

तात : विश्वविद्यालय
Gram : UNIVERSITY



टेलीफोन : कार्यालय : 2320496
कुलसचिव : निवास : 2321214
फैक्स : 0510 : 2321667

बुन्देलखण्ड विश्वविद्यालय, झाँसी BUNDELKHAND UNIVERSITY, JHANSI

झाँसी (उ.प्र.) 284128

संक्रम. BU/Biochem/2022/016

दिनांक 25/06/2022

The Minutes of Meeting of BOS

In reference to the BOS of department of
Biochemistry....., Institute of Life Sciences
..... held on 25/06/2022 regarding the
revision of syllabus in tune with CBCS/NEP-2020 and subsequent
approval from Academic Council. This is to certify that the syllabus is
100% revised.

Shahina

HOD/Coordinator
Dr. Shahina Kalim
Co-Ordinator
Department of Biochemistry
Bundelkhand University, Jhansi



बुन्देलखण्ड विश्वविद्यालय, झाँसी

पत्रांक :- बु0वि0/एकेडमिक/2022/17093-98

दिनांक :- 26/05 /2022

अधिसूचना

एतद द्वारा अध्ययन बोर्ड के गठन से सम्बन्धित अध्यादेश के प्राविधानुसार विज्ञान संकाय के अन्तर्गत बायोकेमिस्ट्री विषय के तदर्थ अध्ययन बोर्ड का गठन कुलपति महोदय के आदेशानुक्रम में निम्नानुसार किया जाता है।

1	प्रो० आर०के० सैनी, संकायाध्यक्ष विज्ञान बुन्देलखण्ड विश्वविद्यालय, परिसर, झाँसी	संकायाध्यक्ष/संयोजक
2	डॉ० रमेश कुमार, बुन्देलखण्ड विश्वविद्यालय, परिसर, झाँसी	सदस्य
3	डॉ० शाहिना कलीम, बुन्देलखण्ड विश्वविद्यालय, परिसर, झाँसी	सदस्य
4	सुश्री सुमिरन श्रीवास्तव, बुन्देलखण्ड विश्वविद्यालय, परिसर, झाँसी	सदस्य
5	प्रो० बेचन शर्मा, इलाहाबाद विश्वविद्यालय, इलाहाबाद	वाह्य विशेषज्ञ
6	श्री राजीव शर्मा, लुपिन फार्मा, पंचकुला, हरियाणा	वाह्य विशेषज्ञ

अध्ययन बोर्ड में समाविष्ट सदस्यों/विशेषज्ञों का कार्यकाल अधिसूचना निर्गत होने की तिथि से तीन वर्ष अथवा सम्बन्धित शिक्षक की अधिवर्षिता की आयु पूर्ण होने तक अथवा इस सम्बन्ध में अन्य आदेश निर्गत होने तक, जो भी पूर्व में हो, तक प्रभावी होगा।

उपरोक्त सम्मानित विशेषज्ञों से अनुरोध है कि कृपया अपना आवासीय पता ई-मेल आई०डी० एवं मोबाइल नं० उपलब्ध कराने का कष्ट करें, जिससे भविष्य में पत्राचार में कठिनाई न हो।

(विनय कुमार सिंह)
कुलसचिव

प्रतिलिपि:- निम्नलिखित को सूचनार्थ एवं आवश्यक कार्यवाही हेतु प्रेषित।

1. उपर्युक्त सदस्यगण।
2. कुलसचिव/परीक्षा नियंत्रक के आशुलिपिक।
3. निजी सचिव कुलपति, कुलपति जी के सूचनार्थ
4. सम्बन्धित पत्रावली

कुलसचिव

25/6/22

Proceedings of the Meeting :-

In the meeting following points were discussed :

- (1) Syllabi for B.Sc(H) Biochemistry (Semester - I, semester - II, Semester - III, Semester - IV, semester - V, semester - VI) according to NEP-2020 were prepared.
- (2) Syllabi for M.Sc Biochemistry (Semester - I, semester - II, Semester - III, Semester - IV) according to NEP-2020 were prepared.
- (3) The panel of Examiners for B.Sc(H) Biochemistry I year (Semester - I, Semester - II), ^{II and III year} Examination for session 2022-23 were finalized.
- (4) The panel of Examiners for M.Sc Biochemistry I year (Semester - I, Semester - II) ^{and II year} Examination for session 2022-23 were finalized.

Paulina
25/6/22

Shahina
25/6/22

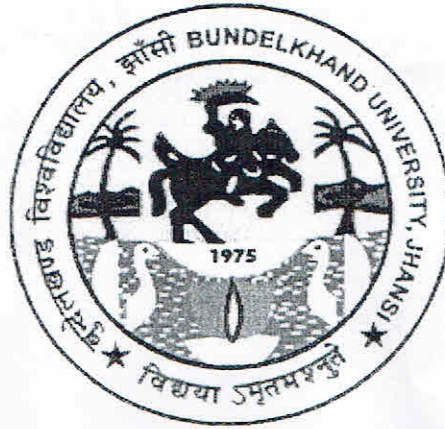
Sunil
25/6/22

[Signature]
25/06/2022

DEPARTMENT OF BIOCHEMISTRY

J.C. BOSE INSTITUTE OF LIFE SCIENCES

BUNDELKHAND UNIVERSITY, JHANSI (U.P.) - 284128



ORDINANCE for M.Sc. in Biochemistry

Under

NATIONAL EDUCATION POLICY-2020

(Effective from the Session: 2022-2023)

Sunil Kumar
25/6/22

Shahina
25/6/22

Alim
25/6/22

Amey
25/06/22

**ORDINANCE FOR POSTGRADUATE (SEMESTER SYSTEM) PROGRAMME
ARTS, SCIENCE & COMMERCE FACULTIES (2022 onward)**

1. INTRODUCTION

1.1 Preamble

This ordinance governs all the rules and regulations as per the NEP 2020 for the traditional post graduate programs (M.A., M.Sc., M.Com, Management courses, etc) which are not covered by any regulatory bodies (AICTE, BAR Council, PCI, NCTE etc) running in the University campus or its affiliated colleges in Bundelkhand University, Jhansi. This ordinance supersedes all the previous relevant ordinances, rules and regulations.

1.2 Duration

Bundelkhand University has adopted the semester system in various Postgraduate courses as per directives of Higher Education Department, Uttar Pradesh Government vide letter No 4017/seventy-3-2022 dated 09-02-2022 to accelerate the teaching-learning process and enable vertical and horizontal mobility in learning from the academic session 2022- 23 onwards.

The duration of PG courses shall be two years comprising of four semesters. In case a student(s) exits from this programme after completion of the first year (2 semesters), he/she may take exit from the programme and shall be awarded the Degree of Bachelor in Research. After the successful completion of two years (4 semesters) a student shall be awarded the Master's degree in the concerned subject. The maximum duration to complete the course shall be four years.

1.3 Eligibility for Admission

- o Candidate, who wishes to seek admission in a course of study prescribed for a post graduate degree of the University, shall be admitted to campus or an affiliated college unless he/she has:
 - passed the three years Bachelor's degree course Examination of the University of Uttar Pradesh or any other Indian University incorporated by any law in force at the time of admission.
 - or
 - passed any other equivalent examination recognized by the University as equivalent thereto.
 - passed any other equivalent examination recognized by a Foreign University as equivalent thereto
- o The date of admission shall follow the University academic calendar.

1.4 Choice of Subject and Course Structure

- i. University/ College shall admit students as per the eligibility criteria and availability of seats decided by the university.
- ii. A student shall take admission to post graduation first year of fourth year of Higher Education program of NEP 2020 after successful completion of Graduate course from NEP 2020 or old course of Science/ Arts/ Commerce/

Shahina
25/5/22

Shahina
25/5/22

Shahina
25/6/22

Shahina

Management, etc. He/she shall have to choose respective faculty courses as per guidelines of NEP 2020 depending on the number of seats available in concerned subject and eligibility criteria. In case a candidate is willing to change the faculty, the following condition is required-

The candidate should have passed Bachelor degree in Science/ Commerce of NEP 2020 or old courses may take admission in some subjects of Arts faculty (excluding practical subjects like geography, psychology etc). Similarly, the Student from Commerce of NEP or old course of Commerce may also be eligible to take admission in Arts subjects. Arts, Management and Commerce candidates cannot be admitted in Science subjects.

- iii. Student(s) shall select subjects for Post graduation course from the major subjects that he / she had opted in the graduation course and shall continue with the same subjects in all the four semesters of the PG programme.
- iv. The course structure shall be as follows:
There shall be four compulsory theory papers in the first semester. In the second and third semester there shall be two compulsory papers and one/two elective papers. The elective papers are the specialization papers.
Student(s) shall have to select one Minor Elective Course as **Minor subject** from any other faculty (except own faculty) or interdisciplinary subject in the first semester of the first year.
- v. Student(s) shall take a Research Project /Survey/ Industrial /Field training program in both the years (Semester II and IV). No pre-requisite shall be required for this.
- vi. List of Minor Elective Course: The candidate shall select any one subject from the following as minor subject in first year of post graduate course.

S No	Science	Arts	Commerce	Interdisciplinary
1.	Mathematical Biology	Tribal Culture and Heritage	Customer Relation Management	Ancient Medical Sciences
2.	Conservation and Water Resource Management	Principle of Administration and Implications	House Keeping and Hospitality	Traditional Medical Therapy
3.	Natural Resources and Conservation	Socio-Economics and Social Security	Share Market and Banking	Vedic Mathematics
4.	Pollution: Causes and Mitigation	Archeological Sites and Monuments	Retail Management and Accounting	Bio Medical Instrumentation and Health
5.	Computational Resources	Indian Constitution	Insurance Policy and Finance	Disaster, Mitigation, & Management
6.	Organic and Natural Farming	Communication and Soft Skill		Mining Plan and Resource Mapping
7.	Computer Hardware Handling	Sanskrit Knowledge System		Water Treatment System
8.	Computer Software	Technical		Climate Change

Shahina
25/6/22

25/6/22

Suma
25/6/22

25/6/22

25/6/22

	Handling	Translation and Trans creation		and Environmental Degradation
9.	Solar and Non Conventional Energy	Urban Economics and Planning		Medicinal and Aromatic Plants Cultivation, extraction and nutraceutical Values
10.	Cyber Crime	Actuarial Economics		
11.	Bee Keeping, Aquaculture and Fish Farming	Social Sector and Gender Economics		Non Conventional Energy Resource
12.	Entrepreneurship in Microbial and Botanical Products	Environmental Economics		Soil and Water Testing
13.				

2. SEMESTER AND CREDIT DISTRIBUTION

An academic year for post graduate program is divided into four semesters. The Odd semester may be scheduled from July to December and Even semester from January to June.

