UNIVERSITY OF RAJSHAHI

RAJSHAHI-6205, BANGLADESH

Curriculum for B.Sc. (Honours)

Session: 2020-2021

Examination:	B.Sc. (Honours) Part-I	: 2021
	B.Sc. (Honours) Part-II	: 2022
	B.Sc. (Honours) Part-III	: 2023
	B.Sc. (Honours) Part-IV	: 2024

Offered by

DEPARTMENT OF BIOCHEMISTRY AND MOLECULAR BIOLOGY

Faculty of Science

This important document should be preserved along with other credentials for future use

Curriculum for Bachelor of Science

(Session: 2020-2021)

Department of Biochemistry and Molecular Biology

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Curriculum for Bachelor of Science (Honours)
(Session: 2020-2021)

1. **Title of the Academic Program**:	Biochemistry and Molecular Biology
2. **Name of the University**:	University of Rajshahi
3. **Vision of the University:**	To pursue enlightment and creativity for producing world class human resources to cater for the needs of changing time.
4. **Mission of the University**	1. To ensure a world class curriculum with talented academicians and conducive academic and research environment for generation and dissemination of knowledge 2. To maintain international standards in education with focus on both knowledge and skills, and humanitarian and ethical values to meet the needs of the society and state. 3. To develop strategic partnership with leading national and international universities, and organizations for academic as well as research collaborations.
5. **Name of the Degree:**	Bachelor of Science (Honours)
6. **Name of the Faculty offering the program**:	Faculty of Science
7. **Name of the program offering Entity**:	Biochemistry and Molecular Biology
8. **Vision of the Program:**	To generate world class knowledge on the molecular events underlying normal and pathophysiological functions in medicine and in the management of human and plant diseases; transfer such knowledge and education to students, physicians, and other allied health personnel, and to educate the general public.
9. **Mission of the Program:**	(i) Offer high quality courses in Biochemistry and Molecular Biology appropriate for bioscience students to produce graduates of high skills in solving the biomedical problems. (ii) Provide the science major with an introduction to biochemistry courses as well as advanced Biochemistry and Molecular Biology courses at the Postgraduate levels. (iii) Encourage and assure high quality research and other scholarly activities on the part of both faculty and students.

10. **Description of the Program:**	The Biochemistry and Molecular Biology Undergraduate Program, which confers B.Sc. Honours degree, prepares students for a career in science by expanding knowledge of biochemistry and molecular biology, and by developing the student's ability in critical thought and creativity. The academic program emphasizes an in-depth study of the field encompassing Biophysical Chemistry, Basic and advanced Biochemistry, Physiology, Microbiology, Endocrinology, Molecular and Cell Biology, Nutrition, Clinical Biochemistry, Immunology, Biotechnology and Bioinformatics. The program bestows a strong preparation for an academic and teaching career, or a biochemical research career at both the fundamental and applied levels in private, governmental or industrial laboratories. We believe that our program provides an excellent environment for undergraduate study in biochemistry and molecular biology by combining the facilities, quality and breadth of research of a larger university with close student-faculty interaction, and an interdisciplinary exchange of ideas usually found only in an ideal institution.
11. **Program Educational Objectives (PEO):**	1. To ensure through a strong core curriculum, that students acquire knowledge and competence in Biochemistry and Molecular Biology. 2. To encourage students to develop a life-long commitment to learning. 3. To instill a critical awareness of advances at the forefront of the Biochemistry and Molecular Biology discipline. 4. To train students in methods of academic inquiry, problem solving and scientific research. 5. To promote high quality research in the fields of Biochemistry and Molecular Biology.
12. **Program Learning Outcomes (PLO):**	Upon successful completion of the program, students will be able to: i) Understand and examine in detail the major underlying principles of biochemistry and Molecular biology and explain the basic concepts and principles related to life sciences. (**Knowledge**) ii) Interpret numerical data and demonstrate proficiency in computing technology for life science and formulate solutions to problems both theoretical and in a practical laboratory setting. (**Execution**) iii) Critically evaluate scientific data and apply scientific

<table>
<tr><td></td><td colspan="2">methods to analyze, draw conclusions and offer sound arguments to justify a position. (Judgment)
iv) Effectively communicate scientific concepts to specialists as well as to a lay audience through oral and written presentations. (Communication)
v) Work independently as well as collaborate effectively in a team to solve scientific problems. (Interpersonal Skill & Leadership)
vi) Appraise the history, development and societal impact, both positive and negative, of life science in general and biochemistry and Molecular biology in particular. (Appreciation of Science)
vii) Draw on scientific knowledge in developing a principled worldview and apply this to persuading and influencing others through informed discussion of the impact of science, both as a force for progress and as an agent of harm. (Ethical Practice)
viii) Appreciate the global impact of innovation in communications on science practice. (International Outlook)
ix) Evaluate personal capabilities and motivation for a scientific career. (Self-reflection)</td></tr>
<tr><td>13. Generic Skills/Graduate Profile</td><td colspan="2">Biochemistry and molecular biology (BMB) students should demonstrate proficiency in the foundational concepts of the discipline and possess the skills needed to practice as professionals. The skills that should be demonstrated by a BMB graduate include the assembly of experimental, mathematical, and interpersonal skills including collaboration, teamwork, safety, and ethics. In addition, experimental design, data interpretation / analysis and the ability to communicate findings to diverse audience to be essential skills. To aid in the development of appropriate assessments these skills are grouped into three categories, 1) Process of Science, 2) Communication and Comprehension of Science, and 3) Community and Practice Aspects of Science.</td></tr>
<tr><td rowspan="3">14. Mapping/Alignment University's Mission vs PEO</td><td>University's Mission</td><td>PEO</td></tr>
<tr><td>To ensure a world class curriculum with talented academicians and conducive academic and research environment for generation and dissemination of knowledge</td><td>1,3</td></tr>
<tr><td>To maintain international standards in education with focus on both knowledge and skills, and humanitarian and ethical values to</td><td>2,4</td></tr>
</table>

	meet the needs of the society and state.	
	To develop strategic partnership with leading national and international universities, and organizations for academic as well as research collaborations.	5
15. **Mapping/Alignment PEO vs PLO**	**PEO**	**PLO**
	To ensure through a strong core curriculum, that students acquire knowledge and competence in Biochemistry and Molecular Biology.	i, ix, iv
	To encourage students to develop a life-long commitment to learning.	vii
	To instill a critical awareness of advances at the forefront of the Biochemistry and Molecular Biology discipline.	ii, iii, iv
	To train students in methods of academic inquiry, problem solving and scientific research.	vi, viii
	To promote high quality research in the fields of Biochemistry and Molecular Biology.	vii
16. **Mapping/Alignment of PEO vs types of Courses**	**PEO**	**Course**
	To ensure through a strong core curriculum, that students acquire knowledge and competence in Biochemistry and Molecular Biology.	101, 102, 103, 104, 105, 201, 202, 203, 204, 205, 301, 302, 303, 304, 305, 306, 307, 308, 309, 401, 402, 403, 404, 405, 406, 407, 408, 409, 410
	To encourage students to develop a life-long commitment to learning.	106, 107, 108 110, 206, 208
	To instill a critical awareness of advances at the forefront of the Biochemistry and Molecular Biology discipline.	111, 112, 210, 211, 310, 311, 411, 412
	To train students in methods of academic inquiry, problem solving and scientific research.	109, 111, 207, 209, 210, 310 311, 412,

		413
	To promote high quality research in the fields of Biochemistry and Molecular Biology.	111, 210, 310, 411

17. Mapping between PLO and CLO

Program Learning Outcomes (PLO):

PLO1	Understand and examine in detail the major underlying principles of biochemistry and Molecular biology and explain the basic concepts and principles related to life sciences. (**Knowledge**)
PLO2	Interpret numerical data and demonstrate proficiency in computing technology for life science and formulate solutions to problems both theoretical and in a practical laboratory setting. (**Execution**)
PLO3	Critically evaluate scientific data and apply scientific methods to analyze, draw conclusions and offer sound arguments to justify a position. (**Judgment**)
PLO4	Effectively communicate scientific concepts to specialists as well as to a lay audience through oral and written presentations. (**Communication**)
PLO5	Work independently as well as collaborate effectively in a team to solve scientific problems. (**Interpersonal Skill & Leadership**)
PLO6	Appraise the history, development and societal impact, both positive and negative, of life science in general and biochemistry and Molecular biology in particular. (**Appreciation of Science**)
PLO7	Draw on scientific knowledge in developing a principle worldview and apply this to persuading and influencing others through informed discussion of the impact of science, both as a force for progress and as an agent of harm. (**Ethical Practice**)
PLO8	Appreciate the global impact of innovation in communications on science practice. (**International Outlook**)

B.Sc. Honours Part-I, 2020									
Course Code	**Course Title**	**Course Learning Outcomes (CLOs)**	**PLO1**	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**
BMB-101	Basic Biochemistry	CLO1	√		√	√		√		
		CLO2	√			√				
		CLO3		√	√	√				
		CLO4	√	√	√	√				
BMB-102	Bioorganic Chemistry	CLO1		√	√	√	√		√	
		CLO2		√	√	√	√		√	
		CLO3		√	√	√	√			
BMB-103	Biophysical Chemistry	CLO1	√				√			
		CLO2		√			√		√	
		CLO3			√	√	√			

BMB-104	Physiology-I	CLO1	√		√	√				
		CLO2				√				
		CLO3		√	√		√			
BMB-105	Introductory Microbiology	CLO1		√	√					
		CLO2	√	√						
		CLO3						√	√	
BMB-106	Botany	CLO1	√	√						
		CLO2	√		√					
		CLO3			√					
		CLO4			√	√	√			
BMB-107	Basic Statistics	CLO1		√		√				
		CLO2		√			√			
		CLO3		√	√					
BMB-108	Computer Fundamentals	CLO1				√			√	
		CLO2				√			√	
		CLO3								√
BMB-109	Computer Practical	CLO1				√	√			
		CLO2					√		√	√
		CLO3		√	√		√			
BMB-Eng-110	English-noncredit	CLO1	√			√	√			
		CLO2	√			√	√			
		CLO3				√				
		CLO4				√				
BMB-111	Laboratory Work	CLO1					√		√	√
		CLO2		√			√			
		CLO3			√		√			
BMB-112	Viva-voce	CLO1		√		√	√			
		CLO2		√		√	√			
		CLO3		√		√	√			

B.Sc. Honours Part-II, 2021										
Course Code	**Course Title**	**Course Learning Outcomes (CLOs)**	**PLO1**	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**
BMB-201	Molecular Biology-I	CLO1	√		√	√		√		
		CLO2	√		√	√		√	√	
		CLO3	√	√			√	√	√	
BMB-202	Human Nutrition	CLO1	√		√	√	√	√		
		CLO2	√					√		
		CLO3	√		√	√			√	
BMB-203	Enzymes	CLO1	√	√	√	√		√		
		CLO2	√		√	√				
		CLO3	√	√			√			
BMB-204	Metabolism - I	CLO1	√		√	√	√	√	√	
		CLO2	√	√	√	√				
		CLO3	√		√	√	√			
BMB-205	Microbiology	CLO1	√	√	√	√				
		CLO2		√		√	√	√		
		CLO3	√	√		√			√	√
BMB-Bot-206	Botany-II	CLO1	√	√	√	√				
		CLO2	√	√			√	√		
		CLO3	√					√	√	
BMB-Bot-207	Botany Practical	CLO1	√	√	√		√			
		CLO2	√	√	√		√			
		CLO3	√	√				√	√	
BMB-Biostat-208	Biostatistics	CLO1	√	√		√	√			
		CLO2	√	√	√	√	√			
		CLO3	√	√	√		√	√		
BMB-209	Biostatistics Practical	CLO1	√	√	√		√			
		CLO2	√	√	√		√			
		CLO3	√	√	√		√	√		
BMB-210	Laboratory Work	CLO1	√	√	√	√				
		CLO2	√	√	√	√				
		CLO3	√	√			√		√	√
BMB-211	Viva-voce	CLO1	√	√		√				√
		CLO2	√				√	√		
		CLO3	√					√		√

