors and make it available to the students to choose from.

3. Internship: Students at all HEIs will be provided with opportunities for internship in local industries, businesses, banks, artists, crafts persons, and so on. As well as research internships with faculty and researchers at their own or other HEIs/research institution.

4. Generic/Open Elective (OE): Generic or Open Elective shall be a pool/ basket of courses which is meant to provide multidisciplinary or interdisciplinary education to students. GE or SE shall consist of pool/ basket of courses offered by the various departments under different discipline/faculty of study.

5. Ability Enhancement Courses (AEC) - Language, Literature & Environment Studies. The courses based upon the content that leads to knowledge enhancement through various areas of study. They are language and literature and environment science and sustainable development which will be mandatory for all disciplines.

6. Indian Knowledge System (IKS): IKS is a generic phrase that covers practically everything about India. While designing the curriculum, it need to be understood that IKS is not about merely knowing some ancestral knowledge. IKS is also about protecting received wisdom, economic security, and national pride.

7. Vocational and Skill Enhancement Courses (VSEC): In all disciplines/faculties are aimed at providing hands-on-training, competencies, proficiencies and skills to students. The basic purpose of vocational courses is to enhance skill and employability.

8. Internship and apprenticeship: It provides for an industry led, practice oriented and outcome based learning. Forming robust industry-academia linkage. Every HEI will undertake MOUs with industry for industry-institute linkage for promotion of apprenticeship/ Internship/ research/ entrepreneurship/ employment opportunities. There will be 4-6 weeks of structured summer internship in industry or research institute.

9. Field Projects: The field based learning/ projects should attempt to provide opportunities for students to understand the different socio-economic contexts. It should aim at giving student exposure to development-related issues in rural and urban settings. It will provide opportunities for the student to observe situation in rural and urban contexts, and to observe and study actual field situation regarding issues related to socio-economic development.

10. Community engagement and service: Community engagement and service seeks to expose students to the socio-economic issues in society so that the theoretical learning can be supplemented by actual life experiences to generate solutions to real life problems. This component will include participation in activities related to NSS, NCC, adult education/ literacy initiatives and mentoring school students.

(Note: Change in Structure will be applicable as per guidelines of University Grant Commission and State Government of Maharashtra released from time to time)

4.Course Structure

B. Sc. Biochemistry First Year (Semester I) (Level 4.5)
Teaching Scheme

Year/ Semester and Level	Section	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs/ week)	
				Theory	Practical	Total	Theory	Practical
First Year Semester I Level 4.5								
	Major	DSE-1	NBC101T	Biomolecules -I	03	--	03	--
			NBC101P	Lab based on Biomolecules -I	...	02	--	04
		DSE-2	NBC102T	Biomolecules -II	03	--	03	--
			NBC102P	Lab based on Biomolecules -II	---	02	---	04
	Supportive	Minor-1	NBC103T1	Introduction to Biochemistry	02	--	02	--
			NBC103T2	Biochemistry in Health & Diseases	02	--	02	--
			NBC103T3	Applications of Computer in Biochemistry	02	--	02	--
Applied	Generic Elective Select any one course from Basket		NBC104T1	Tools and Techniques-I	02	--	02	
			NBC104T2	Microbiology	02	--	02	
			NBC104T3	Forensic Biology	02	--	02	
	SEC		NBC105P1	Lab based on Essentials Tools		02		04

	course from Basket		and Techniques-I						
		NBC105P2	Lab based on Microbiology		02	02	--	04	
		NBC105P3	Lab based on Forensic Biology		02	02	---	04	
	VSC	NBC106T	Aptitude and Reasoning	02	----	02	02	--	
AES, VEC, IKS/ Language Curriculum	AEC-1 English	NBC-ENG-101	English	02					
	L1-MIL	NBC-MIL-101	Marathi/Hindi	02					
	VEC-1	NBC-VEC-101	Indian Constitution	02					
	IKS-1	NBC-IKS-101	Indian Knowledge System	02					
VEC/Life Skill Curriculum	JOC-1	NBC107T	Presentation Skill	02	----	02	02	---	
	CC-1	NBC108T	Health and wellness	02	----	02	02	---	

B. Sc. Biochemistry First Year (Semester I) (Level 4.5)
Evaluation/Examination Scheme
[40% Continuous Assessment and 60% of Semester End/ University Assessment]

Year/ Semester and Level	Section	Course Code	Course Name	Credit		Evaluation Method		Total Mark s	Max mark	Min Mark
				Theor y	Practical	CA	UA			
First Year Semester I Level 4.5	Major	DSE-1	NBC101T	Biomolecules -I	03	20	30	50	50	20
			NBC101P	Lab based on Biomolecules -I		--	50	50	50	20
		DSE-2	NCOM102T	Biomolecules -II	03	20	30	50	50	20
			NBC102P	Lab based on Biomolecules -II	-----	---	50	50	50	20
	Support ive	Minor-1 Select any one course from Basket 1	NBC103T1	Introduction to Biochemistry	02	20	30	50	50	20
			NBC103T2	Biochemistry in Health & Diseases						
			NBC103T3	Applications of Computer in Biochemistry						
	Generic Elective Select	NBC104T1	Tools and Techniques-I	02	---	20	30	50	50	20

		any one course from Basket	NBC104T2	Microbiology								
			NBC104T3	Forensic Biology								
Applied	SEC Select any one course from Basket		NBC105P1	Lab based on Essentials Tools and Techniques-I	---	02	---	50	50	50	50	20
			NBC105P2	Lab based on Microbiology								
			NBC105P3	Lab based on Forensic Biology								
	VSC		NBC106T	Aptitude and Reasoning English	02	--	20	30	50	50	50	20
AES, VEC, IKS/ Language Curriculum	AEC-1 English		NBC-ENG-101	English	02	---	20	30	50	50	50	20
	L1-MIL		NBC-MIL-101	Marathi/Hindi	02	---	20	30	50	50	50	20
	VEC-1		NBC-VEC-101	Indian Constitution	02	...	20	30	50	50	50	20
	IKS-1		NBC-ICS-101	Indian Knowledge System	02	...	20	30	50	50	50	20
VEC/Life Skill Curriculum	JOC-1		NBC107T	Presentation Skill	02	---	20	30	50	50	50	20
	CC-1		NBC108T	Health and wellness	02	---	20	30	50	50	50	20
Total Marks										700	700	280

B. Sc. Biochemistry First Year (Semester II) (Level 4.5)

Teaching Scheme

Year/ Semester and Level	Section	Course Code	Course Name	Credits Assigned			Teaching Scheme (Hrs/ week)	
				Theory	Practical	Total	Theory	Practical
First Year Semester II	Major	NBC201T	Cell Biology	03	--	03	03	--
		NBC201P	Lab based Cell Biology	...	02	02	--	04
		NBC202T	Basic Enzymology	03	--	03	03	--
		NBC202P	Lab based on Basic Enzymology	---	02	02	---	04
Level 4.5	Supportive	NBC203T1	Protein Biochemistry	02	--	02	02	--
		NBC203T2	Biostatistics	02	--	02	02	--
		NBC203T3	Basic Virology	02	--	02	02	--
	Generic Elective /OE-2	NBC204T1	Tools and Techniques-II	02	--	02	02	
NBC204T2		Physiological Biochemistry	02	--	02	02		
NBC204T3		Basic Bioinformatics	02	--	02	02		
Applied	SEC-2 Select any one course from	NBC205P1	Lab based on Tools and Techniques-II		02	02		04