Fourth Year				
	VII Sem	Credits	VIII Sem	Credits
Major	Theory – 04 Papers	5 Credits each Total Credits=20	Theory – 04 Papers	5 Credits each Total Credits=20
	Or Theory – 04 Papers Practical -02	Or 4 Credits each Total Credits=16 2 Credit each Total Credits=4 Total Credits=20	Or Theory – 04 Papers Practical -02	Or 4 Credits each Total Credits=16 2 Credit each Total Credits=4 Total Credits=20
Minor	Minor Elective-1 paper of 04 credits	04 Credits Total Credits=04		
Research Project/ Industrial training/ Survey/ Field Training	One of each 04 Credits	04 Credits Total Credits=04	One of each 04 Credits	04 Credits Total Credits=04
Total Credits		23		24
Total in Both Semester				52 Credit

Shikha
25/6/22

Shikha
25/6/22

Page 3 of 9

Sunisa
25/6/22
Shikha

Fifth Year

Semester	IX	Credits	X	Credits
Major	Theory – 04 Papers	5 Credits each Total Credits=20	Theory – 04 Papers	5 Credits each Total Credits=20
	Or Theory – 04 Papers Practical -02	Or 4 Credits each Total Credits=16 2 Credit each Total Credits=4 Total Credits=20	Or Theory -- 04 Papers Practical -02	Or 4 Credits each Total Credits=16 2 Credit each Total Credits=4 Total Credits=20
Research Project / Industrial training / Survey	One of each 04 Credits	04 Credits Total Credits=04	One of each 04 Credits	04 Credits Total Credits=04
		24		24
Total Credits				
Total in Both Semester	48 Credit			

3. ATTENDANCE

The expression "a regular course of study" wherever it is used in these Ordinances, means attendance of at least 75% of the lectures and other teaching in campus / affiliated college in the subject for the examination at which a candidate intends to appear and at such other practical work (such as work in a laboratory) as is required by any Statute, Ordinance or Regulation in force for the time being in the University.

A shortage up to 5% of the total number of lectures delivered or practical work done in each subject may be condoned by the Principal of the college/ Head of the Department (in case of University Campus) concerned.

A further shortage up to 10% may be condoned only by the Vice-Chancellor on the specific recommendation of the Principal of the college/Head of the Department concerned (in case of University Campus).

4. EXAMINATIONS

- There shall be examinations at the end of each semester as, for odd and even semesters in accordance with the academic calendar of the university. A candidate who does not pass the examination in any course(s) shall be permitted to appear in such failed course(s) in the subsequent examinations upto the maximum duration of the course.

Shahina
25/6/22

Shahina
25/6/22

Sumra
25/6/22
Shahina

2. A candidate should get enrolled/registered for the first semester examination and is mandatory. If enrolment/ registration is not possible owing to shortage of attendance / rules prescribed OR belated joining or on medical grounds, such students shall not be permitted to proceed to the next semester. Such students shall re-do the first semester in the subsequent term of that semester as a regular student; however, a student of first semester shall be admitted in the second semester, if he/she has successfully completed the first semester.
3. It shall be mandatory for the student(s) to register for examination in each and every semester (i.e. to fill up the examination form with the requisite fee). If a student fails to register for the examination in any semester, he or she shall not be allowed to appear in that semester as a back paper student. Such student(s) shall appear in the (next) subsequent examination of that semester.

5. EVALUATION

The performance of a student in each course is evaluated in terms of percentage of marks with a provision for conversion to grade point. Evaluation for each course shall be done by a Continuous Internal Assessment (CIA) by the concerned course teacher as well as by end semester examination and will be consolidated at the end of course. The evaluation must be continuous and holistic and should be based on following parameters:

- i. Academic assessment
- ii. Skill assessment
- iii. Physical assessment
- iv. Personality assessment
- v. Extra-curricular assessment

5.1 THEORY PAPER

Semester Examinations shall be conducted by the university as mentioned in the academic calendar. The Question paper will be set by the examiners appointed by the Vice Chancellor based on the recommendation of the board of studies. The pattern of the question paper shall be as given in annexure II.

- i. Internal Assessment (C.I.A.) - 25% weightage of a course
 - Test/ Mid-Term Assessment - 10 marks
 - Term paper/Presentation on given project/assignment - 10 marks
 - Attendance/activities - 05 marks
- ii. End Semester Exam (External examination) - 75% weightage of course

5.2 PRACTICAL PAPER

Practical examinations will be conducted by the examiners appointed by the Vice Chancellor on the recommendations of the Board of Studies. Each student has to present the practical records.

- i. Internal Assessment (C.I.A.) - 25% weightage of a course
 - Test/ Mid-Term Assessment - 10 marks
 - Term paper/Presentation on given project/assignment - 10 marks
 - Attendance/activities - 05 marks

Shahina
25/6/22

Shahina
25/6/22

Sundar
25/6/22
AM

- ii. End Semester Exam (External examination)– 75% weightage of a course

MINIMUM PASSING STANDARD

1. The minimum passing standard for combined external and internal examinations for each subject/paper shall be 45%, i.e. 45 out of 100 marks for theory and practical courses. The minimum passing standard for Aggregate in a semester end Examination shall be 45%.
2. Continuous Internal Assessment (CIA) shall be ensured by the Principal of the colleges / HODs for the Campuses courses. The Principal of the colleges / HODs of the Campus shall provide the marks of the same to the university and it shall be mandatory to maintain the records of the same till the maximum duration of that course.
3. The internal assessment, field training and practical examination awards of a student who fails in any semester examination shall be carried forward to the next examination.
4. It shall be mandatory for a student to secure minimum 45% marks (i.e. 45/100) in the theory and practical paper separately.

.....

PROVISION FOR BACK PAPERS AND EX-STUDENTS

A Back Paper (B.P.) candidate shall be promoted to next semester. The back paper facility in a semester provides promotion to the next semester and another opportunity to obtain a minimum of the pass marks assigned for an individual paper or in the aggregate. Following category of students of Bundelkhand University shall be eligible for back paper facility as under,

1. A student shall be required to pass in minimum two subject papers in each semester. However, at the end of each year, it shall be mandatory for a student to pass in at least two subjects papers and minor paper otherwise he/she shall be deemed as failed and will be treated as a year back / ex- student.
5. Students shall get the attempts to appear in the Back paper examination in the subsequent odd / even semester till the maximum duration of the said course.
6. Special back paper examination shall be held only for regular students of the final year of PG course.
7. The candidates who fail in more than three of the total papers, will be deemed as failed. These candidates can appear only in subsequent examination of that semester as Ex- Students.

8. PROMOTION RULES

8.1 Semester Course & Examination:

The students who have taken admission in any post-graduation programme in a session and who have put in the minimum percentage of attendance for appearing at the Examination, presented himself/herself for internal assessment and have filled in the examination form in time for appearing at the End Semester Examination shall be allowed to appear at the respective examinations.

8.2 Declaration of results

After appearing in the Examination of both the semesters in a particular year, the student can be put in the following categories in the context of declaration of the results of the Semester Examination:

- Passed
- Promoted with Back Paper(s)
- Failed

8.3 Promotion to next Semester:

ADG
25/6/22

Shahina
25/6/22

[Signature]

Sumroo
25/6/22
[Signature]

All students under category Passed and promoted with back papers shall be promoted to the next Semester.

"Failed" students may clear their UNCLEARED courses in subsequent examinations as ex-students. Students promoted with back papers shall clear their back papers in subsequent examinations as ex-students.

A student who has failed in a course shall get two more chances to clear this course subject to the maximum duration for passing the course. Further, each candidate shall have to clear all the courses within the maximum period of seven years from the date of his/her latest admission.

A candidate who has qualified for the Degree shall be placed in the First / Second Division as per following table:

8. COMPUTATION OF SGPA AND CGPA

The guidelines formulated by Bundelkhand University shall be followed in order to bring uniformity in evaluation system of every CBCS based Course and computation of the SGPA (Semester Grade Point Average) and CGPA (Cumulative Grade Point Average) based on students' performance in examination. The number of core, elective, open elective papers and foundation papers and the required credit for each paper shall be formulated by respective Board of Studies (BOS) and faculty board. For the purpose of computation of work load the UGC proposed mechanism is adopted i.e. one credit=1 Theory period of one hour duration, 1 credit=1 Tutorial period of one hour duration, 1 credit=1 Practical period of one hour duration. The credit(s) for each theory paper/practical/tutorial/dissertation will be as per the respective Board of Studies of departments.

Letter Grade	Numerical grade
O (outstanding)	10
A+ (Excellent)	9
A (very good)	8
B+ (Good)	7
B (average)	6
F (Fail)	<5
Ab (Absent)	0

The minimum passing marks shall be 45% of the maximum marks as prescribed in the University Examination and 45% of marks in the aggregate marks in the subject including internal / sessional marks. i.e. Minimum Passing Grade is "B".

A student who obtains Grades "O" or "B" shall be considered as PASSED. If a student secures "F" grade, he/she shall be considered as FAILED and shall have to re appear in the examination. It is mandatory for a student to earn the required SGPA as in each semester. If a student is not able to secure 45% / B grade in any theory / practical / internal / sessional / viva-voce / internship / project examination, the awarded grade point shall be ZERO (0).

[Signature]
25/6/22

[Signature]
Shahina
25/6/22

[Signature]
Sawra
25/6/22

[Signature]

9.1 The University, adopts absolute grading system where in the marks are converted to grades, and every semester results will be declared with semester grade point average (SGPA) and year result will be declared with year grade point average (YGPA). The Cumulative Grade Point Average (CGPA) will be calculated in end of final semester. The grading system of pharmacy department will be with following letter grades and grade points scale as given below:

Table A (For all courses except Pharmacy courses)

Level	Outstanding	Excellent	Very Good	Good	Average			Fail
Letter Grade	O	A+	A	B+	B			F
Grade Points	10	9	8	7	6			0
Score (Marks) Range (%)	≥ 90 (90-100)	$< 90,$ ≥ 80 (80-89.99)	$< 80,$ ≥ 70 (70-79.99)	$< 70,$ ≥ 60 (60-69.99)	$< 60,$ ≥ 45 (50-59.99)			< 45 (0-35.99)

1.1 A student obtaining Grade "F" shall be considered failed and will be required to reappear in the examination. Such students after passing the failed subject in subsequent examination / will be awarded with grade respective of marks he/she scores in the subsequent examination/s.

1.2 The University has the right to scale/moderate the theory exam / practical exam / internal exam / sessional marks of any subject when ever required for converting of marks into letter grades on the basis of the result statistics of university as in usual practice, i.e. marks obtained in decimal will be converted in nearest integer.