B.Sc. Honours Part-III, 2022										
Course Code	**Course Title**	**Course Learning Outcomes (CLOs)**	**PLO1**	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**
BMB-301	Molecular Biology-II	CLO1	√	√	√	√		√		
		CLO2	√	√	√		√	√		
		CLO3	√	√	√		√	√		
BMB-302	Cell Biology	CLO1	√	√		√		√		
		CLO2	√	√	√		√			
		CLO3	√	√	√	√		√		
BMB-303	Physiology II	CLO1	√		√	√	√			
		CLO2	√		√	√	√	√		
		CLO3	√	√	√	√	√			
BMB-304	Endocrinology	CLO1	√	√	√	√		√		
		CLO2	√	√	√	√	√			
		CLO3	√	√	√	√	√			
BMB-305	Protein Technology	CLO1	√	√	√	√		√		
		CLO2	√	√	√	√	√			
		CLO3	√	√	√	√	√			
BMB-306	Immunology-I	CLO1	√	√	√	√		√		
		CLO2	√	√	√	√		√		
		CLO3	√	√	√	√	√			
BMB-307	Clinical Biochemistry	CLO1	√	√	√	√		√		
		CLO2	√	√	√		√			
		CLO3	√	√		√	√	√		
BMB-308	Metabolism-II	CLO1	√		√	√	√			
		CLO2	√		√	√	√	√		
		CLO3	√	√	√	√	√			
BMB-309	Bioenergetics	CLO1	√	√	√	√	√			
		CLO2	√	√	√	√		√		
		CLO3	√	√	√	√	√			
BMB-310	Laboratory Work	CLO1	√	√	√	√				
		CLO2	√	√	√	√				
		CLO3	√	√			√		√	√
BMB-311	Viva-voce	CLO1	√	√		√				√
		CLO2	√				√	√		
		CLO3	√					√		√

B.Sc. Honours Part-IV, 2023										
Course Code	**Course Title**	**Course Learning Outcomes (CLOs)**	**PLO1**	**PLO2**	**PLO3**	**PLO4**	**PLO5**	**PLO6**	**PLO7**	**PLO8**
BMB-401	Molecular Biology and Genetic Engineering	CLO1	√	√						
		CLO2		√					√	√
		CLO3				√	√	√		√
BMB-402	Basic Bioinformatics	CLO1	√	√						
		CLO2		√	√					
		CLO3		√		√				√
BMB-403	Biotechniques	CLO1	√							
		CLO2		√	√	√				
		CLO3		√	√					
BMB-404	Industrial Biotechnology	CLO1	√	√						
		CLO2	√	√	√				√	√
		CLO3		√	√			√	√	
BMB-405	Plant Biotechnology	CLO1	√							
		CLO2		√	√					√
		CLO3		√	√		√	√		
BMB-406	Pharmaceutical Biochemistry	CLO1	√							
		CLO2		√	√					
		CLO3		√	√					√
BMB-407	Immunology-II	CLO1	√		√					
		CLO2		√	√	√				
		CLO3	√			√				
BMB-408	Oncology-I	CLO1	√	√		√				
		CLO2		√	√					
		CLO3	√			√		√		√
BMB-409	Neurochemistry	CLO1	√	√		√				
		CLO2	√			√				
		CLO3	√	√		√				
BMB-410	Enzyme Technology	CLO1	√	√						
		CLO2		√	√			√		√
		CLO3		√				√		√
BMB-411	Laboratory Work	CLO1	√	√	√				√	√
		CLO2		√	√				√	√
		CLO3	√	√	√				√	√
BMB-412	Viva-voce	CLO1	√	√		√				√
		CLO2	√				√	√		
		CLO3	√					√		√

Ordinance for the Undergraduate Program

1. The Faculty of Science shall consist of the following Departments:

   (a) Mathematics, (b) Chemistry, (c) Physics, (d) Statistics, (e) Biochemistry and Molecular Biology, (f) Pharmacy, (g) Population Science and Human Resource Development, (h) Applied Mathematics, (i) Physical Education and Sports Science and such other Department(s) that may be established by the University from time to time as assigned to the faculty by the Academic Council.

2. The Faculty of Science shall be constituted according to the Statutes, Ordinances and Regulations of the University governing the constitution of the Faculties.

3. There shall be a program of study for the Bachelor of Science with Honours hereinafter referred to as B. Sc. Honours degree. Bachelor of Science also includes Bachelor of Pharmacy (B. Pharm.).

4. Duration of the program of study:
   The program of study for the degree of B.Sc./B. Pharm. Honours shall extend over a minimum period of four academic years and the degree shall be completed within a maximum period of six academic years. No student shall be allowed to stay for more than two academic years in each of the 1^{st}, 2^{nd} and 3^{rd} year of the program.

5. Admission requirements:
   (a) Subject to the conditions laid down and conditions as set by the admission committee, students passing Higher Secondary Certificate (HSC) Examination in Science or an equivalent examination of a recognized University or Board may be admitted to the program of study leading to the degree of B. Sc. /B. Pharm. Honours on recommendation of the academic committee of the department concerned.

   (b) To be eligible for admission to B. Sc. /B. Pharm. Honours program, a student must have to obtain at least **3.00** GPA excluding 4^{th} subject in both the SSC and HSC examinations individually and **7.00** GPA in total in the two examinations excluding the 4^{th} subjects but this will be fixed up according to the decision of the admission committee of University.

   (c) Only one year of break of study after passing HSC/ equivalent examination shall be allowed for admission. Students passed in O level and A level examinations shall have to obtain at least "C" grade in both the examinations to be considered for admission.

6. Course and Distribution of Marks:

(a) **Marks**: The program of study for the B. Sc./B.Pharm. Honours degree shall carry a total of 4000 marks (40 units, 160 credits), 15-30% of which are for the related subjects and 20-40% for the practical, viva voce, class assessment/ tutorial/ terminal/ home assignment, thesis/ dissertation / project/ in-plant training, etc. The related courses shall have to be completed in the first and second year of the program. In addition, a non-credit English language course for Scientific/ Technical terminologies and its applications shall be offered in the first year of the program.

(b) **Contact hours**: There shall be a minimum of 30, 45 and 60 lecture hours in an academic year for each theory course of **2 Credits, 3 Credits and 4 Credits,** respectively and at least 48 and 96 laboratory periods in an academic year for each practical course of **2 Credits and 4 Credits,** respectively. For other fractions of a unit, proportionality should be applied. One laboratory period is equivalent to 3 (three) theoretical lecture periods.

(c) **Examinations**: The B. Sc./B.Pharm. Honours examination shall be held annually and shall consist of the (i) B. Sc. /B.Pharm. Honours Part-1 examination at the end of the first academic year, (ii) B. Sc. /B.Pharm. Honours Part-2 examination at the end of the second academic year, (iii) B. Sc. /B.Pharm. Honours Part-3 examination at the end of the third academic year and (iv) B. Sc. /B.Pharm. Honours Part-4 examination at the end of the fourth academic year.

A Honours student, for obtaining the degree, shall have to pass all the examinations within 6 (six) academic years from the date of his/ her first admission and shall not be allowed to stay for more than 2 (two) academic years in each of his/ her first, second, and third year Honours classes. The non-credit English course shall have to be passed in 4 (four) academic years from the date of his/ her admission.

(d) **Marks distribution**: The year-wise distribution of marks among the theory, practical, viva-voce, class assessment/ tutorial/ terminal/ home assignment, thesis/ dissertation/ project/ in-plant training, etc. shall be as follows:

(i) B. Sc. /B.Pharm. Honours Part-1 Examination

Nature of course	Units	Marks	Credits
Theory (including related)	5.5-7.5	550-750	22-30
English (noncredit)[1]	0.5-1.0	50-100	00
Practical[2]	1.0-2.5	100-250	4-10
Viva-voce (general)	0.5	50	2
Total (credit courses)	9.5	950	38

(ii) B. Sc. /B.Pharm. Honours Part-2 Examination:

Nature of course	Units	Marks	Credits
Theory (including related)	5.5-7.5	550-750	22-30
Practical[2]	1.0-2.5	100-250	4-10
Viva-voce (general)	0.5	50	2
Total (credit courses)	9.5	950	38

(iii) B. Sc. /B.Pharm. Honours Part-3 Examination:

Nature of course	Units	Marks	Credits
Theory	6.5-8.5	650-850	26-34
Practical[2]	1.0-2.5	100-250	4-10
Viva-voce (general)	0.5	50	2
Total (credit courses)	10.5	1050	42

(iv) B. Sc. /B.Pharm. Honours Part-4 Examination:

Nature of course	Units	Marks	Credits
Theory	6.5-8.5	650-850	26-34
Practical[2]	1.0-2.5	100-250	4-10
Viva-voce (general)	0.5	50	2
Project/ Thesis/ dissertation / in-plant training/ special practical[4]	0.5-1.5	50-150	2-6
Total (credit courses)	10.5	1050	42

[1] A candidate shall not be allowed to continue the B.Sc./ B.Pharm. Honours program if he/ she fails to obtain the letter grade (LG) "S" in the English course in 4 (four) academic years from the date of admission. The letter grade "S" corresponds to at least 30% marks.

[2] 30% of the total practical marks shall be allocated for continuous laboratory assessment.

[3]20% of the total marks per course shall be allocated for class assessment (15%) (tutorial/terminal/assignment/presentation etc.) and attendance in the class (5%). The marks for attendance shall be awarded on the basis of the following table:

Table for awarding marks on attendance

Attendance	Marks	Attendance	Marks	Attendance	Marks
95-100%	100%	90-<95%	90%	85-<90%	80%
80-<85%	70%	75-<80%	60%	70-<75%	50%
65-<70%	40%	60-<65%	30%	<60%	00%

[4] Theoretical course(s) may be offered instead, if a department desires.

7. Examinations:

(a) **Class Assessment**: Each of class assessment examinations on each theory course shall be taken in one lecture period by the individual course teacher(s) during the middle of the progress and/or the end of the course for internal evaluation. Laboratory assessment examination shall be taken by the concerned teacher(s) continuously throughout the year in each laboratory class.

(b) **Duration of Examination**: The duration of examination of the theory courses shall be 3 hours for a 0.50 unit course, and 4 hours for each of 0.75 and 1.00 unit courses. The duration of practical examination shall be 6-12 and 12-24 hours (4-6 hours per day) per0.50 and 1.00 unit practical courses, respectively. For other fractions of a unit, proportionality shall be applied.

(c) **Submission of Marks**: Average of all class assessment of theory courses and average of all laboratory assessment marks shall have to be submitted by the course instructor(s) concerned in sealed envelope to the Chairman of the relevant examination committee before the commencement of the final examination. A course instructor, failing to submit the assessment marks before the commencement of the final examination, shall not be allowed to act as an examiner of the course examination. The decision will be taken by the relevant examination committee with the approval of the departmental academic committee.

Consolidated average marks of theory courses, class assessment, viva-voce, laboratory assessment, practical courses, etc. shall have to be converted to the letter grade by the relevant examination committee and submitted to the Controller of Examinations before finalizing the result.

8. **Eligibility for Examination**:

(a) Percentage of Attendance: In order to be eligible for taking up the B. Sc./B.Pharm. Honours examinations, a candidate must have pursued a regular course of study by attending not less than 75% of the total number of classes held (theoretical, practical, class assessment etc.) provided that the academic committee of the department on special grounds and on such documentary evidence that may be necessary, may condone the cases of shortage of attendance not below 60%. A candidate, appearing at the examination under the benefit of this provision shall have to pay in addition to the examination fees, the requisite fee prescribed by the syndicate for the purpose. Candidates having less than 60% attendance shall not be allowed to fill in the examination form.

(b) Readmission: A candidate, who failed to appear at the examination or did not pass the examination, may on the approval of the relevant department be readmitted to the immediate following session in the first, second, third or fourth year of the program. A readmitted candidate shall have to reappear at all course examinations.

9. **Admission to Examinations**:

For admission to B. Sc./B.Pharm. Honours examination a candidate shall have to submit his/ her application in the prescribed form together with certificates of attendance and fulfill all other conditions prescribed by the University. The application shall be submitted through the Chairman of the Department and Provost of the Hall concerned so as to reach the Controller of Examinations at least 6 weeks before the date fixed for the commencement of the examination.

10. **Examination Committees**:

(a) There shall be separate examination committee for each of the B. Sc./B.Pharm. Honours Part-1, Part-2, Part-3 and Part-4 examinations called **main examination committees**. The examination committee shall be proposed by the departmental academic committee.

The main examination committee shall consist of 5 members: (a) One expert member from outside the Department/ University, (b) Chairman of the committee and three other members from among the teachers of the department concerned.

(b) In addition to the four main examination committees for Part-1, Part-2, Part-3 and Part-4 examinations, there shall be two more **related examination committees** for Part-1 and Part-2 examinations.

The related examination committee shall be constituted as follows:

(i) Chairman: The Chairman of the main examination committee, (ii) Three members: One member from the main committee from the category of the teacher of the department, and two members from the department of the related subjects; and (iii) one expert member from outside the department (may also be from the departments of related subjects)

(c) The main examination committee shall (i) propose the names of the questions setters and script/ thesis/ dissertation/ project/ in-plant training examiners from the previously approved panel of examiners; (ii) moderate examination questions of Honours subjects; (iii)

propose examination schedule (for approval of the departmental academic committee) to conduct the examinations properly; (iv) make necessary arrangements for holding the practical examination of the Honours subject, and theory and viva-voce examinations; (v) recommend the names of three tabulators (for approval of the Vice-Chancellor); and (vi) finalize the results.