B. Sc. Biochemistry First Year (Semester II) (Level 4.5)
Evaluation/Examination Scheme
[40% Continuous Assessment and 60% of Semester End/ University Assessment]

Year/ Semester and Level	Section	Course Code	Course Name	Credit		Evaluation Method		Total Mark s	Max mark	Min Mark
				Theory	Practical	CA	UA			
First Year Semester II Level 4.5	DSE-3	NBC201T	Cell Biology	03		20	30	50	50	20
		NBC201P	Lab based Cell Biology		02	--	50	50	50	20
		NBC202T	Basic Enzymology	03		20	30	50	50	20
	DSE-4	NBC202P	Lab based on Basic Enzymology	-----	02	---	50	50	50	20
		NBC203T1	Protein Biochemistry	02	---	20	30	50	50	20
		NBC203T2	Biostatistics							
Support ive	Minor-2 Select any one course from Basket 1	NBC203T3	Basic Virology							
		NBC204T1	Tools and Techniques-II	02	---	20	30	50	50	20
		NBC204T2	Physiological Biochemistry							

		course from Basket	NBC204T3	Basic Bioinformatics																	
Applied		SEC-2 Select any one course from Basket	NBC205P1	Lab based on Tools and Techniques-II	---	02	---	50	50	50	50	50	20							20	
			NBC205P2	Lab based on Physiological Biochemistry																	
			NBC205P3	Lab based on Basic Bioinformatics																	
			NBC206T	Web designing																	
AES,VE C, IKS/ Langua ge Curricul um		VSC AEC-2 English L2-MIL VEC-2 IKS-2	NBC-ENG-201	English	02	--	20	30	50	50	50	50	20							20	
			NBC-MIL-201	Marathi/Hindi	02	---	20	30	50	50	50	20								20	
			NBC-VEC-201	Environment Education	02	...	20	30	50	50	50	20									20
			NBC-IKS-201	Indian Knowledge System	02	...	20	30	50	50	50	20									20
VEC/Lif e Skill Curricul um		VOC-1	NBC207T	Personality Development & Interview Techniques	02	---	20	30	50	50	50	20								20	
			NBC208T	Yoga Education/Sports and Fitness	02	---	20	30	50	50	50	20									20
													Total Marks		700	700	280				

Basket 1: Minor Subject

* Students will have to choose one subject from Basket 1 as a Minor subject, from same faculty or discipline or other than DSC (in col. 3)

Semester	Details of Minor Subject	
	Code	Title of Subject
I Semester	NBC103T1	Introduction to Biochemistry
	NBC103T2	Biochemistry in Health & Diseases
	NBC103T3	Applications of Computer in Biochemistry
II Semester	NBC203T1	Protein Biochemistry
	NBC203T2	Biostatistics
	NBC203T3	Basic Virology

Basket 2: Generic Elective course (GE)

* Students will choose one GE course offered as a generic major

Semester	Details of Generic Elective	
	Code	Title of Subject
I Semester	NBC104T1	Tools and Techniques-I
	NBC104T2	Microbiology
	NBC104T3	Forensic Biology
II Semester	NBC204T1	Tools and Techniques-II
	NBC204T2	Physiological Biochemistry
	NBC204T3	Basic Bioinformatics

Basket 3: Skill Enhancement Course (SEC)

Student should Choose any one from Basket

Semester	Details of Skill Enhancement Course (SEC)	
	Code	Title of Subject
I Semester	NBC105TP1	Lab based on Essentials Tools and Techniques-I
	NBC105TP2	Lab based on Microbiology
	NBC105TP3	Lab based on Forensic Biology
II Semester	NBC205TP1	Lab based on Tools and Techniques-II
	NBC205TP2	Lab based on Physiological Biochemistry
	NBC205TP3	Lab based on Basic Bioinformatics

Curriculum AES,VEC,IKS/Language

Semester	Name of Subject	Details of Skill Enhancement Course (SEC)		
		Code	Title of Subject	
I Semester	AEC-1 English	NBC-ENG-101	English	
	MIL –Marathi /Hindi	NBC-MIL-101	Marathi/ Hindi	
	VEC	NBC-VEC-101	Constitution of India	
	IKS	NBC-IKS-101	Indian Knowledge System	
II Semester	AEC-2 English	NBC-ENG-102	English	
	MIL –Marathi /Hindi	NBC-MIL-102	Marathi/ Hindi	
	VEC	NBC-VEC-101	Environment Education	
	IKS	NBC-IKS-101	Indian Knowledge System	

5. Vision

To be recognized as a centre for excellence in Biochemistry that provides an atmosphere to acquire skills in identifying the link between biological and human resources and transform it to enhance the quality of life.

6. Mission

To generate high quality students by offering UG (B.Sc. Honours) programmes in Biochemistry and to develop a premier Biochemistry teaching and research department to cater the needs and challenges of the region and the country.

7. Eligibility

Candidates who have passed 10+2 with Science from recognized board and as per the eligibility criteria lay down by Dr. Babasaheb Ambedkar Marathwada University, Aurangabad will be eligible for admission to B.Sc. Biochemistry (Honours) course.

8. Duration

The undergraduate program in Biochemistry is offered through the courses designed for granting the following B.Sc Biochemistry. The duration of the program is 4 years or 8 semesters. Students who desire to undergo a 3-year UG Programme will be allowed to exit after completion of the 3rd year. If a student wants to leave after the completion of the first or second year, the student will be given a UG Certificate or UG Diploma, respectively, provided they secure the prescribed number of credits. Students who exit with a UG certificate or UG diploma are permitted to re-enter within three years and complete the degree programme.

UG Certificate: Students who opt to exit after completion of the first year and have secured 60 credits will be awarded a UG certificate.

UG Diploma: Students who opt to exit after completion of the second year and have secured 120 credits will be awarded the UG diploma.

3-year UG Degree: Students who wish to undergo a 3-year UG programme will be awarded UG Degree in the Major discipline after successful completion of three years, securing 180 credits.

4-year UG Degree (Honours): A four-year UG Honours degree in the major discipline will be awarded to those who complete a four-year degree programme with 224 credits.

4-year UG Degree (Honours with Research): Students who choose a research stream in the fourth year. They should do a research project or dissertation under the guidance of a faculty member of the University/College. The research project/dissertation will be in the major discipline. The students who secure 224 Credits.

9. Medium of Instructions

The medium of instruction for this course is English.

10. Attendance

A candidate is required to put in a minimum of 75% of attendance in both theory papers practical separately in each subject before admission to the examination. This relaxation in attendance includes for medical & any other reasons approved by the head of the Institution. A candidate lacking in the prescribed attendance and progress in any one of the subjects in theory and practical in the first appearance shall not be permitted for admission to the entire examination.

11. Evaluation Methods/ Scheme of Examination, Earning Credits, Grading System

Continuous assessment methods that are appropriate to a given disciplinary/subject area and a programme of study will be used to assess progress toward the course/programme learning outcomes. Priority will be accorded to formative assessment.