9. CONVERSION OF GRADES IN TO PERCENTAGE

1.3 Conversion formula for the conversion of CGPA into Percentage is $CGPA \text{ Earned} \times 10 = \text{Percentage of marks scored}$.

Illustration: $CGPA \text{ Earned } 8.2 \times 10 = 82.0\%$

2. AWARD OF DIVISION

Division shall be awarded only after the final semester examination based on integrated performance of the student for all the semesters as per following details.

2.1 A student who qualifies for the award of the degree securing "B" or above grades in all subjects pertaining to all semesters, and in addition secure as a CGPA of 8.0 and above shall be declared to have passed the examination in **FIRST DIVISION WITH HONOURS**.

2.2 A student who qualifies for the award of the degree securing "B" or above grades in all subject pertaining to all semesters, and in addition secures a CGPA of 7.0 and above shall be declared to have passed the examination in **FIRST DIVISION**.

[Signature]
25/6/22

[Signature]
25/6/22

[Signature]
25/6/22

[Signature]


2.3 A student who qualifies for the award of the degree securing "B" or above grades in all subjects pertaining to all semesters, and in addition secures a CGPA of 5.0 and above shall be declared to have passed the examination in **SECOND DIVISION**.

10. **UNFAIR MEANS:**

Cases of unfair means in the End Semester Examinations and Mid-Term Tests shall be dealt as per the rules laid by the University.

Note:

1. Those students who are NOT eligible for promotion to next year shall have to reappear in the coming examination as ex-students. However, the marks of internal assessment shall be carried forward in such cases.
2. Scrutiny facility and Challenge evaluation facility shall be available for those students who want to improve their grades.


25/6/22





Shahina
25/6/22

Suwan
25/6/22



14. **सिद्धि व परिष्कार कार्यक्रमों की प्रगति रिपोर्ट**

Year	Sem.	Subject I	Subject II	Subject III	Subject IV	Vocational	Co-Curricular	Industrial Training/ Survey/ Research Project	Remission Credits For the year	Communicative/ Minimum Credits Required for Award of Certificate/ Diploma/ Degree
1	I	Major 4/5/6 Credits	Major 4/5/6 Credits	Major 4/5/6 Credits	Minor Elective 4/5/6 Credits	Major 3 Credits	Minor	Major 4 Credits	46	{46}
	II	Th-1(6) or Th-1(4)+ Pract-1(2)	Th-1(6) or Th-1(4)+ Pract-1(2)	Th-1(6) or Th-1(4)+ Pract-1(2)	Th-1(6) or Th-1(4)+ Pract-1(2)	1	1	Industrial Training/ Survey/ Research Project		
2	III	Th-1(6) or Th-1(4)+ Pract-1(2)	Th-1(6) or Th-1(4)+ Pract-1(2)	Th-1(6) or Th-1(4)+ Pract-1(2)	1 (4/5/6)	1	1	1	46	{92}
	IV	Th-1(6) or Th-1(4)+ Pract-1(2)	Th-1(6) or Th-1(4)+ Pract-1(2)	Th-1(6) or Th-1(4)+ Pract-1(2)	1 (4/5/6)	1	1	1		
3	V	Th-2(5) or Th-2(4)+ Pract-1(2)	Th-2(5) or Th-2(4)+ Pract-1(2)	Th-2(5) or Th-2(4)+ Pract-1(2)				1 (Qualifying)	40	{132}
	VI	Th-2(5) or Th-2(4)+ Pract-1(2)	Th-2(5) or Th-2(4)+ Pract-1(2)	Th-2(5) or Th-2(4)+ Pract-1(2)				1 (Qualifying)		
4	VII	Th-3(5) or Th-3(4)+ Pract-1(2)	Th-3(5) or Th-3(4)+ Pract-1(2)	Th-3(5) or Th-3(4)+ Pract-1(2)	1 (4/5/6)			1 (4)	16	{288}
	VIII	Th-3(5) or Th-3(4)+ Pract-1(2)	Th-3(5) or Th-3(4)+ Pract-1(2)	Th-3(5) or Th-3(4)+ Pract-1(2)	1 (4/5/6)			1 (4)		
5	IX	Th-4(5) or Th-4(4)+ Pract-1(2)	Th-4(5) or Th-4(4)+ Pract-1(2)	Th-4(5) or Th-4(4)+ Pract-1(2)				1 (4)	48	{232}
	X	Th-4(5) or Th-4(4)+ Pract-1(2)	Th-4(5) or Th-4(4)+ Pract-1(2)	Th-4(5) or Th-4(4)+ Pract-1(2)				1 (4)		
6	XI	2 (6)	Research (4) Methodology					1 (6)	16	{288}
6,7,8	XII-XVI							Ph. D. Thesis (Qualifying)	16	Ph.D. in Subject

Note: Blue Colour: No. of papers Read colour: Credits Purple colour: Non-Credit Qualifying Courses; Th-Theory, Pract-Practical

N. N. N.

Shriya
05/15/22

Sumita
05/16/22

05/16/22

05/16/22

Program Outcomes (POs)

Program Outcomes (POs): It represents the knowledge, skills and attitudes the students should have at the end of the program.

PO-1: Ability to Demonstrate an Understanding of Fundamental Biochemistry principles including Topics specific to chemistry and biology

PO-2: Ability to use current biochemical and molecular techniques to plan and carry out experiments.

PO-3: Awareness of current developments in the biochemical research

PO-4: Ability to understand that communication comprises attentiveness and listening, reading and comprehension, to communicate and gather information through oral and written formats.

PO-5: Ability to work safely in a laboratory

PO-6: Good skill of conducting experiments and interpretation of results

Program specific outcomes (PSOs)

Program specific outcomes (PSOs): PSOs are statements that describe what the students should be able to do.

PSO – 1: Apply Knowledge and Techniques of Biochemistry in society benefit

PSO – 2: Use fundamental concepts in modern biology to meet the ever changing advance trends.

PSO – 3: Understand the functions of biomolecules in relation to their molecular structure

PSO– 4: Interpret the results and draw conclusions using computer software

PSO – 5: Investigate the impact of science in society and plan to pursue research

PSO – 6: Ability to manage projects independently and as a member or leader in diverse teams and in multidisciplinary environment

Course outcomes (COs)

CO – 1: Apply modern instrumentation theory to biochemical problems

CO – 2: Recognize the need for, and apply independent and life – long learning

CO– 3: Understand the principles of various fields of chemistry and biology

CO – 4: Ability to present relevance of scientific experiments to an audience 7

DEPARTMENT OF BIOCHEMISTRY

J.C. BOSE INSTITUTE OF LIFE SCIENCES

BUNDELKHAND UNIVERSITY, JHANSI (U.P.) - 284128



SYLLABUS for B.Sc. (H) in Biochemistry

Under

NATIONAL EDUCATION POLICY-2020

(Effective from the Session: 2022-2023)

COURSE CURRICULUM

B.Sc. (H) Biochemistry

Year	Semester	Subject code	Subject Title	Credits	Marks		
					Internal	External	Total
Year-I	Semester-I	BCH DSC-1/Major I	Biomolecules	4	25	75	100
		BCH Pr-I	Practical-I	2	25	75	100
		BCH DSC-2/Major II	Cell Biology	4	25	75	100
		BCH Pr-II	Practical-II	2	25	75	100
		BCH DSE-1/Major III	Discipline Specific Elective* ¹	6	25	75	100
		BCH GE-1/Minor I	Generic Elective* ²	4	25	75	100
		BCH SEC-1/Minor II	Skill Enhancement Course* ³	3	25	75	100
		BCH VAC-1/Minor III	Food and Nutrition	Qualifying	25	75	100
	Total Credits:25				Total Marks:700		
	Semester-II	BCH DSC-3/Major I	Biochemical Techniques	4	25	75	100
		BCH Pr-III	Practical-III	2	25	75	100
		BCH DSC-4/Major II	Genetics and Evolution	4	25	75	100
		BCH Pr-IV	Practical-IV	2	25	75	100
		BCH DSE-2/Major III	Discipline Specific Elective* ¹	6	25	75	100
		BCH SEC-2/Minor II	Skill Enhancement Course* ³	3	25	75	100
BCH VAC-2/Minor III		First Aid and Health	Qualifying	25	75	100	
Total Credits: 21				Total Marks: 600			
CERTIFICATE in BIOCHEMISTRY (46 Credits)							
Year-II	Semester-III	BCH DSC-5/Major I	Enzymology	4	25	75	100
		BCH Pr-V	Practical-V	2	25	75	100
		BCH DSC-6/Major II	Nutritional Biochemistry	4	25	75	100
		BCH Pr-VI	Practical-VI	2	25	75	100
		BCH DSE-3/Major III	Discipline Specific Elective* ¹	6	25	75	100
		BCH GE-2/Minor I	Generic Elective* ²	4	25	75	100
		BCH SEC-3/Minor II	Skill Enhancement Course* ³	3	25	75	100
		BCH VAC-3/Minor III	Human Values and Environmental Studies	Qualifying	25	75	100
	Total Credits: 25				Total Marks: 700		
	Semester-IV	BCH DSC-7/Major I	Membrane Biochemistry	4	25	75	100
		BCH Pr-VII	Practical-VII	2	25	75	100
		BCH DSC-8/Major II	Metabolism-1	4	25	75	100

		BCH Pr-VIII	Practical-VIII	2	25	75	100	
		BCH DSE-4/Major III	Discipline Specific Elective* ¹	6	25	75	100	
		BCH SEC-4/Minor II	Skill Enhancement Course* ³	3	25	75	100	
		BCH VAC-4/Minor III	Physical Education and Yoga	Qualifying	25	75	100	
		Total Credits: 21		Total Marks: 600				
DIPLOMA in BIOCHEMISTRY (92 Credits)								
Year-III	Semester-V	BCH DSC-9/Major I	Molecular Biology	4	25	75	100	
		BCH Pr-IX	Practical-IX	2	25	75	100	
		BCH DSC-10/Major II	Metabolism-2	4	25	75	100	
		BCH Pr-X	Practical-X	2	25	75	100	
		BCH DSC-11	Plant Physiology and Metabolism	4	25	75	100	
		BCH Pr-XI	Practical-XI	2	25	75	100	
		BCH VAC-5/Minor III	Analytical Ability and Digital Awareness	Qualifying	25	75	100	
			Total Credits:18		Total Marks: 600			
	Semester-VI	BCH DSC-12/Major I	Immunology and Clinical Biochemistry	4	25	75	100	
		BCH Pr-XII	Practical-XII	2	25	75	100	
		BCH DSC-13/Major II	Microbiology and Virology	4	25	75	100	
		BCH Pr-XIII	Practical-XIII	2	25	75	100	
		BCH DSC-14	Human Physiology	4	25	75	100	
		BCH Pr-XIV	Practical-XIV	2	25	75	100	
Industrial/ Training program		Industrial/Training program	4	25	75	100		
BCH VAC-6/Minor III		Communication skills and Personality Development or Character Building	Qualifying	25	75	100		
		Total Credits:22		Total Marks: 700				
BACHELOR of Science in Honours in BIOCHEMISTRY (132 Credits) B.Sc. (H) Biochemistry								

*¹ Student have to select discipline specific elective (DSE) as Major – III from Table 3a

*² Student have to select generic elective (GE) as Minor – I from Table 4

*³ Student have to select skill enhancement course as Minor – II from Table 5

National Education Policy -2020

**DEPARTMENT OF BIOCHEMISTRY
BUNDELKHAND UNIVERSITY, JHANSI**

SYLLABUS FOR THE “CERTIFICATE IN BIOCHEMISTRY”

(B.Sc. First year)

(Total Credits in First Year: 46)

Title of Paper: BIOMOLECULES

Type: BCH DSC - 1 / Major - I Core

Semester – I

TOTAL CREDITS: 4

TOTAL HOURS: 48L+12T+0P

Course Objectives

- Learn the elements present in biomolecules and the difference monomers and polymers.
- Explain the role of water in synthesis and breakdown of polymers.
- List the four major complex biomolecules found in living cells, three of which are found on food labels and the basis for grouping of biomolecules into those four groups.