(d) The related examination committee shall (i) propose the names of the question setters and script examiners; (ii) moderate the questions for related courses; and (iii) make necessary arrangements for holding the practical examination of the related subjects.

11. **Medium of Questions and Answers**:

Questions shall be made in English. The medium of answers in the examination of all courses shall be either English or Bangla as directed by the department. However, a mixing of English and Bangla shall never be allowed in an answer-script.

12. **Question setters and examiners**:
(a) For each of the Honours examination, there shall be two question setters and two script examiners (first and second examiners) for each theory course, and two external examiners from outside the department for thesis/ dissertation/ project. For the practical examinations, there shall be five examiners including one external. However, if the number of examinees in the practical examination is less than 10 (ten) per day, there shall be three examiners including the external examiner. Concerned supervisor shall not be eligible to be an examiner of his/ her supervised thesis/ dissertation/ project. The arithmetic mean of the marks awarded by the two examiners shall be taken. In case the marks awarded by the two examiners differ by 20% or more, the examination committee shall recommend a third examiner and the arithmetic mean of the two nearest mark shall be counted. In case both the extreme marks differ from the middle mark by exactly the same margin, the arithmetic mean of the two higher marks (advantage to the student) shall be taken. If the number of scripts to be examined third time are 50% or more of the total number of scripts of a course then all scripts of that course shall have to be third examined.

(b) At least three copies of thesis/ dissertation/ project report (type-written/ printed and bound) shall have to be submitted to the Chairman of the relevant examination committee within the scheduled date (ordinarily 3 months after the completion of the written examination) of submission.

One copy of thesis/ dissertation, approved for the degree, shall be sent by the Chairman of the relevant examination committee to the departmental seminar/ university library for future reference.

(c) The reports of the in-plant training shall be evaluated by two (first and second) examiners.
(d) The viva-voce examination shall be conducted by the relevant examination committee.

13. **Course Completion, Holding of Examination and Publication of Results**:
Courses shall be conducted according to the academic calendar circulated by the department concerned and be completed within 8 months from the commencement of the courses. The time limit for the publication of results shall ordinarily be 6 (six) weeks from the date of completion of the written examination.

14. **The Grading Systems**:

(a) **Credit Point (CP)**: The credit points achieved by an examinee for 0.50 and 1.00 unit courses shall be 2 and 4, respectively. For other fractions of a unit, proportionality should be applied.

(b) **Letter Grade (LG) and Grade Point (GP)**: Letter Grades, corresponding Grade Points and Credit Points shall be awarded in accordance with provisions shown below:

(i) Table of LG, GP and CP for credit courses

Numerical grade	LG	GP / unit	CP / unit
80% or its above	A^+ (A plus)	4.00	4
75% to less than 80%	A (A regular)	3.75	4
70% to less than 75%	A^-(A minus)	3.50	4
65% to less than 70%	B^+ (B plus)	3.25	4
60% to less than 65%	B (B regular)	3.00	4
55% to less than 60%	B^- (B minus)	2.75	4
50% to less than 55%	C^+ (C plus)	2.50	4
45% to less than 50%	C (C regular)	2.25	4
40% to less than 45%	D	2.00	4
Less than 40%	F	0.00	0
Incomplete	I	--	0

Absence from the final examination shall be considered incomplete with the letter grade "I".

(ii) Table of LG, GP and CP for non-credit courses

Numerical grade	LG	GP / unit	CP / unit
30% and above	S	0.0	0.0
Less than 30%	U	0.0	0.0

Here S and U refer to "satisfactory" and "unsatisfactory", respectively.

(c) **Grade Point Average (GPA) and Total Credit Point (TCP)**: The weighted average of the grade points obtained in all the courses by a student and Total Credit Point shall be calculated from the following equations:

GPA = Sum of $[(CP)_i \times (GP)_i]$ / sum of $(CP)_i$

and

TCP = Sum of $(CP)_i$

(d) **Cumulative Grade Point Average (CGPA)**: The weighted average of the GPAs of a student in all four years shall be calculated from the following equation:

CGPA = Sum of $[(TCP)_j \times (GPA)_j]$ / sum of $(TCP)_j$

where $(GP)_i$ = grade point obtained in individual courses, $(CP)_i$ = credit point for respective course, $(GPA)_j$ = grade point average obtained in a year and $(TCP)_j$ = total point for that year.

According to the resolution (49) of 242nd Academic Council meeting held on 01-10-2016 and approved by the 468th Syndicate meeting on 08-10-2016, the following points shall have to be considered for taking the decimal points in preparing the results of B.Sc. (Honours) examination:

(a) In the case of GPA, up to 3 (three) digits after decimal point shall have to be taken. The 4th digit after the decimal will not be countable in any way. Only decimals should be recorded up to the 3rd digit.

For example: $\left(3.4999 \longrightarrow 3.499\right)$

(b) In case of CGPA, 2 (Two) digits after decimal point shall have to be taken. In this case, if the 3rd digit is ≥5, then 1 (One) should be added with second digit after decimal point and thus 2 (Two) digits after decimal point shall be recorded in CGPA.

For example: $3.485 \longrightarrow 3.49, \quad 3.354 \longrightarrow 3.35$

An illustration of calculating GPA and CGPA: Suppose a student has completed five courses in each of first and second year and four courses in each of third and fourth year examinations and obtained the following grades:

1st year course	Credits	Grade	GP
Chem-101	2	A	3.75
Chem-111	4	A^+	4.00
Chem-112	4	B^+	3.25
Chem-131	4	B^-	2.75
Math-112	4	C	2.25

$$(GPA)_1 = \frac{2(3.75) + 4(4.00) + 4(3.25) + 4(2.75) + 4(2.25)}{2 + 4 + 4 + 4 + 4} = \frac{56.5}{18} = 3.138888 = 3.138$$

2nd yeare course	Credits	Grade	GP
Chem-203	4	A^+	4.00
Chem-205	4	B	3.00
Chem-207	4	A	3.75
Math-205	2	B^+	3.25
PH-201	2	A^-	3.50

$$(GPA)_2 = \frac{4(4.00) + 4(3.00) + 4(3.75) + 2(3.25) + 2(3.50)}{4 + 4 + 4 + 2 + 2} = \frac{56.5}{16} = 3.53125 = 3.531$$

3nd yeare course	Credits	Grade	GP
Chem-311	4	B	3.00
Chem-312	3	B	3.00
Chem-321	4	C	2.25
Chem-331	2	A	3.75

$$(GPA)_3 = \frac{4(3.00) + 3(3.00) + 4(2.25) + 2(3.75)}{4 + 3 + 4 + 2} = \frac{37.5}{13} = 2.8846153 = 2.884$$

4th year course	Credits	Grade	GP
Chem-401	2	A^-	3.50
Chem-412	2	A^+	4.00
Chem-422	2	B^-	2.75
Chem-432	4	D	2.00

$$(GPA)_4 = \frac{2(3.50) + 2(4.00) + 2(2.75) + 4(2.00)}{2 + 2 + 2 + 4} = \frac{28.50}{10} = 2.850$$

His/her CGPA is:

$$CGPA = \frac{18(3.138) + 16(3.531) + 13(2.884) + 10(2.850)}{18 + 16 + 13 + 10} = \frac{178.97}{57} = 3.139859649 = 3.14$$

LG corresponding to CGPA=3.14 is "B".

15. Award of Degree, Promotions and Improvement of Results:

(a) **Award of degree**: The degree of Bachelor of Science with Honours in any subject shall be awarded on the basis of CGPA obtained by a candidate in B. Sc./B. Pharm. Honours Part-1, Part-2, Part-3 and Part-4 examinations. In order to qualify for the B. Sc./B. Pharm. Honours degree a candidate must have to obtain within 6 (six) academic years from the date of admission :

(i) a minimum CGPA of 2.50

(ii) a minimum GPA of 2.00 in the practical courses in each of Part-1,Part-2, Part-3 and Part-4 examinations.

(iii) 144 Credits out of 160

(iv) "S" letter grade in English course (in 4 academic years from the date of admission).

The result shall be given in CGPA with the corresponding LG (Table of LG, GP and CP) in bracket. For instance, in the example cited above the result is "CGPA=3.10 (B)".

(b) **Publications of results**: The overall results of a successful candidate covering all examinations of four years shall be declared on the basis of CGPA. The transcript in English shall show the course number, course title, credit, grade and grade point of individual courses, GPA of each year, CGPA and the corresponding LG for the overall result.

(c) **Promotions**: In order to be eligible for promotion from one class to the next higher Honours class, a candidate must secure **(i)** at least 2.00 GPA in each of his/her Part-1, Part-2 and Part-3 examinations, (ii) at least 2.00 GPA in each of his/her Part-1, Part-2 and Part-3 practical and class assessment/tutorial/terminal/home assignment course examinations, and (iii) (a) minimum 30 credits in his/her Part-1 examinations (iii) (b) minimum 30 credits in his/her Part-2 examinations and 64 credits in total of Part-1 and Part-2 examinations. (iii) (c) minimum 34 credits in his/her Part-3 examinations and 102 credits in total of Part-1, Part-2, and Part-3 examinations. (iii) (d) minimum 34 credits in his/her Part-4 examination for considering the award of Honours degree.

(d) **Course Improvement**: A promoted student earning a grade less than **3.00** in individual courses shall be allowed to improve the grades on courses, not more than **8 Credits** courses including those of "**F**" grades, if any, of Part-1, Part-2 and Part-3 examinations or their equivalent courses (in case of changes in the syllabus), defined by the departmental academic committee, through the regular examination of the immediate following batch. However, if the candidate fails to clear his/her "**F**" grades in the first attempt, he/she shall get a second (last) chance in the immediate next year to clear the "**F**" grades. No improvement shall be allowed in practical course examinations/ viva-voce/ class assessment/ tutorial/ terminal/ home assignment and thesis/ dissertation/ project/ in-plant training courses. If a candidate fails to improve his/her course grade, the previous grade shall remain valid. If a readmitted candidate fails to appear at the regular class assessment/ tutorial/ terminal/ home assignment and thesis/ dissertation/ project/ in-plant training courses, his/her previous grades shall remain valid.

(e) **Result Improvement**: A candidate obtaining a CGPA of less than **2.75** at the end of the Part-4 examinations, within 5 (five) academic years, shall be allowed to improve his/her result, on up to a maximum of 4 (four) full units **(16 Credits)** of the Part-4 theoretical courses in the immediate next regular examination (within six academic years from the date of admission) after publication of his/her result. The year of examination, in the case of a result improvement, shall remain same as that of the regular examination. His/her previous grades for practical courses/ viva-voce/class assessment/ tutorial/ terminal/ home assignment, thesis/ dissertation/ project/ in-plant training courses shall remain valid. If a candidate fails to improve CGPA, the previous results shall remain valid.

(f) **Pass Degree**: Candidates failing to obtain required **CGPA 2.50 and 144 Credit.**
(i) For promotion in Honours Part-3 examination in 4 (four) academic years, in case of readmission in Part-3 course year, in 5 (five) academic years, with no readmission in Part-3 course year from the date of **1st year admission. But fulfill the following Conditions.**
If a candidate fails to obtain required GPA (2.00) and Credit Point (102) for promotion from Part-3 to Part-4 within 5 academic years from his/her first date of admission in First year but secured CGPA 2.00 and total Credit Point 94 with LG of "S" in the English Course, shall be awarded Pass degree, such candidates shall not be allowed to improve their pass degree.
or
If a candidate fails to obtain a minimum of 34 Credits and GPA (2.00) in his/her Part-4 examination also fails to obtain 144 Credits and CGPA 2.50 within 6 academic years from his/her first date of admission in first year but secured minimum CGPA 2.00, 128 Credits, with LG of "S" in the English Course, shall be awarded Pass degree and such candidates shall not be allowed to improve their pass degree.

(g) **Dropping out**: Candidates, failing to earn the yearly required GPA after completing regular examinations and subsequently failed again after taking readmission in 1st, 2nd or 3rd year, or to clear **required** "F" grades in the stipulated period, shall be dropped out of the programme.

16. **Academic Calendar**:
The date of beginning and completion of course(s), date of examination, publication of results etc. shall have to be declared by department concerned through an academic calendar at the beginning of the session. In preparing calendar the following points shall have to be considered:

(a) Course(s) shall have to be completed within 8 (eight) months.
(b) Examination shall start after three weeks from the date of completion of the course(s)
(c) At least 2 (two) theoretical course examinations shall be held per week.
(d) Examination results shall ordinarily be published within 6 (six) weeks from the date of completion of the examination.