Evaluation will be based on continuous assessment, in which sessional work and the semester end examination will contribute to the final grade. Sessional work will consist of weekly class tests, mid-semester examination(s), homework assignments, etc., as determined by the faculty in charge of the courses of study. Progress towards achievement of learning outcomes will be assessed using the following: time-constrained examinations; closed-book and open-book tests; problem-based assignments; practical assignment laboratory reports; observation of practical skills; individual project reports (case-study reports); team project reports; oral presentations, including seminar presentation; viva voce interviews; computerized adaptive assessment, examination on demand, modular certifications, etc.

The Semester Grade Point Average (SGPA) is computed from the grades as a measure of the student's performance in a given semester. The SGPA is based on the grades of the current term, while the Cumulative GPA (CGPA) is based on the grades in all courses taken after joining the programme of study.

Letter Grade	Grade Point
O (outstanding)	10
A+ (Excellent)	9
A (Very good)	8
B+ (Good)	7
B (Above average)	6
C (Average)	5
P (Pass)	4
F (Fail)	0
Ab (Absent)	0

Computation of SGPA and CGPA

The following procedure to compute the Semester Grade Point Average (SGPA) and Cumulative Grade Point Average (CGPA):

i. **The SGPA is the ratio of the sum** of the product of the number of credits with the grade points scored by a student in all the courses taken by a student and the sum of the number of credits of all the courses undergone by a student, i.e.

$$\text{SGPA (Si)} = \sum(C_i \times G_i) / \sum C_i$$

Where C_i is the number of credits of the i th course and G_i is the grade point scored by the student in the i th course.

ii. **The Cumulative Grade Point Average (CGPA)** is also calculated in the same manner taking into account all the courses undergone by a student over all the semesters of a programme, i.e.

$$\text{CGPA} = \sum(C_i \times S_i) / \sum C_i$$

where S_i is the SGPA of the i th semester and C_i is the total number of credits in that semester

12. Programme Outcomes (POs):

PO1- To create interest in Biochemistry and appreciation for chemical basis of biological processes.

PO2- To inculcate the spirit of inquiry and value of systematic study of a discipline. Provide a general understanding of the related disciplines with a holistic knowledge generation in biological sciences.

PO3- To provide an in-depth understanding of chemical reaction mechanisms in biological processes.

PO4- To provide a flavor of historical developments of enzymes and their applications in research, diagnostics and various industries.

PO5- Gain proficiency in basic laboratory techniques and be able to apply the scientific method to the processes of experimentation, hypothesis testing, data interpretation and logical conclusions.

PO6- Develop problem solving and analytical skills through case studies, research papers and hands-on-experience

PO7- To appreciate biochemical mechanistic basis of physiological processes, metabolism under normal and pathological conditions importance and levels of metabolic regulations.

PO8- to apply and effectively communicate scientific reasoning and data analysis in both written and oral forms. They will be able to communicate effectively with well-designed posters and slides in talks aimed at scientific audiences as well as the general public.

PO9- To bridge the knowledge and skill gap between academic out and industry requirements. **PO10-** To give students experience in conducting independent, hypothesis-driven, biological research, project planning and management

PO11- To provide skills to publish research findings, and awareness of IP rights, and scientific publication ethics and problems of plagiarism.

PO12- To prepare competent human resource with better knowledge, hands-on-experience and scientific attitude, at national and global levels for careers in research and development, academia and Pharma-, biotech- and agro-, and food processing industries.

13. Curriculum Semester I

Curriculum of Semester –I

B.Sc. Biochemistry Honours (Semester I)

NBC101T: Biomolecules-I

Paper: Lab Course

Total Credit: 02

Marks: 50

Unit I. Introduction.

History and Development of Biochemistry. Composition of living matter, importance of carbon, origin of life. Prokaryotic and Eukaryotic cells, Structure of Organelles, structure and functions.

Unit II. Carbohydrates.

Definition, biological role and classification of carbohydrates, structure of monosaccharide's, stereoisomerism and optical isomerism of sugars, ring structures and anomeric forms, mutarotation, reactions of aldehyde and ketone groups reactions due to hydroxyl groups. Structure, occurrence and biological importance of monosaccharides, (glucose, fructose, galactose) disaccharides (Sucrose, maltose, lactose) and polysaccharides (cellulose, glycogen, starch) and chitin, agar, pectin, Proteoglycans, Sialic acids, blood group polysaccharides.

Unit III. Lipids.

Definition, fatty acids nomenclature, structure. Classification of Lipids: simple, complex & derived lipids. Physical properties and chemical properties hydrolysis, Saponification, rancidity of fats, reaction of glycerol. Biological significance of fats. Properties and functions of sterols.

Unit IV. Hormones.

Definition, classification, mode of action and target sites, chemistry and function of Pituitary gland, thyroid, parathyroid, adrenal, pancreas, gonads and corpus luteum.

References books:

1. Cohn & Stump – Outline of Biochemistry Wiley Eastern Ltd.
2. L. Lehninger, D. L. Nelson & M M Cox – Principles of Biochemistry.
3. Lubert Stryer – Biochemistry
4. J. Jayraman- Practical Biochemistry
5. Plummer. –Practical Biochemistry
6. A.C.Deb Fundamentals of biochemistry
7. Zuby - Biochemistry 4th edition
8. Boyer- Concepts in Biochemistry
9. Cooper -The tools of Biochemistry

Biochemistry- U Satyanarayan

NBC101P : Lab Based on Biomolecules-I

Paper: Lab Course

Total Credit: 02

Marks: 50

1. Qualitative/ Quantitative test: demonstration of reducing sugar
2. Qualitative/quantitative test :demonstration of non-reducing sugar
3. Demonstration of starch hydrolysis
4. Sugar estimation
5. Demonstration of rancidity
6. Demonstration of saponification

NBC102T: Biomolecules-II

Paper: DSC-2
Contact Hours: 45 (Clock Hours)

Total Credit: 03
Marks: 30

Unit I. Amino Acids.

Common structural features, Sterio-Isomerism, Classification and Structures of standard amino acids, amino acids as zwitterions, physical and chemical properties, titration of amino acids. Peptides; Structure of peptide bond, Structure & functions of Oxytocin & Vasopressin.

Unit II. Proteins.

Introduction, Composition. Protein structure, Levels of Structure; Primary, Secondary-helix and pleated sheets, Tertiary-forces stabilizing tertiary structure and quaternary structure of protein.

Classification: Simple, conjugated & derived proteins, Physico-chemical properties-IpH, denaturation, salting out & salting in, hydrolysis & color reactions of proteins due to side-chain. Biological functions of proteins.

Unit III. Nucleic Acids.

Composition of DNA and RNA, occurrence & types of nucleic acids, generalized structural plan of nucleic acids, Chemistry of nucleotides features of DNA double helix. Denaturation of DNA, structure and roles of different types of RNA (m-RNA, t-RNA, r-RNA) DNA & RNA viruses.

Unit IV. Porphyrins.

Chemistry of nucleus: classification, important, metalloporphyrins (haemoglobin, cytochrome, chlorophyll), Bile pigments: chemistry and their physiological role.

References books:

1. Cohn & Stump – Outline of Biochemistry Wiley Eastern Ltd.
2. L. Lehninger, D. L. Nelson & M M Cox – Principles of Biochemistry.
3. Lubert Stryer – Biochemistry
4. J. Jayraman- Practical Biochemistry
5. Plummer. –Practical Biochemistry
6. A.C.Deb Fundamentals of biochemistry
7. Zuby - Biochemistry 4th edition
8. Boyer- Concepts in Biochemistry
9. Cooper -The tools of Biochemistry
10. Biochemistry- U Satyanarayan

NBC102P : Lab Based on Biomolecules-II

Paper: Lab Course

Total Credit: 02

Marks: 50

1. Qualitative test for detection of proteins and amino acids both: purified and natural sources
2. Protein Estimation
3. Preparation of reagents, Molar and normal solution
4. Preparation of various buffers and determination of p^H
5. Quantitative estimation of DNA by diphenylamine method
6. Quantitative estimation of RNA by Orcinol method.