Course Learning Outcomes

Biomolecules are vital for life as it aids organisms to grow, sustain, and reproduce. They are involved in building organisms from single cells to complex living beings like humans, by interacting with each other. The diversity in their shape and structure provides diversity in their functions.

Sr. No.	Unit No.	Syllabus Content	No. of Hours (L+T+P)
1.	1.	Introduction Introduction to Biochemistry, water as a biological solvent, weak acids and bases, pH, buffers, Henderson-Hasselbalch equation, physiological buffers, fitness of the aqueous environment for living organisms.	4L+1T
2.	2.	Carbohydrates Structure of monosaccharides, Stereoisomerism and optical isomerism of sugars. Reactions of aldehyde and ketone groups. Ring structure and anomeric forms, mutarotation. Reaction of sugar due to hydroxyl groups. Important sugar derivatives. Structure, occurrence and biological importance of monosaccharides, oligosaccharides and polysaccharides e.g. cellulose chitin, agar, pectins, proteoglycans, blood group determinants, glycogen and starch.	8L+2T
3.	3.	Lipids Definition and classification. Fatty acids: introduction, classification, nomenclature, structure and properties of saturated and unsaturated fatty acid. Triacylglycerols: nomenclature, physical properties, chemical properties and characterization of fat - hydrolysis, saponification value,	16L+4T.

		rancidity of fats, reaction of glycerol. Biological significance of fats. Glycerophospholipids (lecithins, lysolecithins, cephalous, phosphatidyl serine, phosphatidyl inositol, plasmalogens), sphingomyelins, prostaglandins, glycolipids-cerebrosides, gangliosides. Properties and function of phospholipids, and sterols.	
4.	4.	Proteins Classification and structure, RS system of designating amino acids, physical and chemical properties, Ionization behaviour of amino acids, Peptides: peptide bond and its properties, Proteins, structure: levels of structure : primary, secondary, tertiary and quaternary structure of proteins	12L+3T
5.	5.	Nucleic acids Nature of genetic material: evidence that DNA is the genetic material, nucleotides, nucleosides, nitrogenous bases-purines and pyrimidines. Composition of RNA and DNA, generalized structural plan of nucleic acids, nomenclature used in writing structure of nucleic acids, features of DNA double helix. Denaturation and annealing of DNA structure and role of different types of RNA, central dogma of molecular biology.	8L+2T.

List of Reference Books

1. Biomolecules: M.P. Arora
2. Biochemistry: Powar and Chatwal
3. Biochemistry : Lubert Stryer
4. Lehninger's Principle of Biochemistry: Nelson and Cox

Teaching Methodology

1. Power-point Presentations
2. Online Class/E-content
3. Class Lecture
4. Assignment and Presentation/Viva-voce

Evaluation Criteria

1. Internal Sessional Examination
2. Assignment Presentation/Viva-voce
3. Main Semester Examination

Title of Paper: CELL BIOLOGY

Type: BCH DSC – 2 / Major - II CORE

SEMESTER – I

TOTAL CREDITS: 4

TOTAL HOURS: 48 L+12T+0P

Course Objectives

- To understand the structures and purposes of basic components of prokaryotic and eukaryotic cells, cell membranes, and cell organelles
- Students will understand how these cellular components are used to generate and utilize energy in cells

Course Learning Outcomes

- Describe cell structure , importance and cell organelles
- Understanding of Cell division for multicellular organisms and the key events that happen during the cell cycle

Sr. No.	Unit No.	Syllabus Content	No. of Hours L+T+P)
1.	1.	Morphology of cell Cell size, shape, composition of prokaryotic and eukaryotic cell structure, cell types including cellular shape and differentiation, differences in plant and animal cells	8L+2T
2.	2.	Structure and function of cell organelles Detailed description of eukaryotic cell organelles, endoplasmic reticulum, nucleus, mitochondria, lysosomes, peroxisomes, Golgi apparatus, ribosomes and polysomes	8L+2T
3.	3.	Cytoskeleton Nature of the Cytoskeleton and endomembrane system, intermediate filaments, microtubules, cilia and centrioles, actin filaments, actin-binding proteins.	8L+2T
4.	4.	Cell Biology techniques	8L+2T

		Use of light microscopy, phase contrast microscopy, transmission and electron microscopy, electron tunneling microscopy and freeze fracture in study of cells and organelles.	
5.	5.	Cell division Cell division: mitosis, meiosis, cell cycle and cell growth, Extracellular matrix, cell adhesion Cancer, oncogenes and tumor suppressor genes.	8L+2T
6	6.	Molecule and Protein Trafficking The compartmentalization of higher cells, transport of molecules into and out of organeller membranes, the endoplasmic reticulum, transport from the ER through the Golgi Apparatus, transport from the trans Golgi network to lysosomes, transport from the plasma membrane via endosomes: Endocytosis, molecular mechanisms of vesicular transport; introduction to transit peptide, signal peptide and translocons.	8L+2T

List of Reference Books

1. Molecular Biology of the Cell: B. Alberts, A. Johnson, J. Lewis, M. Raff, K. Roberts and P. Walter
2. Molecular Cell Biology: H. F. Lodish
3. The World of the Cell: W.M. Becker, L.J. Kleinsmith, J. Hardin and G.P. Bertoni
4. Cell Biology: C.B. Powar

Teaching Methodology

1. Power-point Presentations
2. Online Class/E-content
3. Class Lecture
4. Assignment and Presentation /Viva-voce

Evaluation Criteria

1. Internal Sessional Examination
2. Assignment Presentation/Viva-voce
3. Main Semester Examination

Title of Paper: PRACTICAL - I

Type: BCH Pr - I Core

SEMESTER - I

TOTAL CREDITS: 2

TOTAL HOURS (Hrs): L+T+P (0 Hrs+0Hrs+60 Hrs)

Practicals

List of Practical	No. of Hours (L+T+P)
1) Introduction of Laboratory instruments	60 Hours
2) Safety measures in laboratories	
3) Preparation of normal solutions	
4) Preparation of normal molar solutions	
5) Preparation of buffers	

List of Reference Books

1. Practical Textbook of
BIOCHEMISTRY
DM Vasudevan,
Subir Kumar Das
2. Introduction to Practical Biochemistry
György Hegyi
József Kardos
Mihály Kovács
András Málnási-Csizmadia
László Nyitray
Gábor Pál
László Radnai
Attila Reményi
István Venekei
3. Biochemistry Practical Manual
Soundravally Rajendiran, Pooja Dhiman

Title of Paper: PRACTICAL - II

Type: BCH Pr – I CORE

SEMESTER – I

TOTAL CREDITS: 2

TOTAL HOURS (Hrs): L+T+P (0 Hrs+ 0 Hrs+60 Hrs)

Practicals

List of Practical	No. of Hours (L+T+P)
1) Preparation of phosphate buffers	60 hours
2) Preparation of acetate buffers	
3) To the study of part of microscope	
4) Determination of carbohydrates by anthrone method	
5) Determination of carbohydrates by molisch's mehod	

List of Reference Books

1. Practical Textbook of

BIOCHEMISTRY

DM Vasudevan,

Subir Kumar Das

2. Introduction to Practical Biochemistry

György Hegyi

József Kardos

Mihály Kovács

András Málnási-Csizmadia

László Nyitray

Gábor Pál

László Radnai

Attila Reményi

István Venekei

3. Biochemistry Practical Manual

Soundravally Rajendiran, Pooja Dhiman

Title of Paper: BIOCHEMICAL TECHNIQUES

Type: BCH DSC – 3 / Major - I CORE

SEMESTER - I

TOTAL CREDITS: 4

TOTAL HOURS: 53 L+7T+0P

Course Objectives

To study application of various biochemical techniques for study of numerous cell organelles, biochemical and disease diagnosis

Course Learning Outcomes

- To understand the various techniques used in medical diagnosis, biochemical and study of various cell organelles

Sr. No.	Unit No.	Syllabus Content	No. of Hours L+T+P)
1.	1.	Hydrodynamic Methods Centrifugation: types of centrifuges, rotors, concept of rcf sedimentation velocity, differential centrifugation, and density gradient centrifugation	7L+1T
2.	2.	Measurement of pH Principles of glass and reference electrodes, types of electrodes, complication of pH measurement (dependence of pH on ionic strength, electrode contamination and sodium error) and use of pH paper	7L+1T
3.	3.	Radio isotopic Techniques Types of radioisotopes used in biochemistry, units of radioactivity measurements, techniques used to measure radioactivity (gas ionization and liquid scintillation counting), nuclear emulsions used in biological studies (pre - mounted, liquid and stripping), isotopes commonly used in biochemical studies- ³² P , ³⁵ S . ¹⁴ C and ³ H) Autoradiography, Biological application and safety guidelines.	8L+1T
4.	4.	Principles and applications of chromatography Adsorption chromatography, Partition chromatography, Ion- exchange chromatography, Thin-layer chromatography, Molecular-sieve chromatography, Hydrophobic chromatography, Gas-liquid chromatography, HPLC, Affinity chromatography and Paper	8L+1T

		chromatography.	
5.	5.	Electrophoresis Basic principles of agarose electrophoresis, PAGE and SDS-PAGE, Two-dimensional electrophoresis, its importance. Isoelectrofocussing.	7L+1T
6	6.	Spectroscopic techniques Beer - Lambert law, light absorption and its transmittance, determination and application of extinction coefficient, application of visible and UV spectroscopic techniques (structure elucidation and numericals excluded).	8L+1T
7	7.	Microscopy Basic principles and application of light, phase contrast, dark field and electron microscopy.	8L+1T

List of Reference Books

1. Biophysical chemistry:Upadhyaya and Upadhayaya
2. Physical Biochemistry: David Friefelder
3. Biochemistry: Voet and Voet
4. Practical Biochemistry: Wilson and Walker
5. Concepts in Biochemistry : Rodney Boyer

Teaching Methodology

1. Power-point Presentations
2. Online Class/E-content
3. Class Lecture.
4. Assignment and Presentation/Viva-voce

Evaluation Criteria

1. Internal Sessional Examination
2. Assignment Presentation/Viva-voce
3. Main Semester Examination

Title of Paper: GENETICS AND EVOLUTION

Type: BCH DSC – 4 / Major - II CORE

SEMESTER - II

TOTAL CREDITS: 4

TOTAL HOURS: 48 L+12T+0P

Course Objectives

Introduction to Genetics and Evolution is a college-level class being offered simultaneously to new students of biochemistry. The course gives interested students a very basic overview of some principles behind these, very fundamental areas of Genetics and evolution.