17. **Teaching feed-back**: All students in each course shall be allowed to express their difficulties and/or opinion regarding the course teaching performance through a prescribed form (designed by the faculty), one per course, distributed among the students by the department concerned. The students shall have to duly fill in the forms and drop them in an available sealed box in the departmental office. The Chairman of the department shall collect these forms from the box through a subcommittee and preserve it in sealed envelope until the result of the course year is published. After publication of the result, the sealed envelope shall be opened and discussed in the departmental academic committee, and necessary measures shall be suggested accordingly.

18.**Examination Ethics**:
(a) Everyone involved in the process of examination has to guard the security of the question papers before the examination and examination grades and results before their publication. An examinee can never try to influence the examiners and any such attempts has to be brought to the attention of the Controller of Examinations.
(b) An examinee may never be asked a question so that he/she is hurt for his/her religious or ethnic background.
(c) If someone (teacher or employee) is involved in a course examination process has the following relatives as examinees he/she should inform the Chairman of the concerned examination committee or the Controller of Examinations immediately:
(i) Husband/ wife, (ii) Son/ daughter, (iii) Brother-in-law/ sister-in-law, (iv) Son-in-law/ daughter-in-law, (v) Nephew/ niece, (vi) Uncle/ aunt and (vii) First cousins.

19. This ordinance shall come in force from the first year Honours session **(2013-2014)** onwards and the previous one shall stand cancelled. Students under previous ordinance shall have to complete their programme in special consideration if such students remain in the programme after the due date.

20. **Amendment**:
Any amendment to this ordinance shall be processed through the Faculty of Science and passed by the academic Council of Rajshahi University.

* Article 15 of this amended ordinance shall be implemented for the running Part-1, Part-2, Part-3 and Part-4 examinees of 2012 and subsequent examinations.

(উক্ত অর্ডিন্যান্স গত ২৩/০৬/২০১৩ তারিখে অনুষ্ঠিত বিজ্ঞান অনুষদের ১৭৩ তম সভার ৫৬ নং সিদ্ধান্ত এবং গত ০৪/০৭/২০১৩ তারিখে অনুষ্ঠিত শিক্ষা পরিষদের ২৩৩ তম সভার ১১৩ নং সিদ্ধান্তের সুপারিশক্রমে ০৮/০৭/২০১৩ তারিখে অনুষ্ঠিত ৪৪৯ তম সিন্ডিকেট সভার ৩ নং সিদ্ধান্তে অনুমোদনকৃত)

গত ১১/০৮/২০১৫ তারিখে অনুষ্ঠিত১৭৯তম বিজ্ঞান অনুষদ সভার কার্যবিবরণীর উদ্ধৃতাংশ।

প্রস্তাব নং ৬৩ ঃ ৪ বছর মেয়াদী বি.এস-সি/বি. ফার্ম ও এম.এস-সি/এম.ফার্ম অর্ডিন্যান্স পরিমার্জন বিষয়ে গত ১৫/০৩/২০১৫ তারিখে অনুষ্ঠিত বিজ্ঞান অনুষদের জরুরী সভায় গঠিত কমিটির সুপারিশ সমূহ আলোচনা-

সিদ্ধান্ত নং ৬৩ ঃ প্রস্তাবটি আলোচিত হলো এবং নিম্নরূপ সিদ্ধান্ত সমূহ অনুমোদনের জন্য সুপারিশ করা হলো-

সিদ্ধান্ত (ক)ঃ ৪ বছর মেয়াদী বি.এস-সি./বি.ফার্ম সম্মান পাঠ্যসূচীতে প্রতি বর্ষের ৫০ নম্বরের টিউটোরিয়াল কোর্সটি বিলুপ্ত করে সংশ্লিষ্ট বিভাগ সমমানের একটি নতুন কোর্স প্রনয়ণ করবে অথবা অন্য কোর্সের সাথে ঐ নম্বর যোগ করে মোট নম্বর ও ক্রেডিট বজায় রাখবে। প্রতিটি তত্ত্বীয় কোর্সের ২০% ইন-কোর্স মূল্যায়ন (১৫% টিউটোরিয়াল/টারমিনাল ও ৫% ক্লাস উপস্থিতি) এবং বাকি ৮০% চূড়ান্ত (ফাইনাল) পরীক্ষার জন্য সুপারিশ করা হলো।

সিদ্ধান্ত (খ) ঃ প্রতিটি ইন-কোর্স মূল্যায়ন নূন্যতম ২টি টিউটোরিয়াল/টারমিনাল পরীক্ষার মাধ্যমে সম্পন্ন করতে হবে। ১ম টিউটোরিয়াল/টারমিনাল পরীক্ষা ক্লাশ আরম্ভ হওয়ার পর থেকে ৩ মাসের মধ্যে ও ২য় টিউটোরিয়াল/টারমিনাল পরীক্ষা ক্লাশ আরম্ভ হওয়ার ৪ থেকে ৬ মাসের মধ্যে অবশ্যই গ্রহণ করতে হবে।
কোন কোর্সের একজন শিক্ষক পাঠদান করলে দুইটি পরীক্ষা নিয়ে তার প্রাপ্ত নম্বরের গড় এবং একাধিক শিক্ষক পাঠদান করলে সে ক্ষেত্রে তাঁদের মূল্যায়নের প্রদত্ত নম্বরের গড় করতে হবে।

এই পরীক্ষার মাধ্যমে মূল্যায়িত উত্তর পত্র অবশ্যই ছাত্র-ছাত্রীদের ১৫ দিনের মধ্যে দেখাতে হবে, যাতে তারা প্রশ্নোত্তরের ভুল-ত্রুটিগুলি বুঝতে পারে ও চূড়ান্ত পরীক্ষায় ত্রুটিমুক্ত উত্তরদানের মাধ্যমে শিক্ষার মান উন্নয়ন করতে পারে। কোর্স টিচার নির্ধারিত পাঠদানের বাইরে নির্দিষ্ট দিনে ছাত্র-ছাত্রীদের পাঠ সংক্রান্ত সমস্যাবলী সমাধানে সহায়তা প্রদান করবেন।

(সংশোধনী ক ও খ B.Sc/B.Pharm Honours Ordinance এর 6(a) ধারার অব্যবহিত পরে সংযোজিত হবে, এই সংশোধনী অনুযায়ী 6(d) এর Mark Distribution Tables হতে Class Assesment/Tutorial এর Credit বিলুপ্ত হবে।)

(উক্ত সিদ্ধান্ত গত ১৯/১২/২০১৫ তারিখে অনুষ্ঠিত শিক্ষা পরিষদের ২৩৯ তম সভার ৬৯ নং সিদ্ধান্তের সুপারিশক্রমে ২৬/১২/২০১৫ তারিখে অনুষ্ঠিত ৪৬৩ তম সিন্ডিকেট সভার ২ নং সিদ্ধান্তে অনুমোদনকৃত)।

গত ১৯/০৩/২০১৬ তারিখে অনুষ্ঠিত বিজ্ঞান অনুষদের ১৮১ তম অনুষদ সভার কার্যবিবরণীর উদ্ধৃতাংশ।

প্রস্তাব নং- ২৬ ঃ শারীরিক শিক্ষা ও ক্রীড়া বিজ্ঞান বিভাগকে বিজ্ঞান অনুষদভুক্ত অর্ডিন্যান্সে অন্তভূক্তির জন্য গত ০৯/০২/২০১৬ তারিখে অনুষ্ঠিত সভাপতিবৃন্দের সভায় গঠিত কমিটির নিম্নরূপ সিদ্ধান্ত বিবেচনা-

1. The Faculty of Science shall consist of the following Departments:

(a) Mathematics, (b) Chemistry, (c) Physics, (d) Statistics, (e) Biochemistry and Molecular Biology, (f) Pharmacy, (g) Population Science and Human Resource Development, (h) Applied Mathematics (i) Physical Education and Sports Science.

(বি.দ্র.- শারীরিক শিক্ষা ও ক্রীড়া বিজ্ঞান বিভাগ গত ২৪/০৮/২০১৫ তারিখে অনুষ্ঠিত শিক্ষা পরিষদের ২৩৮ তম সভার ৩০ নং সিদ্ধান্তের সুপারিশক্রমে গত ২৯/০৮/২০১৫ তারিখে অনুষ্ঠিত ৪৬১ তম সিন্ডিকেট সভার ৩ নং সিদ্ধান্তে অনুমোদনকৃত)।
সিদ্ধান্ত নং-২৬ ঃ প্রস্তাবটি বিবেচিত হলো এবং অনুমোদনের জন্য সুপারিশ করা হলো।

(উক্ত সিদ্ধান্ত গত ১৮/০৪/২০১৬ তারিখে অনুষ্ঠিত শিক্ষা পরিষদের ২৪০ তম সভার ২৭ নং সিদ্ধান্তের সুপারিশক্রমে ২১/০৪/২০১৬ তারিখে অনুষ্ঠিত ৪৬৫ তম সিন্ডিকেট সভার ৩ নং সিদ্ধান্তে অনুমোদনকৃত)

Curriculum for Undergraduate Program (Session 2020-2021)

Examinations: 2021 [1st year], 2022 [2nd year], 2023 [3rd year], 2024 [4th year]

The B. Sc. (Honours) programme in Biochemistry and Molecular Biology shall consist of total **4000 marks (40 units, 160 Credits).** There shall be theoretical, practical, viva voce, class assessment/ tutorial/ terminal/ home assignment, project/ in-plant training and related courses. The related courses shall have to be completed in the first and second year of the programme. In addition, a non-credit English language course for scientific/technical terminologies and their applications shall be offered in the first year of the programme.

B.Sc. (Hons.) 1st Year Examination, 2021

Honours Theory	: 450
Related Theory	: 250
Honours Practical	: 200
Honours Viva Voce	: 50
Total : 950	

Course	Title	Full marks	Unit	Credit
Honours Theory				
BMB – 101	Basic Biochemistry	100	1	4
BMB – 102	Bioorganic Chemistry	100	1	4
BMB – 103	Biophysical Chemistry	100	1	4
BMB – 104	Physiology-I	100	1	4
BMB –105	Introductory Microbiology	50	0.5	2
Related Theory				
BMB –Bot- /Zoo-106	Botany / Zoology	100	1	4
BMB- Biostat- 107	Basic Statistics	50	0.5	2
BMB–108	Computer Fundamentals	50	0.5	2
BMB–109	Computer practical	50	0.5	2

Non-Credit Course				
BMB – Eng-110	English (noncredit)	100	1.0	0
Honours Practical and Viva Voce				
BMB –111	Laboratory work [Practical + class assessment] (140 + 60)	200	2.0	8
BMB –112	Viva-voce	50	0.5	2
	Total =	**950**	**9.5**	**38**

Course Code	**: BMB-101**		
Course Title	**: Basic Biochemistry**		
Course Type	**: Core**		
Year/Semester	**: 1st Year**		
Course Teacher	**: Professor Dr. Md. Rezaul Karim-2** **Professor Dr. Md. Masudul Hasan Khan**		
Credit Value:	**: 4**	**Credit hours/week: 4**	**Total credit hours: 60 (minimum)**
Total Marks	**: 100 (Final Exam: 80 and In-course: 20)**		

Course Description:

Biochemistry seeks to explain life in chemical terms and it covers the chemistry of the molecules and macromolecules in the living system. The Basic Biochemistry course is designed to study molecules and macromolecules in living systems through an application of the principles of organic and physical chemistry as well as molecular biology and genetics. This course covers the topics including the structure and functional relationship of biological molecules, including proteins, carbohydrates, lipids, nucleic acids and vitamins.