NBC103T1: Introduction to Biochemistry

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

Total Credit: 02
Marks: 30

Unit 1: Overview of Biochemistry

Definition, scope and significance of Biochemistry. History and important discoveries in Biochemistry. An overview of elements, chemical reactions and biomolecules in living organisms.

Unit 2: Physical properties of molecules

Ionic product of water, physical properties of water. Its effect on biomolecules. Hypo, hyper and isotonic solutions. Osmotic pressure, Effects of osmotic pressure on living cells.

Unit 3: Ionic equilibria

Concept of acids and bases. pH and pKa, buffers, Henderson Hasselbalch equation, biological buffers.

Unit 4: Chemical bonding & Concentration units

Ionic bonding, covalent bonding, hydrogen bonding, Van der Waal's forces, hydrophobic interaction. Molarity and molality, equivalent weight, normality, percentage. Safety measures in laboratory.

Suggested readings

1. Barrow, G. M (2007). Physical Chemistry Tata McGraw-Hill, India.
 2. Kotz, J. C., Treichel, P. M. and Townsend, J. R (2009) General Chemistry Cengage Learning India Pvt. Ltd.: New Delhi.
 3. Douglas, McDaniel and Alexander (1994). Concepts and Models in Inorganic Chemistry, John Wiley, 3rd edition
 4. James E. Huheey, Ellen Keiter and Richard Keiter(2013). Inorganic Chemistry: Principles of Structure and Reactivity, Pearson Public, 4th Edition.
 5. Patabhi. V. and Gautham. N (2002). Biophysics. Narosa Publishing House, India.
- Physical Chemistry – Puri, Pathania& Sharma

NBC103T2: Biochemistry in Health and Disease

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

Total Credit: 02
Marks: 30

Unit 1: Health and Wellness

WHO definition of health, Classification of diseases-Endemic, Epidemic, Pandemic; Professional health hazards. Communicable and non- communicable diseases.

Unit 2: Nutrition and its importance.

Concept of balanced diet. Nutritional importance of carbohydrates, fats, proteins and water. Probiotic.

Unit 3: Food Adulteration and Toxicology

Basic concept on Food Adulteration. Intentional and Incidental adulterants. Source, entry in to biological system and toxicity of - lead, mercury, cadmium and arsenic.

Unit 4: Diseased conditions

Acute disease, chronic disease, Incurable disease, Terminal disease. Allergies. Concept of Addiction. Blood transfusion safety.

Suggested readings

1. Modern Nutrition in Health and Disease, 2006, 10th Edition, Maurice E. Shils, Moshe Shike, A Catharine Ross.
2. Clinical Biochemistry and Metabolic Medicine, 2012, Eighth Edition, Martin Andrew Crook, CRC Press,
3. Nutrition and Health in Developing Countries, 2000, Editors: R. Semba and M.W. Bloem, Humana Press.

NBC103T2: Applications of Computer in Biochemistry

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

Total Credit: 02
Marks: 30

Unit 1:

General features of a Computer. Generation of computers. Personal Computer, Workstation, Mainframe Computer and super Computers. Computer applications – data processing, information processing, Application areas of computer.

Unit II

Computer organization. Central processing module. Computer memory- primary memory and secondary memory. Secondary storage devices – magnetic and optical media. Input and output modules. OMR, OCR, MICR, scanner, mouse, Modem.

Unit III

Computer hardware and software. Machine language and high level language. Application software. Computer program. Operating system. Computer virus, Antivirus and Computer security, Windows OS and its features. Computer arithmetic. Binary, octal and hexadecimal number systems. Algorithm and flowcharts. Illustrations. Elements of database and its applications.

Unit IV

Introduction to MS office Packages- Ms-Word – Editing a Document – Move and Copy text – Formatting text and paragraph – Finding and Replacing text and spelling checking – Using tabs, Tables, and other features, Enhancing document – using mail merge and other features. Introduction to Worksheet- Getting started with excel – Editing Cells and using commands and functions – Moving And Copying, Inserting and Deleting Rows and Columns – Getting help and formatting a worksheet – Printing the worksheet – Creating Charts – using formulae and functions in excel. Introduction to Power Point Presentation

References

1. Fundamentals of Computers, V. Rajaraman 6th edition PHI Learning Private Limited 2014
2. Fundamentals of Information Technology By Chetan Srivastava, Kalyani Publishers
3. Fundamentals of Computers By V. Rajaraman, PHI Publication, IVth Edition.

NBC104T1: Tools and Techniques-I

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

Total Credit: 02
Marks: 30

Unit I Good Laboratory Practices and Preparation of Solutions

Safety measures and first aid in the laboratory. Preparation and storage of reagents (Normal, molar, percent, stock and standard solution). Preparation of buffer and determination of pH. Principle and applications of UV-Visible Spectroscopy

Unit 2: Analysis of Biological samples Biochemistry of blood

ABO blood grouping; Rh factor; Blood cell types ;Haemoglobinfunction; Understanding Blood Pressure. Normal values for important constituents in urine.

Unit 3.Hydrodynamic methods Sedimentation – sedimentation velocity, preparative and analytical ultracentrifugation techniques, determination of molecular weight by hydrodynamic methods (derivations excluded and numerical included).

Unit 4 Radioisotopic techniques Types of radioisotopes used in Biochemistry, units of radioactivity measurements, techniques used to measure radioactivity (gas ionization and liquid and stripping), isotopes commonly used in biochemical studies – ^{32}P , ^{35}S , ^{14}C and ^3H), Autoradiography.

Biological hazards of radiation and safety measures in handling radioisotopes. Biological applications.

Suggested readings

1. Devlin, T.M(2011). Textbook of Biochemistry with Clinical Correlations. John Wiley& Sons, Inc. (New York), ISBN: 978-0-4710-28173-4.
2. Burtis, Ashwood and TietZ W.B.S (1999).Textbook of Clinical Chemistry, (3rded.).
3. Wiley,J.M.,Sherwood,L.M and Woolverton, C.J (2017). Prescott's Microbiology,(10th ed.), McGraw Hill Higher Education;ISBN13: 9781259657573.
5. Upadhyay,A., Upadhyay,K and Nath,N (2014). Biophysical Chemistry: Principles and Techniques,(4th ed.). Himalaya Publishing House, India.
6. David, P (1988). A Textbook of Practical Biochemistry. Tata McGraw-Hill Education.

NBC104T2: Microbiology

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

Total Credit: 02
Marks: 30

Unit I : Determination of micro-organisms

Various shapes of bacteria, determination of microbes by Stains and Staining procedure, Classification, Negative staining, Monochrome staining, Gram staining, Acid Fast staining

Unit II: Microbial Nutrition

Types of growth media: Natural, Synthetic, Enriched, Enrichment and selection, Differential medium.

Unit III : Isolation and purification

Isolation & Purification: Pure culture techniques; streak plate, pour plate and spread plate technique. Techniques used for isolation purification of aerobic and anaerobic microbes.