Course Learning Outcomes

On successfully completing the module students will be able to: History and scope of Genetics.

- Understanding the pre-mendelian genetic concepts.
- To study the laws and concepts of Mendelian inheritance.
- Principles of deviation from Mendelian inheritance with examples.
- Concepts of multiple alleles with examples.
- Understanding the mechanism of sex determination in human and drosophila.

Sr. No.	Unit No.		No. of Hours (L+T+P)
1.	1.	Genetics: A brief history. Germplasm theory, the genotype- phenotype concept, test cross, back cross, Phenocopies. Pangenesis and acquired characters.	3 L+1T
2.	2.	Mendelian principles-Dominance, segregation, Independent assortment Extensions of Mendelian principle-Codominance, Incomplete dominance, Gene interaction.	5 L +1T
3.	3.	Linkage and Crossing over Coupling and repulsion hypothesis, Mechanism of crossing over, linkage and linkage maps, cytological basis of crossing over	3L+1T
4.	4.	Sex determination: chromosome theory of sex determination, balance theory of sex determination	2L +1T

5.	5.	Sex linked inheritance Sex linkage in Drosophila, sex linkage in humans	3L +1T
6	6.	Structural and numerical changes in chromosomes Deletion, duplications, translocations and inversions. Aneuploidy, euploidy (haploidy and polyploidy)	5L +1T
7.	7.	Mutations-Spontaneous mutation and induced mutation, Transition and transversion, Frame shift and substitution mutation, frequency of mutations, Physical and chemical mutagens. Mutations at the molecular level and practical application of mutations.	5L +1T
8.	8.	Multiple allelism and Gene concept Evolution	2 L+1T
9.	9.	Origin life- Origin of basic biological molecules, Abiotic synthesis of organic monomers and polymers, Concepts of Oparin and Haldane, Experiment Of Miller, Geological time scale	5L +1T
10.	10.	. Theories of organic evolution- Theory of inheritance of acquired characters (Lamarckism) Theory of natural selection, mutation theory and synthetic theory	5 L +1T
11.	11.	Evidences of organic evolution from taxonomy, embryology, palaeontology, physiology, biochemistry, genetics and molecular biology	6L +1T
12.	12.	Speciation and Isolating Mechanism: Concept of species and speciation-Allopatric and sympatric Speciation, Isolating mechanisms	4L +1T

List of Reference Books

1. A text book of cytology, genetics and evolution: P.K. Gupta
2. Genetics: Sarin
3. Principles of Genetics : E.J. Gardner
4. Organic Evolution-Dr. Veer BalaRastogi

Teaching Methodology

1. Power-point Presentations
2. Online Class/E-content
3. Class Lecture.
4. Assignment and Presentation/Viva-voce

Evaluation Criteria

1. Internal Sessional Examination
2. Assignment Presentation/Viva-voce
3. Main Semester Examination

Title of Paper: PRACTICAL - III

Type: BCH Pr – III CORE

SEMESTER - II

TOTAL CREDITS: 2

TOTAL HOURS (Hrs): L+T+P (0 Hrs+0 Hrs+60 Hrs)

Practicals

List of Practicals	No. of Hours (L+T+P)
1) Cytochemical staining of proteins by Methylene Blue	60 hours
2) Cytochemical staining of RNA by Methyl Green Pyronin	
3) Effect of lipid composition on the permeability of a lipid monolayer	
4) Determination of CMC of detergents	
5) Separation of photosynthetic pigments by TLC	

List of Reference Books

1. Practical Textbook of
BIOCHEMISTRY
DM Vasudevan,
Subir Kumar Das
2. Introduction to Practical Biochemistry
György Hegyi
József Kardos
Mihály Kovács
András Málnási-Csizmadia
László Nyitray
Gábor Pál
László Radnai
Attila Reményi
István Venekei
3. Biochemistry Practical Manual
Soundravally Rajendiran, Pooja Dhiman

Title of Paper: PRACTICAL - IV

Type: BCH Pr - IV CORE

SEMESTER – II

TOTAL CREDITS: 2

TOTAL HOURS (Hrs): L+T+P (0 Hrs+0 Hrs+60 Hrs)

Practicals

List of Practical	No. of Hours (L+T+P)
1. Study the hill reaction by using artificial electron acceptor	60 hours
2. Separation of RBC membrane proteins by SDS-PAGE	
3. Isolation of mitochondria from liver and assay of marker enzyme SDH	
4. Estimation of β - carotene	
5. Estimation of Ascorbic-Acid	

List of Reference Books

1. Practical Textbook of
BIOCHEMISTRY
DM Vasudevan,
Subir Kumar Das
2. Introduction to Practical Biochemistry
György Hegyi
József Kardos
Mihály Kovács
András Málnási-Csizmadia
László Nyitray
Gábor Pál
László Radnai
Attila Reményi
István Venekei
3. Biochemistry Practical Manual
Soundravally Rajendiran, Pooja Dhiman

National Education Policy -2020

**DEPARTMENT OF _BIOCHEMISTRY
BUNDELKHAND UNIVERSITY, JHANSI**

SYLLABUS FOR THE “DIPLOMA IN BIOCHEMISTRY”

(In continuation of first year)

(Total Credits in Second Year: 46)

TOTAL CREDITS FOR “DIPLOMA IN BIOCHEMISTRY” = 92 (First Year +Second Year)

Title of Paper: ENZYMOLOGY

Type: BCH DSC – 5 / Major - I CORE

SEMESTER – III

TOTAL CREDITS: 4

TOTAL HOURS: 48L+12T+0P

Course Objectives

To understand the theories of enzyme kinetics, the mechanisms of enzyme catalysis, and the mechanisms of enzyme regulation in the cell

Course Learning Outcomes

- Define enzyme structure
- Define differences between enzymes and normal catalytic substances
- Explain cofactor and coenzymes chemical structure
- Express Important coenzymes and the groups they transfer
- Define factors that affect enzyme activity
- Define enzyme kinetics

Sr. No.	Unit No.	Syllabus Content	No. of Hours (L+T+P)
1.	1.	Introduction to Enzymes History, general characteristics, nomenclature classification metallo-enzymes, measurement and expression of enzyme activity, enzyme assays, definition of IU, Katal, enzyme turn over number and specific activity. Role of non-protein organic molecules and inorganic ions-coenzyme, prosthetic groups, Monomeric enzyme, oligomeric enzyme.	4L+1T.
2.	2.	Enzyme catalysis Acid- base catalysis, covalent catalysis, electrostatic catalysis, proximity and orientation effects, strain and distortion theory. Role of cofactors in enzyme catalysis: NAD+/ NADP+, FMN/FAD, coenzyme A, biocytin, cobalamino, lipoamide, TPP, pyridoxal phosphate, tetrahydrofolate and metal ions with special emphasis on coenzyme function.	12L+3T

3.	3.	Enzyme Purification Different Methods for isolation, intracellular localization of enzyme, test for their purification and characterization.	8L+2T
4.	4.	Enzyme Kinetics Factors affecting enzyme activity, enzyme concentration, substrate concentration, pH and temperature. Reversible and irreversible inhibition, competitive, non-competitive and uncompetitive inhibitions, determination of K_m & V_{max} in presence and absence of inhibitor. Derivation of Michaelis-Menten equation for uni-substrate reaction. K_m and its significance. Briggs Halden steady state normalized initial Rate equation and normalized curve Halden rotation. Line Weaver- Burk plot and its limitations. Importance of K_{cat}/K_m	12L+3T
5.	5.	Industrial and Clinical Application of Enzymes Immobilization of enzymes and their industrial applications. Production of glucose from starch, cellulose and dextran, use of lactase in dairy industry; production of glucose-fructose syrup from sucrose; use of protease in food, detergent and leather industry; medical application of enzyme, use of glucose in enzyme electrodes.	12L+3T

List of Reference Books

1. Enzymes- Palmer
2. Enzyme kinetic - Dixon

Teaching Methodology

1. Power-point Presentations
2. Online Class/E-content
3. Class Lecture.
4. Assignment and Presentatiom/Viva-voce

Evaluation Criteria

1. Internal Sessional Examination
2. Assignment Presentation/Viva-voce
3. Main Semester Examination

Title of Paper: NUTRITIONAL BIOCHEMISTRY

Type: BCH DSC – 6 / Major - II CORE

SEMESTER - III

TOTAL CREDITS: 4

TOTAL HOURS: 50L+10T+0P

Course Objectives

- To gain a deeper understanding of aspects such as clinical nutrition, macronutrients and energy, nutritional requirement and other factors that contribute to the interplay.