Course objective:

The overall goals of this course are to:

- provide the students a fundamental understanding of the biochemical mechanisms of cell function and to benefit the student's future endeavors within all areas of the life sciences and in their day-to-day personal lives as well
- project a clear and repeated emphasis on major themes, especially those relating between structure and function
- discover the manner in which macromolecules, such as proteins, interact with other biomolecules to form distinct structural and functional components of a cell
- sustain the student's interest by taking every opportunity to point out connections between processes; identifying gaps in our knowledge

Course Learning Outcomes (CLOs):

CLO No.	Expected Course Outcomes Upon completion of this course, the students will be able to:
CLO1	demonstrate an understanding of fundamental biochemical principles, such as the structure/function of biomolecules and relate them to other branch of science
CLO2	describe the major types of biochemical molecules including small, large and supermolecular components found in cells
CLO3	recognize different types of biomolecules and explain their essential chemical characteristics that make them indispensible for life
CLO4	distinguish DNA and RNA and elaborate how these molecules play different roles in the storage and decoding of the hereditary information and cell function

Course Plan:

Module	Course contents	Credit hrs	CLOs
1	**Biochemistry:** Introduction, scopes and prospects, historical development, relationship of biochemistry with biology, chemistry, medicine, agriculture, industry, and diseases.	4	1
2	**Life and living processes:** Concept and identifying characteristics of living matters.	3	1
3	**Carbohydrates:** Occurrence, nomenclature, biological importance, chemical characteristics, and classification of carbohydrates. **(i) Monosaccharides and disaccharides:** Structure, optical and chemical properties, characteristic tests, amino-sugars and glycosides. **(ii) Polysaccharides:** Occurrence, composition, structures and properties of starch, glycogen, cellulose, other polysaccharides of biological interest, their chemical tests and biological importance, analysis of carbohydrates.	12	2
4	**Lipids:** Nomenclature, classification, general reaction of fat and fatty acids and sterol, structure and biological functions of different classes of lipids, hydrolysis of lipids, fats and oils, animal fat, vegetable oils, phospholipids and non-phosphorylated lipids, isolation of cholesterol and phospholipids from natural sources.	10	2
5	**Amino acids, peptides and proteins:** **(i) Amino acids and Peptides:** Definition, source, classification, structural features, physicochemical properties of amino acids and peptides, essential and non-essential amino acids, peptide bonds,	14	2

	oligopeptides and polypeptides, identification of N-terminal and C-terminal residues of peptide, and synthesis of peptides. **(ii) Proteins:** Introduction, physicochemical properties, classification and biological function, primary, secondary, tertiary and quaternary structure of proteins, protein domain and subunit. **(iii) Fibrous protein:** Secondary structure of proteins, protein conformation, alpha-keratins, planar peptide bonds, alpha-helix, helix forming and destabilizing amino acids, the insolubility of alpha-keratins, beta-keratins, conformation and structure, structure of collagen and elastin, filamentous proteins, actin, myosin and microtubules. **(iv) Globular Proteins:** Tertiary structure of globular proteins, distinctive tertiary structure of myoglobin and haemoglobin.		
6	**Nucleic acid:** General structure of nucleosides and nucleotides, chemistry, types and function of nucleic acids, base pair rule, double helical structure of DNA.	8	3,4
7	**Vitamins:** Definition, classification, chemistry, sources, biological functions, daily requirements.	9	2,3

Teaching-Learning approach	**Assessment strategy**	**Reinforcement assignment/Tasks**
Lecture followed by discussion Participatory question-answer Text books Lecture notes Online resources Video documentation	Class assessment Assignment quiz presentation written exam Attendance	Feedback Individual discussion Counseling

Learning References:

1. Lehninger Principles of Biochemistry by David L. Nelson Michad M. Cox.
2. Harper's Biochemistry by R. K. Murray, D. K. Granner; P. A. Mayes, V. W. Rodwell.
3. Text Book of Biochemistry by E. S. West, W. R. Todd, H. S. Mason, J. T. Van Bruggen.
4. Fundamentals of Biochemistry by Dr. A. C. Deb.
5. Human Physiology Vol. 1 and Vol. 2 by C. C. Chatterjee.

Course Code	**: BMB-102**		
Course Title	**: Bioorganic Chemistry**		
Course Type	**: Core**		
Year/Semester	**: 1st Year**		
Course Teacher	**: Professor Dr. Niranjan Kumar Sana** **Dr. Md. Abdul Aziz**		
Credit Value:	**: 4**	**Credit hours/week: 4**	**Total credit hours: 60 (minimum)**
Total Marks	**: 100 (Final Exam: 80 and In-course: 20)**		

Course Description:

Studying organic chemistry is very much important to understand biology and medicine. This course offers the students an opportunity to learn the role of carbon in organic compounds. The course contents have emphasized on IUPAC nomenclature for organic molecules, the properties of aliphatic and aromatic compounds with a variety of functional groups, conceptual methods of synthesizing different organic compounds, their reaction mechanism and applications.

Course Objective:

The overall goals of this course are to:

- disseminate the basic knowledge on organic compounds specifically their structure, isomerism, different types of reactions, and their mechanisms and applications
- apply this knowledge to understand the biochemical reaction mechanisms in plants and animals
- provide the knowledge about stereochemistry of organic compounds and its application in biochemistry

Course Learning Outcomes (CLOs):

CLO No.	Expected Course Outcomes Upon completion of this course, the students will be able to:
CLO1	explain the molecular structure of organic compounds, identify electrophiles, nucleophiles, carbanions, carbonium ions and apply their mechanisms in carrying out various organic reactions
CLO2	recognize, classify, explain, and apply fundamental organic reactions such as SN_2, SN_1, E_2, E_1, alkene addition, electrophilic aromatic substitution, ring-opening, oxidation-reduction and radical halogenations reaction with their mechanism
CLO3	distinguish aliphatic and aromatic (both benzene and its derivatives and heterocyclic) compounds, recognize their occurrence, structure, nomenclature, properties and applications. Moreover students will be able to gather a clear concept about stereo isomers of organic compounds

Course Plan:

Module	Course contents	Credit hrs	CLOs
1	**Organic Reactions and their Mechanism:** The classical structural theory, electron displacement effects, bond fission, attacking reagents and their role, electrophiles, neucleophiles, carbonium ion, carbanions, types of reaction mechanism, substitution reactions (S_N2 and S_N1), elimination reactions (E_1 and E_2).	8	1,2
2	**Stereochemistry:** Definition, classification of isomerism, asymmetric carbon atom, asymmetric and dissymmetric molecules, chirality, criterion of enantiomerism, Fischer projections, absolute and relative configuration, R and S system, optical isomerism in compound with more than one asymmetric carbon atom, isomerism of tartaric acid, racemization, asymmetric synthesis, Walden inversion.	8	3
3	**Alcohols:** Occurrence, structure, nomenclature, isomerism, synthesis, physical and chemical properties (reactions involving -OH, -CO-, -COOH and α-carbon), testes of monohydric alcohols.	8	3
4	**Carboxylic acids:** Occurrence, structure, nomenclature, isomerism, synthesis, acidity, physical and chemical properties (reactions involving O-H bond, unshared electrons of oxygen and rupture of C-O bond) of monocarboxylic acids.	6	3
5	**Amines:** Nomenclature, structure, synthesis, isomerism, methods of preparation of primary, secondary and tertiary amines, separation, physical and chemical properties.	8	3
6	**Benzene**: Aromaticity, structure, nomenclature, general synthesis, physical and chemical properties and uses.	7	3
7	**Heterocyclic compounds:** Definition, nomenclature, preparation, properties and uses of furans, thiophene, pyrrole, pyridine, pyrimidine and quinoline.	7	3
8	**Reaction mechanisms and their applications:** Reaction mechanism of electrophilic and nucleophilic substitution reactions in aromatic ring, Aldol condensation, Wolf-Kishner reduction, Fridel-Crafts alkylation and acylation reaction,	8	1,2

	Clemenson reaction, Reimer-Tiemann reactions, Grignard reaction.		

Teaching-Learning approach	Assessment strategy	Reinforcement assignment/Tasks
Lecture followed by discussion Participatory question-answer Text books Lecture notes Online resources Video documentation	Class assessment Assignment quiz presentation written exam Attendance	Feedback Individual discussion Counseling

Learning References:

1. Organic Chemistry by Gillman.
2. Organic Chemistry byFieser&Fieser.
3. Organic Chemistry by Morrison & Boyd.
4. Advanced Organic Chemistry by B.S. Bahl&ArunBahl.

Course Code	**: BMB-103**		
Course Title	**: Biophysical Chemistry**		
Course Type	**: Core**		
Year/Semester	**: 1st Year**		
Course Teacher	**: Professor Dr. Md. Belal Uddin** **Dr. Md. Shahriar Shovon**		
Credit Value:	**: 4**	**Credit hours/week: 4**	**Total credit hours: 60 (minimum)**
Total Marks	**: 100 (Final Exam: 80 and In-course: 20)**		

Course description:

Biophysical chemistry is a physical science that uses the concepts of physics and chemistry for the study of biological systems. This course provides a rigorous introduction to the theory underlying widely used biophysical methods, which will be illustrated by practical applications to contemporary biochemical research problems. The goal of the biophysical chemist is to explain physical phenomena taking place in biological systems. The first goal is to explicate the fundamental approaches used by physical chemists to understand the behavior of molecules and to develop related analytical tools. The second goal is to prepare students to apply these methods themselves to their own research projects. Biophysical chemistry is a highly interdisciplinary field between Biochemistry, Physical Chemistry, Biophysics and Physics and examines biological process *in vitro* and *in vivo*.

Course objective:

The overall goals of this course are to:

- aware the students of the importance and applications of Physical Chemistry in biological systems
- familiarize the students with modern advancements in Biophysical Chemistry
- train the students to become familiar with advanced sciences and practical work
- develop skills in students in the field of different area of physical chemistry

Course Learning Outcomes (CLOs):

CLO No.	Expected Course Outcomes Upon completion of this course, the students will be able to:
CLO1	describe the fundamentals of Inorganic and Biophysical Chemistry
CLO2	interpret various principles of physical chemistry in biological systems
CLO3	solve problems related to the industry, medicine, diagnosis, and research

Course Plan:

Module	Course contents	Credit hrs	CLOs
1	**Atomic Structure:** Fundamental particles, atomic models (wave mechanical approaches). Compton's effects, photoelectric effect, wave nature of electrons (Devison and Germer's experiment, Thomson's and Reid's experiment, de-Broglie's equation, Schrodinger wave equation, Plank's quantum theory), Heisenberg uncertainty principle, Pauli's exclusion principle, electronic configuration, modern periodic table (ionization potential, electron affinity and electronegativity). **Chemical bonding**: Development of electronic theory of valancy, hydrogen bond, hydrophobic interaction, Vader Waals weak forces, coordination complexes, Worner's coordination theory, Sigdwick's electronic theory for complexes, hybridization of atomic orbitals, VSEPR theory and its application.	10	1

2	**Thermodynamics:** Definition, basic concepts (system, surrounding, state, state function, enthalpy, entropy, molar heat capacity, work function, free energy etc), laws of thermodynamics (first and second laws). Change of entropy in various process, variation of free energy with temperature and pressure Gibbs-Helmholtz equation, Clapeyron-Clausius equation, application of thermodynamic in Biochemistry, biochemical relevance of classical thermodynamics, open system, high energy compound.	6	1,2,3
3	**Solution of nonelectrolytes:** Concentration units, chemical potential, Henry's law, ideal and non-ideal solution, activity and activity coefficient, osmotic pressure, semi-permeable membrane theory.	6	1,2,3
4	**Phase rule:** Definition of phase, components and degree of freedom/variants, phase rules and its application, phase diagram of water, relation between triple points and sublimation, KI systems, theory of freezing mixture, phenol-water system, theory of fractional and azeotropic distillation.	6	1,2
5	**Colloid:** Definition, classification, preparation, purification and properties of colloids, origin of colloidal charge, protection of colloids, gel, suspension, emulsion, use of colloids.	6	1,2,3
6	**Acids, Bases and Buffers:** Bronsted-Lowry concept, Lewis concept, strength of acids, pH of solutions, buffer solution, Henderson-Hasselbalch equation, acid- base indicators, acid base titrations, theories of indicators. **Salt Hydrolysis:** Definition, Bronsted-Lowry concept of hydrolysis, types of hydrolysis, quantitative aspect of hydrolysis, determination of degree of hydrolysis, solubility product and common ion effect on ionization.	8	1,2,3
7	**Adsorption:** Definition, adsorbate, adsorbent, causes of adsorption, types of adsorption, classical adsorption isotherms (Frieundlisch's and Langmuir's), applications, adsorption of solid from liquid.	5	1,2
8	**Distribution law:** Introduction, Nernst distribution law, solubility and distribution law, distribution law and molecular state.	3	1,2

9	**Photochemistry:** Introduction, adsorption of radiation by matter, sources of photochemical reactions, measurements of intensity of radiation, luminescence, chemiluminescence's, fluorescence, Grothus-Draper law and Einstein-Stark law, Beer-Lambert laws and its application.	5	1,2,3
10	**Radiochemistry:** Discovery of radioactivity, isotopes, isobars, isotones, properties of alpha, beta and gamma rays, units of radiation, law of radioactive disintegration, group displacement, half-life calculation, specific activity, radio-labeling, detection of radioactivity, autoradiography, separation of radioisotopes, nuclear transmutation, artificial radioactivity, nuclear reactions, nuclear binding energy, nuclear forces, nuclear fission and fusion, uses of radioisotopes.	5	1,2,3

Teaching-Learning approach	**Assessment strategy**	**Reinforcement assignment/Tasks**
Lecture followed by discussion, Participatory question-answer, Text books, Lecture notes Online resources Video documentation	Class assessment Assignment quiz presentation written exam Attendance	Feedback Individual discussion Counseling

Books recommended:

1. Modern Inorganic Chemistry, R.D. MADAN.
2. Modern Inorganic Chemistry, S.Z. HAIDER.
3. স্নাতক অজৈব রসায়ন, সায়েন উদ্দিন আহমেদ ও লতিফ হোসেন
4. Advanced Inorganic Chemistry, G.D. TULI, SK BASU and R.D. MADAN
5. স্নাতক অজৈব রসায়ন, নূরুল হক ও মহির উদ্দিন
6. Physical Chemistry, N. KUNDU and S.K. JAIN
7. A text book of physical chemistry, K.K. SHARMA and L.K. SHARMA.
8. Essential of physical chemistry, B.S. BAHL and G.D. TULI.
9. Physical chemistry, V.M. KHANNA, M.M. KAPUR, and V.P. SHARMA
10. স্নাতক ভৌতরসায়ন, পাল ও চক্রবতী
11. স্নাতক ভৌতরসায়ন পরিচিতি, নূরুল হক ও মহির উদ্দিন।

Course Code	**: BMB-104**		
Course Title	**: Physiology-I**		
Course Type	**: Core**		
Year/Semester	**: 1st Year**		
Course Teacher	**: Professor Dr. Farzana Pervin** **Md. Nurujjaman**		
Credit Value:	**: 4**	**Credit hours/week: 4**	**Total credit hours: 60 (minimum)**
Total Marks	**: 100 (Final Exam: 80 and In-course: 20)**		

Course description:

Physiology deals with the normal functions of living organisms as well as their parts and mechanisms which work within a living system. As a branch of biology, the focus of physiology is on how organisms, organ systems, organs, cells, and biomolecules carry out the chemical and physical functions that exist in human body. The contents are designed to adequate exposure in all areas of human physiology as well as take relevant courses in human anatomy, medical biochemistry and pharmacology.