Unit IV: Microbial Control

Physical: Sterilization: Heat: Dry heat, Moist heat, Tyndalization & Pasteurization. Radiations. Chemical control :properties of disinfectant, types of disinfectants, Antimicrobial compounds

References:

1. R. Y. Stanier 6th Edition, General Microbiology, Mc Millan Press. Inc.
2. Pelczar Microbiology, TMH publication
3. Anantnarayan text book of Microbiology 9th edition, Orient Longman Delhi
4. Cappucinno Microbiology; a laboratory manual 4th edition
5. Toratora Microbiology: An introduction
6. Salle A. J. Fundamental Principles of Bacteriology
7. Prescott Microbiology

NBC104T3: Forensic Biology

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

Total Credit: 02
Marks: 30

UNIT-I Forensic Biology: Definition and scope Importance, nature, location, collection and preservation of biological exhibits and crime scene investigation of biological evidence. Cell: Definition, Theories, Classification and Significance of Cells in Forensic Science. Cell Organelles and their Functions, Difference between Eukaryotic and Prokaryotic Cell, Difference between Plant and Animal Cell. Cell Division: Definition, Types, Difference between Somatic and Germinal Cell and Totipotency and Apoptosis. Basic Concept in Brief for Anatomy and Physiology of Digestive, Respiratory, Circulatory, Skeleton, Nervous, Excretory and Reproductive System etc.

Unit-2 Basic Plant biology- plant cell structure and function, basic plant tissues, modes of plant reproduction, plant classification schemes, subspecialties of forensic botany such as plant morphology, plant anatomy, plant ecology, limnology etc. Essential parts of plants. Plant as evidence. Common poisonous plant and types of plant toxins.

Unit-3 Botanical evidences:- Forensic importance, Introduction, types, location, collection, preservation and evaluation of – Wood: types of wood and anatomy, methods of identification and comparison. Leaves: Identification of various types of leaves and their anatomy, methods of comparison. Pollens: Structure, function, methods of identification and comparison. Seeds and spores: structure and formation in fungi, gymnosperm and angiosperm. Forensic Diatomology: Diatoms: Nature, classification, location, structure, life cycle, extraction from various body tissues including bone marrow, preparation of slides, methods of identification and comparison, forensic significance.

Unit-4 Basic Molecular biology- the structure of DNA, source of dna sample, extraction, profiling, restriction fragment length polymorphism, polymerase chain reaction, short tandem repeat markers, single nucleotide polymorphism markers, determination of ethnicity, determination of physical appearance, determination of personality traits, mitochondrial dna, RNA, and DNA database.

References

1. Essential Forensic Biology: Allen Gunn
2. B.B. Nanda and R.K. Tiwari, Forensic Science in India: A Vision for the Twenty First Century, Select Publishers, New Delhi (2001).
3. M.K. Bhasin and S. Nath, Role of Forensic Science in the New Millennium, University of Delhi, Delhi (2002).

4. S.H. James and J.J. Nordby, Forensic Science: An Introduction to Scientific and Investigative Techniques, 2nd Edition, CRC Press, Boca Raton(2005).
5. W.G. Eckert and R.K. Wright in Introduction to Forensic Sciences, 2nd Edition, W.G. Eckert (ED.), CRC Press, Boca Raton(1997).

NBC105P1: Lab Based on Tools and Techniques-I

Paper: SEC

Total Credit: 02

Marks: 50

1. Determination of pH using pH meter.
2. Preparation of buffer using Handerson-Hasselbach equation.
3. Prepration of Normal Solution
4. Prepration of Molar Solution]
5. Determination of ABO Blood groups and Rh factor
6. Estimation of blood Haemoglobin
7. Determination of Blood Pressure
8. Collection & Separation of Blood plasma/serum
9. Estimation of Blood Glucose/ Cholesterol f) Collection of urine and qualitative analysis of normal/ abnormal constituents of urine

NBC105P2: Lab Based on Microbiology

Paper: SEC

Total Credit: 02
Marks: 50

1. Simple staining/Monochrome staining
2. Negative staining
3. Differential staining –Grams staining and Acid Fast staining
4. Media preparation & Test of sterility
5. Isolation of bacteria from soil, water by streak plate, pour plate and spread plate method
6. Preparation of Slant
7. Biochemical characterization (IMViC Test)

NBC105P3: Lab Based on Forensic Biology

Paper: SEC

Total Credit: 02
Marks: 50

1. To examine hair morphology and determine the species to which the hair belongs.
2. . To prepare slides of scale pattern of human hair.
3. To examine human hair for cortex and medulla.
4. To carry out microscopic examination of pollen grains.
5. To carry out microscopic examination of diatoms.
6. To cite a crime case in which diatoms have served as forensic evidence.
7. To prepare a case report on forensic entomology.
8. To prepare a case report on problems of wildlife forensics.

NBC106T: Aptitude and Reasoning

Paper: VSC
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 30

Unit-I: : Quantitative Ability (Basic Mathematics) (10 periods)

- 1.1. Number Systems
- 1.2. LCM and HCF
- 1.3. Decimal Fractions
- 1.4. Simplification
- 1.5. Square Roots and Cube Roots
- 1.6. Average
- 1.7. Problems on Ages
- 1.8. Surds & Indices
- 1.9. Percentages
- 1.10 Problems on Numbers

Unit-II: Quantitative Ability-I (Applied & Engineering Mathematics) (10 periods)

- 2.1. Logarithm
- 2.2. Permutation and Combinations
- 2.3 Probability

Unit-III: Quantitative Ability-II (Applied & Engineering Mathematics) (05 periods)

- 3.1 Profit and Loss
- 3.2 Simple and Compound Interest
- 3.3 Time, Speed and Distance
- 3.4 Time & Work
- 3.5 Ratio and Proportion

3.6 Area

Unit-IV: Logical Reasoning (Deductive Reasoning): (10 periods)

- 4.1. Analogy
- 4.2. Blood Relation
- 4.3 Directional Sense
- 4.4. Number and Letter Series
- 4.5. Coding – Decoding
- 4.6. Calendars
- 4.7. Clocks
- 4.8. Venn Diagrams
- 4.9. Seating Arrangement
- 4.10. Syllogism
- 4.11. Mathematical Operations

Unit-V: Data Interpretation (10 periods)

- 5.1. Data Interpretation
- 5.2. Tables
- 5.3. Column Graphs
- 5.4. Bar Graphs
- 5.5. Line Charts
- 5.6. Pie Chart
- 3.7. Venn Diagrams.