Course Learning Outcomes

- Explain the importance of nutrition.
- Describe the elements of nutrients
- Understanding of healthy diet plane

Sr. No.	Unit No.	Syllabus Content	No. of Hours (L+T+P)
1.	1.	Nutrition and dietary habits Introduction and definition of foods and nutrition. Physiology and nutrition of carbohydrates, fats, proteins and water. Vitamins A,D,E,K, Vit. B-complex and Vit. C and minerals like Ca, Fe and Iodine and their biological functions.	12L+2T
2.	2.	Composition of balanced diet, recommended dietary allowances (RDA) for child, adolescent, adult male and female. Balanced vegetarian and non-vegetarian diets for emphasis on nutritional adequacy, heavy work, moderate work and light work.	8L+2T
3.	3.	Basic concepts of energy expenditure, units of energy, measurement of energy expenditure by direct or indirect calorimetry, calculation of non-protein RQ with respect to carbohydrate and lipids . Determination of heat production of the diet. The basal metabolism and methods of measuring basal metabolic rate (BMR).	10L+2T
4.	4.	Energy requirements during growth, pregnancy, lactation, man and women in various physical activities. Calculation of energy expenditure of average Specific dynamic action (SDA) of food. Planning of dietary regimes for infants, during pregnancy and old age. Malnutrition, its implications and relationship with dietary habits and prevention of malnutrition specially protein-calorie R. malnutrition (Kwashiorkor and Marasmus) by improvement of diets.	10L+2T

5.	5.	Human milk and its virtues, breast vs formulated milk feeding. Food preservation standards, food adulterations and precautions, government regulations on preservation	10L+2T
----	----	--	--------

List of Reference Books

1. Nutrition and -Shubhangi Joshi
2. Principles of nutrition - E.D Wilson
3. Hardbook of nutrition - M.Swaminathan

Teaching Methodology

1. Power-point Presentations
2. Online Class/E-content
3. Class Lecture.
4. Assignment and Presentation/Viva-voce

Evaluation Criteria

1. Internal Sessional Examination
2. Assignment Presentation/Viva-voce
3. Main Semester Examination

Title of Paper: PRACTICAL – V

Type: BCH Pr – V CORE

SEMESTER – III

TOTAL CREDITS: 4

TOTAL HOURS (Hrs): L+T+P (0 Hrs+0 Hrs+60 Hrs)

Practicals

List of Practicals	No.of Hours (L+T+P)
1) Introduction of Laboratory instruments	60 hours
2) Identification of solubility of lipid in different solutions.	
3) Determination of Reducing Sugar by picric acid method	
4) Determination of Reducing Sugar by Fehling method	
5) Determination of Pentose Sugar by Bial's method	

List of Reference Books

1. Practical Textbook of

BIOCHEMISTRY

DM Vasudevan,

Subir Kumar Das

2. Introduction to Practical Biochemistry

György Hegyi

József Kardos

Mihály Kovács

András Málnási-Csizmadia

László Nyitray

Gábor Pál

László Radnai

Attila Reményi

István Venekei

3. Biochemistry Practical Manual

Soundravally Rajendiran, Pooja Dhiman

Title of Paper: PRACTICAL – VI

Type: BCH Pr – VI CORE

SEMESTER – III

TOTAL CREDITS: 2

TOTAL HOURS (Hrs): L+T+P (0 Hrs+0 Hrs+60 Hrs)

Practicals

List of Practicals	No. of Hours (L+T+P)
1) Estimation of Reducing sugar by Titration method	60 hours
2) Assay of salivary amylase	
3) Identification of reducing and non-reducing sugar in given sample by benedict's test	
4) Identification of pentose sugar in given plant sample by bial's test	
5) Identification of starch in a leave with help of iodine solution	

List of Reference Books

1. Practical Textbook of

BIOCHEMISTRY

DM Vasudevan,

Subir Kumar Das

2. Introduction to Practical Biochemistry

György Hegyi

József Kardos

Mihály Kovács

András Málnási-Csizmadia

László Nyitray

Gábor Pál

László Radnai

Attila Reményi

István Venekei

3. Biochemistry Practical Manual

Soundravally Rajendiran, Pooja Dhiman

Title of Paper: Membrane Biochemistry

Type: BCH DSC-7 / Major - I CORE

SEMESTER - IV

TOTAL CREDITS: 4

TOTAL HOURS: 48L+12T+0P

Course Objectives

To study of the membrane properties and mechanism of cell membrane

Course Learning Outcomes

Develop the understanding of Membrane morphology and function of cell and bacteria

Sr. No.	Unit No.	Syllabus Content	No. of Hours (L+T+P)
1.	1.	Biological Membranes Chemical composition of biomembranes, Different models of cell membranes, preparation of liposomes and micelles, Red cell membrane	8L+2T
2.	2.	Membrane dynamics Lateral, transverse and rotational motion of lipids and proteins. Techniques used to study membrane dynamics – FRAP, TNBS labeling etc. Transition studies of lipid bilayer, transition temperature. Membrane fluidity, factors affecting membrane fluidity	8L+2T
3.	3.	Membrane transport Types of transport: simple diffusion, facilitated diffusion, active and passive transport, Simple diffusion and Fick's law. Porins facilitated diffusion. Porter molecules, kinetics of facilitated transport, antiport and uniport. Na ⁺ -K ⁺ pumps examples and metabolic significance. Gap and tight junction	8L+2T
4.	4.	Vesicular transport and membrane fusion Types of vesicle transport and their function – clathrin, COP I and COP II coated vesicles. Molecular mechanism of vesicular transport. Membrane fusion. Receptor mediated endocytosis of transferrin.	8L+2T
5.	5.	Membrane receptor Types, structure and function and Introduction to signal transduction pathways	8L+2T

6	6.	Bacterial and plant cell wall Structure and composition. Inhibitors of bacterial cell wall synthesis.	8L+2T
----------	-----------	--	-------

List of Reference Books

1. Lehninger: Principles of Biochemistry: D.L. Nelson and M.M. Cox
2. Molecular Cell Biology: J. Darnell, P. Matsudaira, L. Zipursky, H. Lodish, A. Berk, and D. Baltimore
3. Biochemistry: R.H. Garret and C. M. Grisham
4. Principles of Biochemistry: D.J. Voet, J.G. Voet and C.W. Pratt

Teaching Methodology

1. Power-point Presentations
2. Online Class/E-content
3. Class Lecture
4. Assignment and Presentation/Viva-voce

Evaluation Criteria

1. Internal Sessional Examination
2. Assignment Presentation/Viva-voce
3. Main Semester Examination

Title of Paper: INTERMEDIARY METABOLISM-1

Type: BCH DSC – 8 / Major - II CORE

SEMESTER - IV

TOTAL CREDITS: 2

TOTAL HOURS: 50L+10T+0P

Course Objectives

- To deliver molecular understanding of primary and secondary metabolic process of carbohydrate, amino acid
- Energy production (ATP Production)
- Regulation and waste management of carbohydrate and amino acid

Course Learning Outcomes

- Draw or describe the structure of amino acids, proteins, enzymes, chemical messengers, carbohydrates

Sr. No.	Unit No.	Syllabus Content	No. of Hours L+T+P)
1.	1.	Introduction to Metabolism Definition of metabolism, Terminology of metabolism , Types of metabolism –anabolic pathway, catabolic pathway , regulation of metabolic pathways, Evolution in metabolic pathways	10 L+2T
2.	2.	Energetics of Metabolism suitability of Gibbs free energy changes as a criteria of spontaneously standard free energy, enthalpy, entropy exergonic and endergonic reaction. ATP and their significance	8 L+2T
3.	3.	3 Carbohydrate Metabolism Reactions and energetics of glycolysis. alcoholic and lactic acid fermentations. Reactions and energetics of TCA cycle. Gluconeogenesis, glycogenesis and glycogenolysis. Reactions and physiological significance of pentose phosphate pathway. Regulation of glycolysis and TCA cycle. Photosynthesis, a brief review.	12 L+2T
4.	4.	Electron Transport Chain and Oxidative Phosphorylation Structure of mitochondria, sequence of electron carriers, sites of ATP production, inhibitors of electron transport chain. Hypothesis of mitochondrial oxidative phosphorylation (basic concepts). Inhibitors	10L+2T

		and uncouples of oxidative phosphorylation. Transport of reducing potentials into mitochondria.	
5.	5.	Amino acid Metabolism General reactions of amino acid metabolism : transamination, oxidative deamination and decarboxylation. Urea cycle. Degradation and biosynthesis of amino acids. Glycogenic and ketogenic amino acids.	10 L+2T

List of Reference Books

1. Fundamentals of Biochemistry : Donald Voet, J.g.Voet & Pran
2. Biochemistry : Geoffrey L. Zubay
3. Biochemistry : Lubert Stryer, W.H.Freeman & Co.

Teaching Methodology

1. Power-point Presentations
2. Online Class/E-content
3. Class Lecture
4. .Assignment and Presentation/Viva-voce

Evaluation Criteria

1. Internal Sessional Examination
- 2 Assignment Presentation/Viva-voce
3. Main Semester Examination

Title o Paper: PRACTICAL – VII

Type: BCH Pr – VII CORE

SEMESTER – IV

TOTAL CREDITS: 2

TOTAL HOURS (Hrs): L+T+P (0 Hrs+0Hrs+60 Hrs)

Practicals

List of Practical	No. of Hours (L+T+P)
1) Identification of amino acid by thin layer chromatography	60 hours
2) Identification of Hexose sugar in the sample by ammonium molybdate test	
3) Identification of tannins in plant leave sample	
4) Identification of flavonoids in given plant sample	
5) Identification of terpenoids in given plant leave sample	

List of Reference Books

1. Practical Textbook of

BIOCHEMISTRY

DM Vasudevan,

Subir Kumar Das

2.Introduction to Practical Biochemistry

György Hegyi

József Kardos

Mihály Kovács

András Málnási-Csizmadia

László Nyitray

Gábor Pál

László Radnai

Attila Reményi

István Venekei

3.Biochemistry Practical Manual

Soundravally Rajendiran, Pooja Dhiman

Title of Paper: PRACTICAL - VIII

Type: BCH Pr – VIII CORE

SEMESTER – IV

TOTAL CREDITS: 2

TOTAL HOURS (Hrs): L+T+P (0 Hrs +0 Hrs+60 Hrs)

Practicals

List of Practicals	No. of Hours (L+T+P)
1) Identification of glycosides in given plant leave sample	60 hours
2) Identification of phlobatannins in given plant leave sample	
3) Identification of simple protein (egg albumin) by following colour reaction: Biuret test,	
4) Identification of simple protein (egg albumin) by following colour reaction: Millon's test,	
5) Identification of simple protein (egg albumin) by following colour reaction: Xanthoproteic test.	

List of Reference Books

1. Practical Textbook of

BIOCHEMISTRY

DM Vasudevan,

Subir Kumar Das

2. Introduction to Practical Biochemistry

György Hegyi

József Kardos

Mihály Kovács

András Málnási-Csizmadia

László Nyitray

Gábor Pál

László Radnai

Attila Reményi

István Venekei

3. Biochemistry Practical Manual

Soundravally Rajendiran, Pooja Dhiman

National Education Policy -2020

**DEPARTMENT OF _BIOCHEMISTRY
BUNDELKHAND UNIVERSITY, JHANSI**

SYLLABUS FOR THE DEGREE OF

“BACHELOR OF SCIENCE IN HONOURS IN BIOCHEMISTRY”

“B.Sc. (H) BIOCHEMISTRY”

(In continuation of Second year)

(Total Credits in Third Year: 40)

TOTAL CREDITS FOR THE DEGREE OF “BACHELOR OF SCIENCE IN HONOURS IN BIOCHEMISTRY” =

(First Year (46 Credits) +Second Year (46 Credits) + Third Year 40 (Credits)

= 132 Credits

Title of Paper: MOLECULAR BIOLOGY

Type: BCH DSC – 9 / Major – I CORE

SEMESTER - V

TOTAL CREDITS: 4

TOTAL HOURS: 44L+16T+0P

Course Objectives

Molecular biology deals with nucleic acids (replication and transcription) and proteins and how these molecules interact within the cell to promote proper growth, division, and development. This course will emphasize the molecular mechanisms of DNA replication, repair, protein synthesis.