Course objectives

The overall goals of this course are to:

- familiarize students with structure and function of digestive, respiratory, excretory, muscular systems
- provide understanding to explore the integration and interrelationships between these bodily systems
- provide an understanding of human physiology to realistic scenarios, case problems, and pathologic conditions altering normal physiology of human body

Course Learning Outcomes (CLOs):

CLO No.	Expected Course Outcomes Upon completion of this course, the students will be able to:
CLO1	describe the relationship between structure and function at the cellular level, and relate dysfunctional states of health to problems at the cellular level when appropriate
CLO2	provide relevant physiological information and also explain the physiological mechanisms involved
CLO3	explain the concepts of homeostasis and feedback control in relationship to each organ system

Course Plan:

Module	Course contents	Credit hrs	CLOs
1	**Cell:** Structure and function of sub-cellular organelles (Cell membrane, endoplasmic reticulum, mitochondria, golgi body and nucleus).	9	1
2	**Blood:** Composition of blood and its functions (blood corpuscles and plasma protein etc.), blood cells and plasma, total count (TC), differential count (DC), coagulation, blood grouping (types) and cross matching, blood diseases (anemia, leukemia, thalassemia etc).	10	1,2
3	**Digestive system:** Anatomy and function of digestive system, digestive glands, digestive enzymes, mechanism of secretion of gastric acid, physiology of digestion and absorption of foods. Diseases of the gastro-intestinal tract (diarrhoea, enteritis, peptic ulcer, gastric ulcer and deudenum ulcer, constipation).	10	1,2
4	**Respiratory system:** Anatomy of the respiratory tract and lungs, physiology of respiration, lungs volume and lungs capacity, carries of oxygen and carbon dioxide, chloride shift, mechanism of breathing and common respiratory diseases (bronchitis, asthma, common cold, tuberculosis).	10	2,3
5	**Excretory system:** Kidney - Structure and function of nephron, glomerular filtration rate, selective reabsorption and secretion, endocrine function of the kidney, the role of kidney - water, electrolyte and acid base balance of the body.	8	2,3
6	**Muscular system:** Classification, structure and function of muscle, muscle protein and mechanism of muscle contraction.	7	1,2,3
7	**Endocrine system**: Endocrine glands and their hormones (definition, classification, chemistry, major functions), role of hypothalamus in the secretion of hormone.	6	1,3

Teaching-Learning approach	Assessment strategy	Reinforcement assignment/Tasks
Lecture followed by discussion Participatory question-answer	Class assessment Assignment	Feedback Individual discussion

Text books Lecture notes Online resources Video documentation	quiz presentation written exam Attendance	Counseling

Learning References:

1. Review of Medical Physiology, W. F. Ganong
2. Human Physiology, C. C. Chaterjee
3. A Text Book of Medical Physiology. Gyton
4. Human Physiology, Chakrabarti, Ghos and Sahana

Course Code	**: BMB-105**		
Course Title	**: Introductory Microbiology**		
Course Type	**: Core**		
Year/Semester	**: 1st Year**		
Course Teacher	**: Professor Dr. Tanzima Yeasmin** **Professor Dr. Md. Salim Uddin**		
Credit Value:	**: 2**	**Credit hours/week: 2**	**Total credit hours: 30 (minimum)**
Total Marks	**: 50 (Final Exam: 40 and In-course: 10)**		

Course description:

Microbiology course involves the study of microorganisms with particular emphasis on the biology of bacteria, viruses and fungi. It introduces the basic principles of microbiology examining the microbes that inhabit our planet and their effect on the biosphere and the impact of these organisms on human and the environment. Topics include the various groups of microorganisms, their structure, general principles for growth, evolution and classification, description of microbiological life forms, physiology, genetics, microbial pathogenicity, and uses of microorganisms, and microorganisms in disease. Descriptions of different prokaryotic, eukaryotic and other life forms are included with the principle to be utilized. Microscopy with basic microbiological techniques i.e aseptic technique, staining, culture methods are to be applied in the laboratory for identification of unknown bacteria.

Course objective:

The overall goals of this course are to:

- familiarize the students with the apparatus and equipment used with a wide variety of microbiological laboratory techniques
- provide knowledge and skill on the basic principles and handling of various microscopes

- enable students to identify challenging societal problems and to make plan career to develop innovative solutions for such problems
- enable to identify major microbial interactions and illustrate how these interactions affect the well-being of plants and animals
- enable to recognize the importance and use of microorganisms in the food industry, biotechnology, industrial processes, and the development of medical treatments

Course Learning Outcomes **(CLOs):**

CLO No.	**Expected Course Outcomes** Upon completion of this course, the students will be able to:
CLO1	apply the microbiology concepts in different practical fields such as medical, industrial, environment, genetics, agriculture, etc.
CLO2	explain the impact of microbiology on 21st century challenges and exploit the opportunities aroused from our understanding of microbes
CLO3	impart basic principles of bacteriology, the nature of pathogenesis, laboratory diagnosis, transmission, prevention and control of diseases common in the country

Course Plan:

Module	**Course contents**	**Credit hrs**	**CLOs**
1	**Introduction to microbiology:** Definition, scope and history of microbiology, characteristics, brief introduction to bacteria, fungi and virus, microbial classification and identification, general features of prokaryotic and eukaryotic cells.	4	1
2	**Origin of life:** Spontaneous generation and chemical evolution	3	3
3	**Microscope and Microscopy:** Light microscope and electron microscope; bright-field, dark-field, phase-contrast, fluorescent, and electron microscopy.	4	1
4	**Bacteria:** Morphology, classification, staining, taxonomy, bacterial genetics, vitamin D, testosterone and aldosterone.	6	1, 2, 3
5	**Growth and reproduction of bacteria**: Nutritional requirement, cultivation of bacteria, different types of media, culture methods, pure colony isolation, identification of bacteria, measurement of bacterial growth, growth curve, reproductive process of bacteria.	6	1, 2, 3
6	**Role and Economic importance of bacteria:** In brewing (production of alcohol, wine and beer) and milk products (cheese and yogurt).	4	1

7	**Application of bacteria in agriculture and industry**: (food and beverage, pharmaceutical, petroleum and mining, textile etc.).	3	1, 2

Teaching-Learning approach	**Assessment strategy**	**Reinforcement assignment/Tasks**
Lecture followed by discussion Participatory question-answer Text books Lecture notes Online resources Video documentation	Class assessment Assignment quiz presentation written exam Attendance	Feedback Individual discussion Counseling

Learning References:

1. Microbiology-Application and Concept- Pelczar, Chan and Crieg
2. Microbiology- Pelczar, Chan and Crieg
3. Microbiology – Prescott, Haley and Klein
4. General Microbiology - Stainer
5. Fundamentals of Microbiology - Frobisher
6. Prescott and Dunn's Industrial Microbiology

Course Code	**: BMB-106**		
Course Title	**: Botany**		
Course Type	**: Related**		
Year/Semester	**: 1st Year**		
Course Teacher	**: Saika Kabir Nitu** **Md. Mamunur Rashid Sarkar**		
Credit Value:	**: 4**	**Credit hours/week: 4**	**Total credit hours: 60 (minimum)**
Total Marks	**: 100 (Final Exam: 80 and In-course: 20)**		

Course Description:

This course introduces kingdom systems of living organisms, various groups of microorganisms including their morphology, physical and chemical structure, reproduction, classification and importance. It also includes the study of the prokaryotic and eukaryotic forms of algae growing in terrestrial and aquatic habitats. This course deals with the habit and habitat, structure, reproduction and function of Bryophytes and Pteridophytes. Student will know about the gamete formation, pollination, fertilization and embryogenesis, systematic of diseases and pathogens, host-pathogen interactions, pathogenesis and disease management.

Course Objectives:

The overall goals of this course are to:

- provide knowledge about various plant groups from primitive to highly evolve
- provide knowledge on plant and on natural phenomenon, manipulation of nature and

micro environment in the benefit of human being

- develop skill in practical work, experiments along with collection and interpretation of biological materials and data
- familiarize scientific terms, concepts, facts, phenomenon and their relationship
- make the students aware about conservation and sustainable use of plants

Course Learning Outcomes (CLOs):

CLO No.	Expected Course Outcomes Upon completion of this course, the students will be able to:
CLO1	describe microorganisms and their role in society and provide basic idea on the significance and potentiality of algae
CLO2	identify the external morphology, internal structure and reproductiuon of different types of Bryophytes and Pteridophytes and analyze the methods and principles of classification and nomenclature
CLO3	distinguish microsporangium, megasporangium, embryo and fertilization process
CLO4	identify the different symptoms and causal agents of plant diseases and apply the knowledge to control diseases

Course Plan:

Module	Course contents	Credit hrs	CLOs
1	Concept of living world and nonliving environment, plant world, origin and distribution of plants in association with animals.	5	1
2	Classification of plant kingdom, different major taxa of plants, flowering and non -flowering plants, vascular and non-vascular plants, embryo bearing plants.	5	3
3	Lower groups, taxons included in lower groups, classification range of structure and modes of reproduction in the major taxa.	5	3
4	Life histories of typical members of each major taxa: (a) Algae: Volvox, Ulothrix, Chleochaete, (b) Fungi: lower and higher penicillium, and Agaricus (c) Bacteria: A feneralaccunt. (d) Bryophytes: Riccia and Moss. (e) Pteridophyte: Equisetum and a fern. (f) Virus. (g) Myxomycetes. (h) Actinomycetes.	19	1,2

5	Role of lower plants in maintaining the environment and their economic importance, plant diseases caused by fungi, one important disease each of rice, jute, sugarcane and potato.	6	4
6	Higher Plants: angiosperms and gymnosperms, diversity in angiosperms, reproduction and embryology, gametophyte formation and fertilization.	6	3
7	Classification of angiosperms, systems of classification, Benthem and Hookers system, Engler and Prentil system, study of the following families: Nymphaeose, Cruciferae, Leguminosae, Solanaceae, Labiates, Apocynaceae, Malvaceae, Compositae, Palmae and Graminae	14	3

Teaching-Learning approach	**Assessment strategy**	**Reinforcement assignment/Tasks**
Lecture followed by discussion Participatory question-answer Text books Lecture notes Online resources Video documentation	Class assessment Assignment quiz presentation written exam Attendance	Feedback Individual discussion Counseling

Learning References:

1. Alexopoulos, C.J., Mims,C.W. and Blackwell, M. 2007. Introductory Mycology (4th Edition). Wiley India Pvt. Ltd.
2. Bhattacharya, K., Majumdar, M.R. and Bhattacharya,S.G. 2011. A Textbook of Palynology. New Central Book Agency, India.
3. Bhojwani, S.S. and BhatnagarS.P. 2014. The Embryology of Angiosperms. Vikas Publication House Pvt. Ltd. New Delhi.
4. Davis, P.H. and Heywood, V.H. 1963. Principles of Angiosperm Taxonomy. Oliver and Boyd Ltd, Edinburgh, London.
5. Dube, H.C. 1990. An Introduction to Fungi (2nd Edition). Vikas Publishing House Pvt. Ltd., New Delhi-110014, India.
6. Lawrence, G.H.M. 1951. Taxonomy of Vascular Plants. The Macmillan Co. New York.
7. Lee, R.E. 2008. Phycology.
8. Pelczer, M.J.; Chan, E.C.S and Krieg, N. R- Microbiology.
9. Principles of Plant Pathology-R. S. Singh.
10. Rangaswami, G. and Mahadevan, A. 2014. Discases of Crop Plants in India (4th Edition). PHI Learning Private Limited, Delhi-110092, India.
11. Sivaranjan, V.V. and Robson, N.K.P. 1991. Introduction to the Principles of Plant Taxonomy (2nded.). Oxford & IBH Publishing Co. Pvt. Ltd. Calcutta, New Delhi.
12. Vashishta, BR. 1990. Botany for Degree Students: Part III: Bryophytes. S. Chand & Com. Ltd. New Delhi.
13. Vashishta, BR. 2005. Botany for Degree Students: Pteridophytes. S. Chand and Com. Ltd. New Delhi.