Reference books:

1. A Modern Approach To Verbal & Non Verbal Reasoning By R S Agarwal
2. Analytical and Logical reasoning By Sijwali B S
3. Quantitative aptitude for Competitive examination By R S Agarwal

NBC107T: Presentation Skill

Paper: VSC
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 30

Unit-I: : Communication Skills (10 periods)

Communication Skills: The Communication Process, Elements of Interpersonal Communication, Non-Verbal Communication: Body Language, Posture, Eye Contact, Smile, Tone of Voice, Barriers to Communication. Effective Listening Skills: Active Listening, Passive Listening, Asking Questions, Empathizing, Being Non-Judgmental, Being Open Minded, Mass Communication: Design of Posters, Advertisements, notices, writing formal and informal invitations

Unit-II: Presentation (10 periods)

Focus on Audience Needs, focus on the Core Message, Use Body Language and Voice, Start Strongly, Organizing Ideas& Using Visual Aids:

Unit-III: Model and Ruls (05 periods)

SPAM Model, Effective Opening and Closing Techniques, GuyKawasaki'sRule
Overcoming Stage Fear, Story Telling

Unit-IV: Group Discussion (10 periods)

Group Discussion: Understanding GD, Evaluation Criteria, Nine Essential Qualities for Success, Positive and Negative Roles, Mind Mapping, structuring Response, Methods of Generating Fresh Idea

Unit-V: Data Interpretation (10 periods)

Data Interpretation: Interpretation and analysis of data in Tables, Case lets, Line-graphs, Pie-graphs, Boxplots, Scatterplots and Data Sufficiency

References:

1. Verbal Ability & Reading Comprehension by Arun Sharma and Meenakshi Upadhyay

2. Study material for CAT, SAT, GRE, GMAT by TIME, Career Launcher and IMSetc

Curriculum of Semester –II

B.Sc. Biochemistry Honours (Semester II)

NBC201T: Cell Biology

Paper: DSC-3
Contact Hours: 45 (Clock Hours)

Total Credit: 03
Marks: 30

Unit1. Cell Structure and organelles

Cell theory Organization :Origin of eukaryotic cells endosymbiotic theory,. Overview of cell specializations: Plants epidermis,vascular tissue and cortex, Animals epithelia,connective tissue, nervous tissue, muscle, blood, germ cells and sensory cells. Structure and Functions of Organelles

Unit II. Membrane Structure

Membrane models Overton's lipid nature of membrane, Langmuir's lipid monolayer, Davson and Danielli's lipid bilayer plus protein sheet, Robertson's Unit membrane, Singer and Nicolson's fluid mosaic. Membrane structure 2D Lipid bilayer, composition of lipid bilayer, asymmetric nature, fluidity, membrane proteins and their function.

Unit III. Cell Division and Cell Cycle

Mitosis, Meiosis, and Cytokinesis, role of protein kinases and Cyclin Cdk-complex in controlling cell cycle, control of cell proliferation in multicellular organisms, programmed cell death

Unit IV: Cell Communication and Cell Signalling

Cellular Communication and Cell signaling: general principles of cell communication, , cell adhesion and roles of different adhesion molecules, gap junctions, extracellular matrix, integrins,Neurotransmissions and its regulation, Hormones and their receptors, cell surface receptor, G-protein coupled receptors, signal transduction pathways, second messengers, regulation of signaling pathways, bacterial and plant two-component signaling systems, bacterial chemotaxis and quorum sensing.

References:

1. Cell Biology by -Sadava
2. Molecular Cell Biology, Lodish et al., Freeman and Company, New York, 1999
3. Essential Cell Biology An introduction to the molecular Biology of the cell Alberts, Bray, Johnson, Lewis, Raff, Roberts, Walter, Garland Publishing.
4. Molecular Biology of the cell Bruce Alberts, Garland Publishing Inc.
5. Cell Biology A short course, Second edition, Stephen R. Bolsover, Wiley Publication
6. Genes XI Benjamin Lewin, Prentice Hall Publication
7. An introduction to Practical Biochemistry David T Plummer, Tata McGraw Hill Edition
8. Developmental Biology, Ninth edition, S.F. Gilbert, Sinauer Associates Inc.

NBC201P: Lab Based on Cell Biology

Paper: DSC-3
Marks :50

Total Credit: 02

1. Demonstration of golgi body, endoplasmic reticulum, peroxisomes (Permanent preparations)
2. Studies on various stages of Mitosis and
3. Studies on various stages of Meiosis
4. Studies on Plasmoptysis and Plasmolysis
5. Transport across membrane
6. Effect of detergent on permeability of membrane

NBC201T: Basic Enzymology

Paper: DSC-4

Contact Hours: 45 (Clock Hours)

Total Credit: 03

Marks: 30

Unit 1 Introduction to enzymes No. of Hours:

Nature of enzymes - protein and non-protein (ribozyme). Cofactor and prosthetic group, apoenzyme, holoenzyme. IUBMB classification of enzymes.

Unit 2 Features of enzyme catalysis Factors affecting the rate of chemical reactions, collision theory, activation energy and transition state theory, catalysis, reaction rates and thermodynamics of reaction. Catalytic power and specificity of enzymes (concept of active site), Fischer's lock and key hypothesis, Koshland's induced fit hypothesis.

Unit 3 Mechanism of action of enzymes

General features - proximity and orientation, strain and distortion, acid base and covalent catalysis (chymotrypsin, lysozyme). Metal activated enzymes and metalloenzymes, transition state analogues.

Unit 4 Regulation of enzyme activity

Control of activities of single enzymes (end product inhibition) and metabolic pathways, feedback inhibition (aspartate transcarbamoylase), reversible covalent modification phosphorylation (glycogen phosphorylase). Proteolytic cleavage- zymogen. Multienzyme complex as regulatory enzymes. Occurrence and isolation, phylogenetic distribution and properties (pyruvate dehydrogenase, fatty acyl synthase) Isoenzymes - properties and physiological significance (lactate dehydrogenase).

SUGGESTED READINGS

1. Lehninger: Principles of Biochemistry (2013) 6th ed., Nelson, D.L. and Cox, M.M., W.H. Freeman and Company (New York), ISBN:13: 978-1-4641-0962-1 / ISBN:10:1-4292-3414-8.
2. Biochemistry (2011) 4th ed., Donald, V. and Judith G.V., John Wiley & Sons Asia Pvt. Ltd. (New Jersey), ISBN:978-1180-25024.
3. Fundamentals of Enzymology (1999) 3rd ed., Nicholas C.P. and Lewis S., Oxford University Press Inc. (New York), ISBN:0 19 850229 X

NBC201P: Lab Based on Basic Enzymology

Paper: DSC-4

Total Credit: 02

Marks :50

1. Partial purification of acid phosphatase from germinating mung bean.
2. Assay of enzyme activity and specific activity, e.g. acid phosphatase.
3. Effect of pH, Temp. on enzyme activity
4. Continuous assay of lactate dehydrogenase.
5. Coupled assay of glucose-6-phosphate dehydrogenase.

NBC203T1: Protein Biochemistry

Paper: Minar-2
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 30

Unit 1 Introduction to amino acids, peptides and proteins

Amino acids and their properties - hydrophobic, polar and charged. Biologically important peptides - hormones, antibiotics and growth factors. Multimeric proteins, conjugated proteins and metallo proteins. Diversity of function

Unit 2 Characterization of proteins

Determination of purity, molecular weight, extinction coefficient and sedimentation coefficient, IEF, SDS-PAGE and 2-D electrophoresis.