Course Learning Outcomes

Upon successful completion of this course student should be able to:

- Learning and understanding the concepts of central dogma of molecular biology.
- Explain the concept of DNA and RNA as genetic material through experimental techniques.
- To discuss the mechanism of DNA replication in prokaryotes.
- To explain the transcription and protein synthesis machinery in prokaryotes.

Sr. No.	Unit No.	Syllabus Content	No. of Hours (L+T+P)
1.	1.	Basic concepts of genetic information a. Nucleic acids as genetic information carrier, experimental evidence e.g. bacterial genetic transformation, Hershey-Chase Experiment, Tobacco Mosaic Virus reconstitution experiment. b. Salient features of eukaryotic prokaryotic. c. Organization of DNA, highly repetitive, moderately repetitive and unique DNA sequences, Nucleic acid hybridization, Cot value and satellite DNA. Sequencing of DNA and RNA. d. The fine structure of eukaryotic and prokaryotic gene, introduction to regulation of gene expression.	8L+2T
2.	2.	DNA replication DNA replication in prokaryotes-conservative, semiconservative and dispersive types, experimental evidence for semiconservative replication. DNA polymerases, other enzymes and protein factors	8L+2T

		involved in replication.	
3.	3.	<p>Transcription</p> <p>Transcription in prokaryotes. RNA polymerase, promoters, initiation, elongation and termination of RNA synthesis, Inhibitors of transcription. Reverse transcriptase, Major differences with eukaryotic system.</p>	7L+3T
4.	4.	<p>Translation and regulation of gene expression</p> <p>a. Genetic code: Basic features of genetic code experimental evidence biological significance of degeneracy. Wobble hypothesis.</p> <p>b. Process of translation in prokaryotes: Ribosome structure, A, P and E sites, charged tRNA, f-tRNA, initiation codon, Shine-Dalgarno, consensus sequences, formation of 70S initiation complex, role of EF Tu, EF-Ts, EF-G and GTP, release factors; RF1 and RF2.</p>	7L+3T
5.	5.	<p>Mutation and repair</p> <p>a. Mutation: Molecular basis of mutation, types of mutation, e.g. transition, transversion, frame shift, insertion, deletion, suppresser sensitive, dominant and recessive mutations, spontaneous and induced mutations-Lederberg's replica plating experiment.</p> <p>b. Mutagenecity testing: Correlation of mutagen city and carcinogenicity: Ames testing, random and site-directed mutagenesis.</p> <p>c. DNA Repair: UV repair systems in E.coli, significance of thymine in DNA.</p>	7L+3T
6.	6.	<p>Recombinant DNA Technology</p> <p>General introduction of recombinant DNA technology, method of gene transfer, Restriction endonucleases, brief discussion of steps in DNA cloning. Applications of recombinant DNA technology. Introduction of polymerase chain reaction.</p>	7L+3T

List of Reference Books

1. VIII Levin
2. Principles of Biochemistry-Lehninger
3. Biochemistry-Stryer
4. Biochemistry-Voet&Voet
5. David and Grover

Teaching Methodology

1. Power-point Presentations
2. Online Class/E-content
3. Class Lecture.
4. Assignment and Presentation/Viva-voce

Evaluation Criteria

1. Internal Sessional Examination
2. Assignment Presentation/Viva-voce
3. Main Semester Examination

Title of Paper: INTERMEDIARY METABOLISM-2

Type: BCH DSC – 10 / Major - II CORE

SEMESTER - V

TOTAL CREDITS: 4

TOTAL HOURS: 50L+10T+0P

Course Objectives

- To deliver molecular understanding of primary and secondary metabolic process of lipid, nucleotide and vitamins
- Energy production and role of fat, nucleotide and vitamins

Course Learning Outcomes

Draw or describe the structure of fatty acid , enzymes, chemical messengers, nucleic acids and vitamins

Sr. No.	Unit No.	Syllabus Content	No. of Hours (L/T/P)
1.	1.	Introduction, hydrolysis of triacylglycerols, transport of fatty acids into mitochondria, b-oxidation of saturated fatty acids, ATP yield from fatty acid oxidation. Biosynthesis of saturated and unsaturated fatty acids./, oxidation of unsaturated and odd chain fatty acids	10 L +2T
2.	2.	Biosynthesis of triglycerides and important phospholipids, glycolipids, sphingolipids and cholesterol. Regulation of cholesterol metabolism. Metabolism of ketone bodies	10 L +2T
3.	3.	Sources of the atoms in the purine and pyrimidine molecules. Biosynthesis and degradation of purines and pyrimidines. Regulation of purine and pyrimidine biosynthesis	8L+2T
4.	4.	Biosynthesis and degradation of porphyrins. Production of bile pigments.	8 L+2T
5.	5.	Role of vitamin in metabolic pathway	14L +2T

List of Reference Books

1. Fundamentals of Biochemistry : Donald Voet, J.g.Voet & Pran
2. Biochemistry : Geoffrey L. Zubay

3. Biochemistry : Lubert Stryer, W.H.Freeman & Co.

Teaching Methodology

1. Power-point Presentations
2. Online Class/E-content
3. Class Lecture
4. Assignment and Presentation/Viva-voce

Evaluation Criteria

1. Internal Sessional Examination
2. Assignment Presentation/Viva-voce
3. Main Semester Examination

Title of Paper: Plant Physiology and Metabolism

Type: BCH DSC – 11 CORE

SEMESTER - V

TOTAL CREDITS: 4

TOTAL HOURS: 48L+12T+0P

Course Objectives

- To explore the link between form and function in plants.
- This course is designed to survey contemporary aspects of plant physiology with emphasis on recent research progress in related fields.

Course Learning Outcomes

- Develop understanding of photosynthesis, mineral nutrition, respiration, transportation, and ultimately plant development and growth which are traits displayed by living entities.

Sr. No.	Unit No.	Syllabus Content	No. of Hours (L+T+P)
1.	1.	Plant-water relation: Importance of water, water potential and its components; Transpiration and its significance; factor affecting transpiration; Root pressure and guttation. Mineral nutrition: Essential elements, macro and micronutrients; Criteria of essentiality of elements; Role of essential elements; Transport of ions across cells membrane, active and passive transport, carriers, channels and pumps.	12L+3T
2.	2.	Translocation in phloem: Composition of phloem sap, girdling experiment; Pressure flow model; Phloem loading and unloading. Photosynthesis: Photosynthetic Pigments (Chl a, b, xanthophylls, carotene); Photo system I and II, reaction center, antenna molecules; Electron transport and mechanism of ATP synthesis; C3, C4 and CAM pathways of carbon fixation; Photorespiration	12L+3T
3.	3.	Respiration: Glycolysis, anaerobic respiration, TCA cycle, Oxidative photophorylation, Glyoxylate, Oxidative Pentose Phosphate Pathway. Enzymes: Structure and properties; mechanism of enzymes catalysis and enzyme inhibition.	12L+3T

		Nitrogen metabolism: Biological nitrogen fixation; Nitrate and ammonia assimilation.	
4.	4.	Plant growth regulators: Discovery and physiological roles of auxins, gibberellins, cytokinins, ABA, ethylene. Plant response to light and temperature : Photoperiodism (SDP, LDP, Day neutral plants); Phytochrome (discovery and structure), red and far red light responses on photomorphogenesis; Vernalization.	12L+3T

List of Reference Books

1. Plant Physiology and Development: L. Taiz, E. Zeiger, I.M. Moller and A. Murphy
2. Introduction to Plant Physiology : W.G. Hopkins, N.P.. Huner

Teaching Methodology

1. Power-point Presentations
2. Online Class/E-content
3. Class Lecture.
4. Assignment and Presentation/Viva-voce

Evaluation Criteria

1. Internal Sessional Examination
2. Assignment Presentation/Viva-voce
3. Main Semester Examination

Title of Paper: PRACTICAL - IX

Type: BCH Pr – IX CORE

SEMESTER – V

TOTAL CREDITS: 2

TOTAL HOURS (Hrs): L+T+P (0 Hrs+0 Hrs+60 Hrs)

Practicals

List of Practicals	No. of Hours (L+T+P)
1) Basic fruit analysis of Banana/Apple/pineapple	60 hours
2) Determination of constituents by Physical method	
3) Sample preparation and chemical analysis	
4) Estimation of aldol and ketose sugar by seliwanoff's method	
5) Determination of polysaccharide by starch test	

List of Reference Books

1. Practical Textbook of

BIOCHEMISTRY

DM Vasudevan,

Subir Kumar Das

2. Introduction to Practical Biochemistry

György Hegyi

József Kardos

Mihály Kovács

András Málnási-Csizmadia

László Nyitray

Gábor Pál

László Radnai

Attila Reményi

István Venekei

3. Biochemistry Practical Manual

Soundravally Rajendiran, Pooja Dhiman

Title of Paper: PRACTICAL - X

Type: BCH Pr – X CORE

SEMESTER - V

TOTAL CREDITS: 2

TOTAL HOURS (Hrs): L+T+P (0 Hrs+ 0 Hrs+60 Hrs)

Practicals

List of Practicals	No. of Hours (L+T+P)
1) Estimation of Reducing sugar by nelson-somogyi's method	60 hours
2) Estimation of non-reducing sugar	
3) Estimation of non-reducing sugar	
4) Cholesterol estimation	
5) Estimation of blood glucose	

List of Reference Books

1. Practical Textbook of

BIOCHEMISTRY

DM Vasudevan,

Subir Kumar Das

2. Introduction to Practical Biochemistry

György Hegyi

József Kardos

Mihály Kovács

András Málnási-Csizmadia

László Nyitray

Gábor Pál

László Radnai

Attila Reményi

István Venekei

3. Biochemistry Practical Manual

Soundravally Rajendiran, Pooja Dhiman

Title of Paper: PRACTICAL – XI

Type: BCH Pr – XI CORE

SEMESTER – V

TOTAL CREDITS: 2

TOTAL HOURS (Hrs): L+T+P (0 Hrs+0 Hrs+60 Hrs)

Practicals

List of Practicals	No. of Hours (L+T+P)
1) Identification of simple protein by heat and acid coagulation reaction;	60 hours
2) Identification of simple protein by Esbach's precipitation reaction;	
3) Estimation of ascorbic acid in fruit juice	
4) Identification of carbohydrate in potato/rice/ maize	
5) Identification of starch in potato/rice/maize	

List of Reference Books

1. Practical Textbook of

BIOCHEMISTRY

DM Vasudevan,

Subir Kumar Das

2. Introduction to Practical Biochemistry

György Hegyi

József Kardos

Mihály Kovács

András Málnási-Csizmadia

László Nyitray

Gábor Pál

László Radnai

Attila Reményi

István Venekei

3. Biochemistry Practical Manual

Soundravally Rajendiran, Pooja Dhiman

Title of Paper: IMMUNOLOGY AND CLINICAL BIOCHEMISTRY

Type: BCH DSC – 12 / Major - I CORE

SEMESTER – VI

TOTAL CREDITS: 4

TOTAL HOURS: 48 L+12T+0P

Course Objectives

- Demonstrate the basic knowledge of immunological processes at a cellular and molecular level.
- Define central immunological principles and concepts. outline, compare and contrast the key mechanisms and cellular players of innate and adaptive immunity and how they relate.