Course Code	**: BMB-107**		
Course Title	**: Basic Statistics**		
Course Type	**: Related**		
Year/Semester	**: 1st Year**		
Course Teacher	: **Professor Dr. Md. Monimul Huq**		
Credit Value:	**: 2**	**Credit hours/week: 2**	**Total credit hours: 30 (minimum)**
Total Marks	**: 50 (Final Exam: 40 and In-course: 10)**		

Course Description:

This is a very basic and introductory course of Statistics. Stress has been laid on concepts, data processing, exploratory data analysis, statistical tools and techniques of analyzing data. Well-known probability distributions are also provided in this course.

Course objectives:

The overall goals of this course are to:

- familiarize the students with data, nature of data, how to process and condense the data and to apply appropriate statistical tools and techniques to analyze the data
- provide ideas of probability and learn commonly used probability distributions
- describe the features of various correlations and simple regression; and to perform the statistical tests accurately

Course Learning Outcomes **(CLOs):**

CLO No.	**Expected Course Outcomes** Upon completion of this course, the students will be able to:
CLO1	organize and condense the data and present these data in suitable manner
CLO2	use Venn-diagrams to represent the results of set operations; understand the concept of random variables and apply selected probability distributions to solve the problems
CLO3	solve problems related to the correlations and regression and interpret about the results; draw valid conclusions about hypotheses from the results of different statistical tests

Course Plan:

Module	Course contents	Credit hrs	CLOs
1	**Statistics:** Meaning and scope, variables and attributes, collection and presentation of statistical data, frequency distribution and graphical representation.	3	1
2	**Analysis of Statistical Data:** Location, dispersion and their measures, Skewness, Kurtosis and their measures, Moments and Cumulants.	7	1
3	**Probability:** Concept of probability, sample space, events, union and intersection of events, probability of events, laws of probability, conditional probabilities, Bose-Einstein statistics, Baye's Theorem, Chebyshev's inequality.	3	2
4	**Random Variables and Probability Distributions:** Basic concepts, discrete and continuous random variables, density and distribution functions, mathematical expectation and variance, joint, marginal and conditional density functions, conditional expectation and conditional variance, moment and cumulant generating functions, characteristic function, study of binomial, poisson, normal and bivariate normal distributions.	6	2
5	**Bivariate Distribution:** Bivariate data, Scatter diagram, marginal and conditional distributions, correlation, rank correlation, partial and multiple correlations, contingency analysis.	4	3
6	**Linear Regression:** Linear Regression for two variables, principles of least squares method, lines of best fit, residual analysis.	3	3
7	**Test of Significance:** Basic idea of null hypothesis, alternative hypothesis, type-I error type-II errors, level of significance, degree of freedom, rejection region and acceptance region, test of single mean, single variance, two sample means and variances, test for 2×2 contingency tables and independence test.	4	3

Teaching-Learning approach	Assessment strategy	Reinforcement assignment/Tasks
Lecture followed by discussion Participatory question-answer Text books Lecture notes Online resources Video documentation	Class assessment Assignment quiz presentation written exam Attendance	Feedback Individual discussion Counseling

Learning References:

1. Anderson, A.J.B (1989): Interpreting Data, Chapman and Hall, London.
2. Cramer, H. (1955): The Elements of Probability Theory, Wiley, N.Y.
3. Gupta, S.C. and Kapoor, V.K.(2001): Fundamentals of Applied Statistics, 3rd ed., Sultan Chand and Sons, New Delhi, India.
4. Hoel, P.G. (1993): Introductory Statistics, Wiley, N.Y.
5. Lipschutz, S. (1987): Probability, McGraw-Hill, N.Y.
6. Mosteller, F., Rourke and Thomas (1970): Probability with Statistical Applications, 2nd ed., Addison-Wesley, N. Y.
7. Ross, S.M. (2002): Introduction to Probability Models. 3rd ed., Academic Press, N.Y.
8. Yule, G. U. and Kendall, M. G. (1994): An Introduction to the Theory of Statistics, 14th ed., Charles Griffin, London.

Course Code	**: BMB-108**		
Course Title	**: Computer Fundamentals**		
Course Type	**: Related**		
Year/Semester	**: 1st Year**		
Course Teacher	**: Dr. A. K. M. Asaduzzaman** **Dr. Md. Rowshanul Habib**		
Credit Value:	**: 2**	**Credit hours/week: 2**	**Total credit hours: 30 (minimum)**
Total Marks	**: 50 (Final Exam: 40 and In-course: 10)**		

Course Description

In this introductory course, students will become familiar with concepts of computer basics including hardware and peripherals, software, data processing and networking. Students will gain knowledge on history and development of computers, impact of computers on society, basic units of computer hardware and peripherals, data organization and processing, software and basic concepts of computer networks. The overall aim of this course is to provide basic competencies for application of a computer to everyday tasks.

Course objective

The overall goals of this course are to:

- introduce the fundamentals of computer, particularly with respect to personal use of computer hardware and software along with data processing
- provide knowledge on the basic concepts of computer networks and its goals as well as internet system and its services
- give students an understanding of why computers are essential components in business, education and society

Course Learning Outcomes **(CLOs):**

CLO No.	**Expected Course Outcomes** Upon completion of this course, the students will be able to:
CLO1	identify the fundamental hardware and peripherals components required in a computer system and describe the usage of computers in business and society
CLO2	explain the role of software in data processing thereby using the computer for personal and professional purpose
CLO3	apply various types of networks, network standards, internet system to communicate with the global society

Course Plan:

Module	**Course contents**	**Credit hrs**	**CLOs**
1	**Computer Basic:** Introduction to studying computer, history and development of computers, computer generations, types of computers, impact of computers on society.	4	1
2	**Computers Hardware and Peripherals:** Basic units of computer hardware, processing devices, input devices (like keyboard, mouse, scanner etc), output devices (like monitor, speaker printer etc), different types of monitors, power supply, different parts of system unit, internal structure of CPU, memory devices and functions of RAM, ROM and cache memory, storage devices, basic function mechanism of FDD, HDD and CD-ROM.	7	1
3	**Information and Data processing:** Data organization, types of data processing, data processing cycle, data processing	4	2

	system, database concepts, database management system, working with database, querying a database.		
4	**Software:** Classification of software, system software, operating system concepts and importance, types of operating system, components and basic function of disk operating system (DOS), Windows/Windows-NT/Windows-XP, working with application software, graphics software, multimedia systems, network operating system, enhancing an operating system with utility.	8	2
5	**Networking:** Basic concepts of computer networks and its goals, network structure, concept on LANs, WANs, MANs, CANs and HANs, network topologies and protocols, data communication with telephone lines and modems, digital data connection, the Internet's history, internet system and its services, E-mail, E-commerce, World Wide Web (WWW), searching the web, search engine.	7	3

Teaching-Learning approach	**Assessment strategy**	**Reinforcement assignment/Tasks**
Lecture followed by discussion Participatory question-answer Text books Lecture notes Online resources Video documentation	Class assessment Assignment quiz presentation written exam Attendance	Feedback Individual discussion Counseling

Learning References:

1. Introduction to Computers by Peter Norton

Course Code	**: BMB-109**		
Course Title	**: Computer Practical**		
Course Type	**: Related (Practical)**		
Year/Semester	**: 1st Year**		
Course Teacher	**: Dr. A. K. M. Asaduzzaman** **Dr. Md. Rowshanul Habib**		
Credit Value:	**: 2**	**Credit hours/week: 2**	**Total credit hours: 30 (minimum)**
Total Marks	**: 50 (Final Exam: 40 and In-course: 10)**		

Course description:

This introductory practical course will provide students with the opportunity to handle computer operating systems. It familiarizes the students with computer application programs like Microsoft Word, Excel and PowerPoint to create text documents, spreadsheets and

presentations. Students will also be experienced to use Internet, SPSS (Statistical Package for the Social Sciences), Probit analysis and Chem-draw softwares throughout this course. A course such as this can be taken as a beginning part to ensure that students can use computers.

Course objective:
The overall goals of this course are to:

- acquaint students with knowledge of the computer operating systems with emphasis on their uses and limitation
- develop the skill of using some basic programs like MS-Word, MS-Excel and MS-power point among the students
- build an understanding of using computers to perform some tasks related to biological field

Course Learning Outcomes (CLOs):

CLO No.	Expected Course Outcomes Upon completion of this course, the students will be able to:
CLO1	use computers at user level, including operative systems and programming environments
CLO2	demonstrate the application of computer hardware and software
CLO3	apply different application softwares (SPSS, Probit analysis and Chem-draw) to analyze biological data

Course Plan:

Module	Course contents	No. of classes (1 class = 2 credit hrs)	CLOs
1	Introduction to operating system (Windows Xp, Windows 7, 8 and 10).	2	1,2
2	Introduction to word processing (MS-Word), spreadsheet (MS-Excel) and presentation (MS-power point) programs.	3	1,2
3	Graphical works using MS-Excel	3	1,2

4	Statistical (Calculation of standard deviation, standard error of mean and P-value) and probit analysis by SPSS-software.	3	1,2,3
5	Application of Chem-draw software.	2	1,2,3
6	Searching the Bibliographies over internet.	2	1,2

Teaching-Learning approach	**Assessment strategy**	**Reinforcement assignment/Tasks**
Lecture followed by discussion Participatory question-answer Text books Lecture notes Online resources Video documentation	Class assessment Assignment quiz presentation written exam Attendance	Feedback Individual discussion Counseling

Learning References:

1. Practical Book of Computer Applications by ShubiLall
2. Microsoft office training guide (version 2007, 2010, 2013) by MahbuburRahman
3. IBM SPSS statistics by *M*. FarukImam

Course Code	**: BMB-Eng-110**		
Course Title	**: English-noncredit**		
Course Type	**: Non-credit**		
Year/Semester	**: 1st Year**		
Course Teacher	**: Professor Dr. Md. Shahidul Haque** **Dr. Md. Farhad Hossain**		
Credit Value:	**: 4**	**Credit hours/week: 4**	**Total credit hours: 60 (minimum)**
Total Marks	**: 100 (Final Exam: 80 and In-course: 20)**		

Course description

English is an international language of communication. The purpose of this course is, to improve the English-language proficiency of students and to help them become confident in reading, writing, speaking, and listening to the English language. With a focus on scientific

literature, the course draws specific attention to the accurate use of structures, improvement of practical skills, and the development of scientific writings and presentation.

Course objective

The overall goals of this course are to:

- improve their listening and reading skills in English
- improve their skills in written and oral English needed to communicate confidently, effectively and independently
- improve their deeper understanding of correct English structures in descriptive, narrative, and instructional texts
- develop skills in scientific writings and presentations

Course Learning Outcomes (CLOs):

CLO No.	Expected Course Outcomes Upon completion of this course, the students will be able to:
CLO1	demonstrate proficiency in correct English structures in descriptive, narrative, and instructional texts
CLO2	demonstrate their listening and reading skills in English to communicate confidently, effectively and independently
CLO3	increase their use of English in formal and informal situations
CLO4	acquire the knowledge of theories, methodologies, and ideologies that give them fundamental supports for scientific writings and presentations

Course Plan:

Module	Course contents	Credit hrs	CLOs
1	**Functional English** (i) Basic rules of English grammar (ii) Sentences (iii) Tense (iv) Change of Voice (v) Appropriate preposition (vi) Completing & combining of sentences	15	1,3
2	Spoken skill using TOEFL/ELTS material. i) Demonstrate listening and speaking using audio/visual system.	15	2

3	Scientific Writing: Definition, organization, preparation of scientific article; title, abstract, introduction methods & materials, results, discussion, acknowledgement reference, abbreviations. i) Writing tables and Illustrations. ii) Preparation of poster / slides & oral presentation. iii) Writing a protocol. iv) Publishing an article.	30	3,4

Teaching-Learning approach	**Assessment strategy**	**Reinforcement assignment/Tasks**
Lecture followed by discussion Participatory question-answer Text books Lecture notes Online resources Video documentation	Class assessment Assignment quiz presentation written exam Attendance	Feedback Individual discussion Counseling

Books Recommended:

1. Planning Research & Writing research papers SY, M. Jasim Uddin
2. Write How to and publish a Scientific paper By Bibert A. Day (oryx press)
3. Degree general English S.C. Chakraborty

Course Code	**: BMB-111**		
Course Title	**: Laboratory Work**		
Course Type	**: Core (Practical)**		
Year/Semester	**: 1st Year**		
Course Teacher	**: Assigned Course Teachers**		
Credit Value	**: 8**	**Credit hours/week: 6**	**Total credit hours: 120 (minimum)**
Total Marks	**: 200 (Final Exam: 140 and Class assessment: 60)**		

Course Description

This course consists of thirteen experiments that are the fundamental laboratory techniques in field of biochemistry and molecular biology. In this course students will gain practical experiences on the nature and preparation of different biochemical solution as well as on the qualitative analysis of biomolecules (Carbohydrate, Protein and Lipid). Moreover, students will also get basic idea how to identify and estimate inorganic and organic molecules present in supplied and biological samples.