Unit 3 Covalent structure of proteins

Organization of protein structure into primary, secondary, tertiary and quaternary structures. N-terminal and C-terminal amino acid analysis. Sequencing techniques – Edman degradation. Generation of overlap peptides using different enzymes and chemical reagents. Disulfide bonds and their location. Mass spectrometric analysis, tandem MS. Solid phase peptide synthesis

Unit 4 Three dimensional structures of proteins

Nature of stabilizing bonds - covalent and non covalent. Importance of primary structure in folding. The peptide bond - bond lengths and configuration. Dihedral angles psi and phi. Helices, sheets and turns. Ramachandran map. Techniques used in studying 3-D structures - X-ray diffraction and NMR. Motifs and domains. Tertiary and quaternary structures. Structures of myoglobin and haemoglobin

Reference Books

1. Cohn & Stump – Outline of Biochemistry Wiley Eastern Ltd.
2. L. Lehninger, D. L. Nelson & M M Cox – Principles of Biochemistry.
3. Lubert Stryer – Biochemistry
4. J. Jayraman- Practical Biochemistry
5. Plummer. –Practical Biochemistry
6. A.C.Deb Fundamentals of biochemistry
7. Zuby - Biochemistry 4th edition

8. Boyer- Concepts in Biochemistry

9. Cooper -The tools of Biochemistry

Biochemistry- U Satyanarayan

NBC203T2: Biostatistics

Paper: Minar-2

Contact Hours: 30 (Clock Hours)

Total Credit: 02

Marks: 30

Unit I: Sampling, Data Collection and Presentation

Introduction to Biostatistics, Common Terms and Notations, Applications. Sampling: Representative Sample, Sample Size, Sampling Bias and Sampling techniques.

Unit II :Data Collection and Presentation:

Type of Data, Method of Collection of Primary and Secondary Data, Methods of Data Presentation, Graphical Representation by Histogram, Polygon, Ogive Curve, Pie Diagram.

Unit III : Central Tendency

Measure of Central Tendency: Mean, mode, median Measure of Variability : Standard Deviation, Standard Error Range ,Mean Deviation, Coefficient of Variation, Correlation Coefficient and Regression (Positive & Negative),Calculation of Correlation Coefficient & Regression Coefficient , Linear Regression and Regression Equation, ANOVA: One and Two Way Classification

Unit IV: Test of Significance & Computer based statistical techniques:

Test of Significance : F-test , Z-test .T-test and Chi-Square ,Probability Distribution : Binomial,Poisson and Normal Distributions. Computer based statistical techniques: Frequency Table of Single Discrete Variable , Bubble Sort , Computation of Mean , Variance and Standard Deviation, T-test , Correlation Coefficient

References :

1. B.K Mahajan method in Biostatistics Jaypee brother medical pulisher Ltd india .
2. Richard ah Introduction to Biostatistics prentice hall of biostat
3. Campbell R.C Statistics for biologist, Cambridge University Press,Cambridge
4. Wardlaw,A.C.(1985) Practical Statistics for experimental Biologists
5. Baily N.T.J. Statistical methods in Biology English University press
6. P.S.S. Sunderrao & J.Richard An Introduction to Biostatistics Prentice hall of India pvt.ltd.
7. Khan, Fundamentals of Biostatistics
8. B.K. Mahajan Methods in Biostatistics, Jaypee brothers medical publisher ltd,India
9. Robert sokal and James Rohlf Introduction to Biostatistics W.H. Freeman Press

NBC203T3: Basic Virology

Paper: Minar-2

Total Credit: 02

Contact Hours: 30 (Clock Hours)

Marks: 30

Unit I: Fundamental concepts in Virology

History and principles of virology, molecular biology of bacterial virus, viral classification, nomenclature, taxonomy; viral strategies for attachment and entry, different strategies for viral replication - the Baltimore Classification System; Basic immune response to viral infection, general virus pathogenesis; virus structure and morphology

Unit II: Cultivation of Viruses

Cultivation and purification of viruses: Different in vivo, in vitro and in ovo growth systems for bacterial, plant and animal viruses, determination of yields; Purification of viruses using ultracentrifugation technique.

Unit III: Virological Methods

Immunological techniques: Immunodiagnosis, haemagglutination and haemagglutination inhibition assays, complement fixation, neutralization, western blot, radio-immunoprecipitation (RIPA) assay, single radial immunodiffusion (SRID) assay, flow-cytometry, immunohistochemistry (IHC), immunofluorescence assay (IFA).

Unit IV: Viral diagnostics

Nucleic acid based techniques: Nucleic acid hybridization, PCR, microarray and sequencing. Microscopic techniques: Fluorescence, confocal and electron microscopic techniques—principles and applications Analytical techniques: Chromatography techniques, membrane filtration, NMR, X-ray Crystallography. Emerging techniques in viral diagnostics

Reference Book

- 1) E. K. Wagner, et al., Basic Virology, Wiley, 2007, 3rd edition
- 2) T. Shores, Understanding Viruses, Jones and Bartlett, 2009, 1st edition
- 3) J. S. Flint, et al., Principles of Virology: Molecular Biology, Pathogenesis, and Control, American Society for Microbiology, 2009
4. D. M. Knipe and P. M. Howley, Fields Virology, Lippincott Williams & Wilkins, 2013, 6th edition

NBC204T1: Tools and Techniques -II

Paper: Generic
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 30

Unit I Chromatography General principles and applications of :

1. Adsorption chromatography
2. Ion-exchange chromatography
3. Thin-layer chromatography
4. Molecular-sieve chromatography
5. Hydrophobic chromatography
6. Gas-liquid chromatography
7. HPLC
8. Affinity chromatography
9. Paper chromatography

Unit II Electrophoresis Basic principles of agarose electrophoresis, PAGE and SDS-PAGE, Two dimensional electrophoresis, its importance. Isoelectrofocussing.

Unit III Centrifugation

Sedimentation, preparative analar centrifugation

Unit IV Nucleic acid related techniques

Sanger dideoxy method, Maxam Gilbert, Southern blotting , Nothern blotting, western blotting, Microarray, Hybridisation methods

NBC204T2: Physiological Biochemistry

Paper: Generic
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 30

Unit I :Microbial Growth

Growth curve, quantification of growth –direct/indirect, Arithmetic, continuous and synchronous growth

Unit II:Transport of Nutrients

Uptake of Nutrient,Passivediffusion,facilateddiffusion,active transport (ABC transporters) ,simple transport(Uniport,symport,andantiport.) group translocation and protein export system.

Unit III:Microbial Differentiation

Bacterial sporulation, stages and biochemical changes during sporulation and germination of spore, Typical Structure of spore.

Unit IV :Microbial toxins and stress response

types of toxin, Shiga toxin, toxins from *E. coli*, cholera toxin, Staphylococcal toxin, septic shock, botulism. Heat shock and cold shock, stress during prolonged stationary phase and other environmental conditions.

References:

1. R. Y. Stanier 6th Edition, General Microbiology, McMillan Press. Inc.
2. Pelczar Microbiology, TMH publication
3. Anantnarayan text book of Microbiology 9th edition, Orient Longman Delhi
4. Cappucinno Microbiology; a laboratory manual 4th edition
5. Tortora Microbiology: An introduction
6. Salle A. J. Fundamental Principles of Bacteriology
7. Prescott Microbiology
8. Rose Chemical Microbiology
9. Cruickshank, Duguid Medical Microbiology

NBC204T3: Basic Bioinformatics

Paper: Generic
Contact Hours: 30 (Clock Hours)

Total Credit: 02
Marks: 30

Unit 1:

Introduction to bioinformatics and data generation Bioinformatics and its relation with molecular biology. Examples of related tools (FASTA, BLAST, BLAT, RASMOL),databases(GENBANK, Pubmed, PDB) and software(RASMOL,Ligand Explorer).