Course Learning Outcomes

- Students understand the basic concept of immune system
- How the cell response against various factor

Sr. No.	Unit No.	Syllabus Content	No. of Hours (L+T+P)
1.	1.	A. Immunology (i) History of Immunology, immunity, Humoral and cellular immunity: Antigens, Immunogens, Haptens. (ii) Different types of Immunoglobulins (iii) Different cells involved in immunity. Clonal selection theory. (iv) Genetic basis of antibody diversity	12L+3T
2.	2.	(v) Antigen-antibody reactions: agglutination, precipitation, opsonization and complement fixation determination of antibody titre by ELISA and RIA (vi) Immunological tolerance (vii) Hypersensitivity and allergy (viii) Monoclonal antibody, preparation and application in biology	12L+3T

3.	3.	B. Clinical Biochemistry (i) Basic concepts of clinical biochemistry Defination and scope of clinical biochemistry. Collection, preservation and chemical analysis of blood and urine, clearance test for urea.	12L+3T
4.	4.	(ii) Clinical enzymology Definition of functional and non-functional plasma enzymes. Isozymes and diagnostic tests. Clinical significance of enzymes: plasma lipase, amylase, cholinesterase, alkaline and acid phosphatase, SGOT, SGPT, LDH and CPK. Functional tests of kidney, liver and gastric fluids	12L+3T

List of Reference Books

1. Immunology- Riot
2. Immunology-Kubey

Teaching Methodology

1. Power-point Presentations
2. Online Class/E-content
3. Class Lecture
4. Assignment and Presentation/Viva-voce

Evaluation Criteria

1. Internal Sessional Examination
2. Assignment Presentation/Viva-voce
3. Main Semester Examination

Title of Paper: MICROBIOLOGY AND VIROLOGY

Type: BCH DSC – 13 / Major - II CORE

SEMESTER - VI

TOTAL CREDITS: 4

TOTAL HOURS: 50L+10T+0P

Course Objectives

- To understand the microbial world
- Effect of micro-organism on health, environmental, social, cultural, industrial and economic benefits

Course Learning Outcomes

- Apply the knowledge to understand the microbial physiology and to identify the microorganisms.
- Understand the regulation of biochemical pathway and possible process modifications for improved control over microorganisms for microbial product synthesis.

Sr. No.	Unit No.	Syllabus Content	No. of Hours (L+T+P)
1.	1.	Classification of microorganisms Type of microorganisms, general characteristics of main group of microorganisms, criteria used in the classification of bacteria, Gram positive and Gram negative bacteria; structure and function of different polymeric components in Gram positive and Gram-negative bacteria. Endospore, plasmid	10L+2T
2.	2.	Nutrition and growth characteristics of bacteria Nutritional requirement: culture media, growth curve, synchronous culture.	10L+2T
3.	3.	Metabolism and genetics of Microorganisms Microbial metabolism-Special features of bacterial metabolism, Glyoxalate cycle and its role in conversion of fats into carbohydrates, role of microorganisms in food spoilage, fermentation: food-borne infections and sewage (domestic and mustrial) disposal	10L+2T
4.	4.	Microbial genetics: Transformation, conjugation, transduction,	

		transfection genetic recombination, plasmids.	8L+2T
5	5.	Morphology and replication of viruses Virus structure and classification, bacteriophages and their role in modern biological research. Structure and life cycle of DNA and RNA containing viruses	12L+2T

List of Reference Books

1. Text book of Microbiology: Prescott
2. Text book of Virology: Davis

Teaching Methodology

1. Power-point Presentations
2. Online Class/E-content
3. Class Lecture
4. Assignment and Presentation/Viva-voce

Evaluation Criteria

1. Internal Sessional Examination
2. Assignment Presentation/Viva-voce
3. Main Semester Examination

Title of Paper: HUMAN PHYSIOLOGY

Type: BCH DSC – 14 CORE

SEMESTER - VI

TOTAL CREDITS: 4

TOTAL HOURS: 50L+10T+0P

Course Objectives

To provide a course of study in mammalian, principally human, systems physiology, building on knowledge of basic physiological principles

Course Learning Outcomes

- To understand the functions of important physiological systems including the cardio-respiratory, renal, reproductive and metabolic systems;
- To understand how these separate systems interact to yield integrated physiological responses

Sr. No.	Unit No.	Syllabus Content	No. of Hours (L+T+P)
1.	1.	Digestive and Endocrine System Digestive system: Structure and function of different components, digestion and absorption of carbohydrates, lipids and proteins, role of enzymes and hormones in digestion.	7L+1T
2.	2.	Respiratory System Components of respiratory system and their functions. Diffusion of oxygen and carbon dioxide, transport of oxygen, role of hemoglobin, dissociation curve of oxyhemoglobin and its significance, Bohr's effect, transport of CO ₂ , and chloride shift. Various buffer system of the blood; acid base balance, factors affecting acid base balance	8L+2T
3.	3.	Excretory system Kidney, structure, its organization and function. Structural and functional characteristics of tubules, selective reabsorption and secretion, active and passive transport of various substances, role of aldosterone and antidiuretic hormones, mechanism of urine formation.	10L+2T
4.	4.	Cardiovascular and Lymphatic system Blood components and their functions, genesis of erythrocytes and leukocytes. Blood groups, the ABO system, the rhesus system, mechanism of blood coagulation. Composition and function of lymph	8L+2T

		and lymphatic system. Overall design of circulatory system, pulmonary and system circulation, Principle of electrocardiogram and its significance.	
5.	5.	Endocrine System: A brief outline of various endocrine glands and their physiological roles, feedback regulation of hormone secretion, hormone receptors and their activation, mechanism of extra cellular and intracellular hormone action	10L+2T
6.	6.	Nervous System Organization of the nervous system, nerve cells, nerve fibers, nerve impulse and neurotransmission, synapses: chemical and electrical synapses, action potential, reflex action and reflex arc.	7L+1T

List of Reference Books

1. Principles of anatomy and physiology: Tortora and Derrickson
2. Medical physiology: Guyton and Hall
3. Review of medical physiology: W.F. Ganong

Teaching Methodology

1. Power-point Presentations
2. Online Class/E-content
3. Class Lecture
4. Assignment and Presentation/Viva-voce

Evaluation Criteria

1. Internal Sessional Examination
2. Assignment Presentation/Viva-voce
3. Main Semester Examination

Title of Paper: PRACTICAL – XII

Type: BCH Pr – XII CORE

SEMESTER - VI

TOTAL CREDIT: 2

TOTAL HOURS (Hrs): L+T+P (0 Hrs+ 0 Hrs +60 Hrs)

Practicals

List of Practical	No. of Hours (L+T+P)
1. Microbiology Laboratory Practices and Bio-safety. 2. To study the principle and applications of important instruments (Laminar air flow, autoclave, incubator, hot plate stirrer, hot air oven, water bath, microscope, pH meter, colony counter, spectrophotometer) 3. Cleaning of glassware, sterilization techniques. 4. Preparation and sterilization of culture media for bacterial cultivation. 5. Preparation of agar plate, slant and deep tube.	60 hours

List of Reference Books

1. Practical Textbook of BIOCHEMISTRY
DM Vasudevan,
Subir Kumar Das
2. Introduction to Practical Biochemistry
György Hegyi
József Kardos
Mihály Kovács
András Málnási-Csizmadia
László Nyitray
Gábor Pál
László Radnai
Attila Reményi
István Venekei
3. Biochemistry Practical Manual
Soundravally Rajendiran, Pooja Dhiman

Title of Paper: PRACTICAL - XIII

Type: BCH Pr – XIII CORE

SEMESTER – XIII

TOTAL CREDITS: 2

TOTAL HOURS (Hrs): L+T+P (0 Hrs+0 Hrs+60 Hrs)

Practicals

List of Practical	No. of Hours (L+T+P)
1) Preparation and maintaing of stock cultures.	60 hours
2) Checking cultures for contamination.	
3) Serial dilution techniques.	
4) Enumeration of soil microbes.	
5) Enumeration of sewage microbes	

List of Reference Books

1. Practical Textbook of
BIOCHEMISTRY
DM Vasudevan,
Subir Kumar Das
2. Introduction to Practical Biochemistry
György Hegyi
József Kardos
Mihály Kovács
András Málnási-Csizmadia
László Nyitray
Gábor Pál
László Radnai
Attila Reményi
István Venekei
3. Biochemistry Practical Manual
Soundravally Rajendiran, Pooja Dhiman

Title of Paper: PRACTICAL – XIV

Type: BCH Pr – XIV CORE

SEMESTER – VI

TOTAL CREDIT: 2

TOTAL HOURS (Hrs): L+T+P (0 Hrs+ 0 Hrs+60 Hrs)

Practicals

List of Practicals	No. of Hours (L+T+P)
1) Methods of sub-cultring of bacteria.	60 hours
2) Isolation of bacteria from curd/milk and its Gram's staining	
3) Isolation of bacteria exposure plate technique.	
4) Pure culture techniques : Streak plate method, spread plate method, pour plate method.	
5) Bacterial population counts.	
6) Smear preparation, staining of bacteria using simple staining, differential staining	

List of Reference Books

1. Practical Textbook of

BIOCHEMISTRY

DM Vasudevan,

Subir Kumar Das

2. Introduction to Practical Biochemistry

György Hegyi

József Kardos

Mihály Kovács

András Málnási-Csizmadia

László Nyitray

Gábor Pál

László Radnai

Attila Reményi

István Venekei

3. Biochemistry Practical Manual

Soundravally Rajendiran, Pooja Dhiman