Unit 2:

Biological Database and its Types Introduction to data types and Source. Population and sample, Classification and Presentation of Data. Quality of data, private and public data sources. General Introduction of Biological Databases; Nucleic acid databases (NCBI, DDBJ, and EMBL). Protein databases (Primary, Composite, and Secondary). Specialized Genomedatabases: (SGD, TIGR, and ACeDB). Structure databases (CATH, SCOP, and PDBsum)

Unit 3:

Data storage and retrieval and Interoperability Flat files, relational, object oriented databases and controlled vocabularies. File Format (Genbank, DDBJ, FASTA, PDB, SwissProt). Introduction to Metadata and search; Indices, Boolean, Fuzzy, Neighboring search. The challenges of data exchange and integration. Ontologies, interchange languages and standardization efforts. General Introduction to XML, UMLS, CORBA, PYTHON and OMG/LIFESCIENCE.

Unit 4:

Sequence Alignments and Visualization Introduction to Sequences, alignments and Dynamic Programming; Local alignment and Global alignment (algorithm and example), Pairwise alignment (BLAST and FASTA Algorithm) and multiple sequence alignment (Clustal W algorithm). Methods for presenting large quantities of biological data: sequence viewers (Artemis, SeqVISTA), 3D structure viewers (Rasmol, SPDBv, Chime, Cn3D, PyMol), Anatomical visualization

Suggested Readings

1. Teresa K Attwood and David J. Parry-Smith, Introduction to Bioinformatics, Pearson Education Asia, 2001
2. Bexavanis & Francis, Bioinformatics-A practical guide to the analysis of genes and proteins, John Wiley and Sons, 2001
3. Rushidi, Basics of Bioinformatics, CRC Publications, 2001
4. Irfan Khan and Atiya Khanum, Emerging trends in Bioinformatics, Ukaaz Publishers, 2002

5. David M. Hill, Craig Martiz and Barke Mable, Molecular systematics
6. Khan Imtiyaz alam ,Rai University, Hyderabad:- Elementry Bioinformatics
7. N. Gautam Bioinformatics- Databases and algorithm
8. Bioinformatics: Sequence and Genome Analysis by D.W. Mount, 2001, Cold Spring Harbor Laboratory Press.

NBC205P1: Lab Based on Tools and Techniques-II

Paper: SEC

Total Credit: 02

Marks :50

1. Separation of sugars paper chromatography
2. Separation of Amino acids paper chromatography
3. TLC
4. Electrophoresis; Gel and Paper
5. Demonstration of starch hydrolysis
6. Sugar estimation
7. Demonstration of rancidity
8. Demonstration of saponification
9. Qualitative test for detection of proteins and amino acids both: purified and natural sources
10. Protein Estimation

NBC205P2: Lab Based on Physiological Biochemistry

Paper: SEC

Total Credit: 02

Marks :50

1. Growth curve –optical density method
2. Standard plate count
3. Total viable count (samples from prolonged stationary phase of growth curve experiment)
4. Arithmetic growth
5. Synchronous culture
6. Demonstration of sporulation
7. Spore staining

NBC205P2: Lab Based on Basic Bioinformatics

Paper: SEC

Total Credit: 02

Marks :50

1. Introduction to NCBI
2. Retrieving the DNA Sequences
3. Retrieving the DNA Sequences
4. Retrieval of a Genbank Entry using an accession number
5. Primary structure analysis of a protein
6. finding the official Symbol, alias name, chromosome number and ID for gene using NCB
7. Similarity Search using BLAST

NBC206T: Web Designing

Paper: VSC

Total Credit: 02

Contact Hours: 30 (Clock Hours)

Marks: 30

UNIT-1: Introduction to Web Designing: (10 period)

Web page, Website, Web browser, www, Developing web Documents-Web design

process, and Publishing documents: Web publishing. Maintaining documents: maintenance phases of web page

UNIT-2: HTML Introduction: (10 period)

HTML Markup tags: Tags-Definition, Basic Tags-HTML, HEAD, TITLE, BODY. Paragraph Tags, List tags, Horizontal Rule Tag, Headings Tags, Block quote Tags, Address Tags, FONT Tag, PRE tag, DIV tags, SPAN tag& other different formatting tags.

UNIT-3: Linking and Image tag in HTML:: (10 period)

Linking in HTML: U.R.L. concept, Hyperlink (Anchor) Tag & it's all attributes, Creating Email Hyperlinks (using mailto anchor).

Images in HTML:

Introduction: Image & image formats, tag& it's all attributes, Inline & Floating Images, Using Images as links

UNIT-4: Tables in HTML (10 period)

Tables in HTML: Introduction, Table Tags:- TABLE, TR, TH, TD & all Attributes, Row span, Cols pan, Cell spacing, Cell padding, Table examples

UNIT-5: Forms in HTML: (05 period)

Introduction to forms, FORM tag& it's attributes (Action, Enctype, Method, Name), Simple form examples, Form controls: Text Field, Password Field, Multiline Text Area, Drop, Down List, Check Box, Radio Buttons, Scrolled List, Reset Button, Submit button.

Reference Books:

1. Thommas A Powel, "The complete Reference (HTML & XHTML)", 4th Edition (Tata McGraw Hill publication.)
2. HTML completes 2nd Edition-BPB Publication

NBC206T: Personality Development and Interview Techniques

Paper: VOC-2

Contact Hours: 30 (Clock Hours)

Total Credit: 02

Marks: 30

UNIT-1: Introduction (10 period)

Introducing the connect with work programme

What is in it for me? Understanding the objective of the CWW programme

UNIT-2: Interview Skills (SEO) (10 period)

Interview Skills :Online Image Building a strong impression online and sustaining online credibility

Self-Awareness :To Know your personality through an MBTI ,Grooming To study corporate grooming habits (The right attire) ,

Body Language :To imbibe the right body language for a professional environment

Confidence: To increase self-belief and faith in one's own abilities Interview FAQs
Learn to face frequently asked interview questions

Resume: To build a strong profiles through effective resume writing

Rejections:To understand how to handle interview rejections and come back from set-backs

UNIT-3: Corporate Readiness (10 period)

Corporate Readiness

Values: An introduction to values in a corporate environment

Ownership: To learn how to be accountable and own tasks, projects etc.

Respect: To understand the importance of respect as a critical corporate value

Teamwork: To understand collaboration and its importance in the corporate world

Autodidacticism: To leverage self-learning and self-directed education

Flexibility: To learn how to be flexible while playing multiple roles

Time Management: To improve effectiveness at work and achieve a balance

Stress Management: To understand how stress can be managed and to lower depression

Positive Attitude: To take the step towards positive success by adapting the right approach

LinkedIn (Profile Management):To gain knowledge on LinkedIn account management and tips to enhance a profile

SWOT Analysis: To Self evaluate and analyze strengths and areas of improvement

UNIT-4: Group Discussions (10 period)

Group Discussions: Group Discussion rules and enhance Public Speaking skills (Group Discussion)

Demo session of group discussion.

UNIT-5: Mock Interviews (05 period)

Mock Interviews: Tips to handle Interviews and be able to create the right impression (Mock Interviews)

Demo session of mock interview.

Reference Books

- 1."Personality Development and Soft Skills" by Barun Mitra
- 2."Personality Development" by Swami Vivekananda
- 3."The Power of your Subconscious Mind" by Joseph Murphy
- 4."50 Mantra's of Personality Development" by Aarti Gurav
- 5."Personality Development for Students" by Dr Vijay Agrawal

END