Course objective:

The overall goals of this course are to:

- train students to handle laboratory tools and instruments
- familiarize students with general laboratory safety and precautions along with maintenance and documentation of records in the laboratory
- provide practical experiences to students on the preparation of standard solution and solution of specific strength from stock solution
- build the practical skill within students to measure different inorganic and organic molecules in samples both qualitatively and quantitatively

Course Learning Outcomes (CLOs):

CLO No.	Expected Course Outcomes Upon completion of this course, the students will be able to:
CLO1	handle laboratory apparatus with ensuring general precautions, safety measures and maintenance
CLO2	prepare standard solution, solution of specific strength and different types of buffer
CLO3	identify unknown organic compounds and perform qualitative and quantitative measurement of different inorganic and organic molecules (including biomolecules) in samples

Course Plan:

Module	Course contents	No. of classes (1 class = 3 credit hrs)	CLOs
1	i) Use of analytical balance. ii) Preparation of standard solutions. iii) Calibration of volumetric apparatus. iv) Acid base titration: a) Titration of a mixture of a strong acid with a weak acid. b) Titration of a strong acid with a strong base. c) Titration of a weak acid with a strong base.	18	1,2
2	v) Estimation of acetic acid content of vinegar. vi) Estimation of ascorbic acid content of biological samples. vii) Identification of organic compounds. viii) Determination of lactose content of milk. ix) Preparation of buffer and determination of	22	1,2,3

	pK of acetic acid. x) Determination of coefficient of viscosity of some organic samples. xi) Qualitative test of carbohydrate, lipid and protein. xii) Determination of Na_2CO_3 content of washing soda. xiii) Preparation of bacterial and fungal growth media		

Teaching-Learning approach	**Assessment strategy**	**Reinforcement assignment/Tasks**
Lecture followed by discussion Text books Lecture notes Group discussion Online resources Demonstration for different Laboratory techniques Power-point demonstration	Lab assessment Presentation Viva voce Written exam Practical Exam	Feedback Individual discussion Counseling

Learning References:

1. Essentials of Practical Biochemistry. Lalit M. Srivastav, Nibhriti Das and SubrataSinha. CBS Publishers and Distributors, India
2. G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denney: Vogel's Qualititative Inorganic Analysis, Longman Scientific & Technical, New York.
3. E.S. Gilreath, Experimental Procedures in Elementary Qualitative Analysis, Mcgraw-Hill.
4. Vogles, Text Book of Qualitative Chemical analysis. 1998.

Course Code	**: BMB-112**
Course Title	**: Viva-voce**
Course Type	**: Core**
Year/Semester	**: 1st Year**
Course Teacher	**: Assigned Examination Committee**
Credit Value:	**: 2**
Total Marks	**: 50**

Course Description:

Viva Voce is a Latin expression that was used in Catholic seminary education to refer to oral exams (it literally means, "living voice"). Oral exams are used not as a substitute, but as a complement to written exams. They are a way to ask what is not feasible through the written format. Ostensibly, the

rationale is that teachers can use the oral format to probe, challenge, and critically assess what a student really knew about a particular topic.

Course objective:

Viva voce will be conducted towards the end of the each year in the form of oral questions-answers and discussions with the expert academic body (the exam committee) which covering the complete syllabus. This course aims at evaluating the basic understanding of the taught courses.

Course Learning Outcomes (CLOs):

CLO No.	Expected Course Outcomes Upon completion of this course, the students will be able to:
CLO1	demonstrate verbally the depth of understanding, thinking and problem solving ability
CLO2	interact with courage and spontaneity beyond nervousness in face to face interview.
CLO3	present their concepts systematically in oral form and exhibit preparedness for future job interview.

Assessment Strategies:

Students will have to appear the interview board (the examiners panel) and the panel will judge them based on their understanding the courses that they had attended and grade them in marks.

B.Sc. (Hons.) 2nd Year Examination, 2021

Honours Theory	: 450
Related Theory	: 150
Honours Practical	: 200
Related Practical	: 100
Honours Viva Voce	: 50
Total : 950	

Course	Title	Full marks	Unit	Credit
Honours Theory				
BMB – 201	Molecular Biology-I	100	1	4
BMB – 202	Human nutrition	100	1	4
BMB – 203	Enzymes	50	0.5	2
BMB – 204	Metabolism-I	100	1	4
BMB – 205	Microbiology	100	1	4
Related Theory				
BMB-Bot-/Zoo-206	Botany/ Zoology	100	1	4
BMB – Biostat-208	Biostatistics	50	0.5	2
Related Practical				
BMB-Bot-/Zoo-207	Botany/Zoology Practical	50	0.5	2
BMB – Biostat-209	Biostatistics Practical	50	0.5	2
Honours Practical and Viva Voce				
BMB – 210	Laboratory work [Practical + class assessment] (140 + 60)	200	2	8
BMB –211	Viva-voce	50	0.5	2
	Total =	**950**	**9.5**	**38**

Course Code	**: BMB-201**		
Course Title	**: Molecular Biology-I**		
Course Type	**: Core**		
Year/Semester	**: 2nd Year**		
Course Teacher	**: Professor Dr. Narayan Roy and Professor Dr. M. Tofazzal Hossain**		
Credit Value	**: 4**	**Credit hours/week: 4**	**Total credit hours: 60 (minimum)**
Total Marks	**: 100 (Final Exam: 80 and In-course: 20)**		

Course Description:

Molecular biology will provide a strong background in the department to prepare the students on the structure and function of biologically important molecules. Students will learn about DNA, RNA, chromosome and the molecular events that govern cell function while exploring the relevant aspects of biochemistry, genetics and cell biology. The course builds on the fundamental knowledge of molecular biology and also provides an overview of physico-chemical properties of DNA and RNA, plasmid isolation and purification and use of restriction enzyme, recombinant DNA, DNA amplification, DNA cloning, etc. This is a dynamic field of biology. There are thousands of opportunities within the medical, pharmaceutical, agriculture and industrial fields for a person with a concentrated knowledge of molecular processes.

Course objective:

The overall goals of this course are to:

- acquaint students with basic knowledge of molecular biology
- understand the structures of DNA, RNA and chromosome in details
- have the idea about isolation, purification and properties of DNA
- comprehend recombinant DNA technology, restriction enzyme, PCR and DNA cloning

Course Learning Outcomes **(CLOs):**

CLO No.	**Expected Course Outcomes** Upon completion of this course, the students will be able to:
CLO1	understand the basics of molecular biology for further study
CLO2	Describe DNA, plasmid, chromosome, restriction enzyme, mutation and molecular cloning
CLO3	solve problems related to the DNA, RNA purification, DNA amplification,

	electrophoresis, recombinant DNA

Course Plan:

Module	Course contents	Credit hrs	CLOs
1	**Molecular Biology:** Definition, scope, historical background, interrelationship with other disciplines, future prospect and importance.	4	1
2	**Nucleic acids:** DNA as genetic material- experimental evidences. Isolation, purification and molecular weight determination of nucleic acids, physico-chemical properties of DNA, denaturation and renaturation of DNA, Tm value, Cot value, different conformation of DNA, DNA-DNA, DNA-RNA hybridization, tandem repeat sequence, palindromic sequence and cruciform structure.	10	1,3
3	**Molecular organization of chromosomes:** Molecular concept of genes and chromosomes, centromere, telomeres, nucleosome and its organization in eukaryotic chromosomes, histone and non-histone proteins, DNA-histone octamer and super coiling of DNA, bacterial and viral genomes.	10	1,2
4	**Non-enzymatic transformations of nucleic acid:** Chemical agents that cause DNA damage, non-enzymatic reactions (deamination, depurination), formation of pyrimidine dimmers induced by UV light.	6	1,3
5	**Mutation:** Definition and classification, Different types of mutation (mis-sense, same-sense and nonsense mutation, frameshift mutation etc), physical and chemical mutagens, inherited mutational diseases. mutation in human, deleterious and recessive, molecular mechanism of mutations, mutation rate and its measurement, mutation and carcinogenesis.	8	2,3
6	**Plasmids:** General properties, types, isolation, transfer of plasmid DNA, role of plasmids in biotechnology.	8	2,3

7	**Restriction enzymes:** Source, specificity of restriction and other enzymes involved in recombinant DNA technology; digestion of DNA fragments by restriction enzymes, host-controlled restriction and modification, mechanism of methylation modification sites, demethylation and its application.	7	2,3
8	**Introduction to molecular cloning:** Cloning of DNA fragments, preparation of cloning vectors, PCR, cloning of PCR products.	7	2,3

Teaching-Learning approach	**Assessment strategy**	**Reinforcement assignment/Tasks**
Lecture followed by discussion Participatory question-answer Text books Lecture notes Online resources Video documentation	Class assessment Assignment quiz presentation written exam Attendance	Feedback Individual discussion Counseling

Learning References:

1. Principles of Biochemistry – Lehninger, Nelson and Cox
2. Molecular Biology of Cell – Bruce Alberts, Dennis Bray, Julian Lewis, Martin Raff, Keith Roberts, James D Watson.
3. Biochemistry –Lubert Stryer.
4. Genes VI and VII – Benjamin and Lewin.
5. Molecular cell biology – Darnell J. E., Loddis H. F. and Baltimore D.

Course Code	**: BMB-202**		
Course Title	**: Human Nutrition**		
Course Type	**: Core**		
Year/Semester	**: 2nd Year**		
Course Teacher	**: Professor Dr. Md. Ashraful Hoque and Professor Dr. Md. Masudul Hasan Khan**		
Credit Value	**: 4**	**Credit hours/week: 4**	**Total credit hours: 60 (minimum)**
Total Marks	**: 100 (Final Exam: 80 and In-course: 20)**		

Course Description:

Human nutrition is the provision to obtain the materials necessary to support life. It deals with the digestion, absorption, transport and metabolism of food in the body by which growth, repair and maintenance of activities are accomplished. The course includes the role of food as well as nutrients and how the body processes them. The course also provides the basis of knowledge required for enhancing health and fitness in individuals of all ages, and in groups and communities. The course presents them with the relevant aspects of human nutrition, public health and biochemistry.

Course objective:

The overall goals of this course are to:

- list major properties, functions, and important food sources of the nutrients
- describe human nutrient and energy needs throughout the life span and in physical training
- translate human nutrient and energy needs into daily food selection utilizing appropriate standards and guidelines
- explain the significance of food practices to nutrition and disease prevention
- effectively evaluate meal plans for nutritional adequacy, nutrient density, balance, variety, and calorie control as well as to communicate accurate nutrition information to target audiences

Course Learning Outcomes (CLOs):

CLO No.	Expected Course Outcomes Upon completion of this course, the students will be able to:
CLO1	understand the properties, functions and health effects of nutrients
CLO2	know the health problems due to malnutrition
CLO3	demonstrate the mechanism of energy metabolism and describe the methods for assaying nutritional status of individuals and community

Course Plan:

Module	Course contents	Credit hrs	CLOs
1	**Carbohydrates and fibers in human nutrition:** Nutritional basis of classification, absorption of carbohydrates, dietary fiber, non-digestible oligosaccharides, resistant starch, polyols and polydextrose, their role in health and diseases.	7	1
2	**Proteins in human nutrition:** Proteins, essential amino acids, limiting amino acid and natural supplementation, protein quality and its evaluation.	5	1
3	**Lipids:** Fats and oils in human nutrition, saturated, monounsaturated and polyunsaturated fatty acids, omega-fatty acid, essential fatty acids. **Water** as a nutrient, function, sources, requirement, water balance and effect of deficiency.	5	1
4	**Malnutrition:** Under-nutrition and over-nutrition, PEM (Kwashiorkor, Marasmus and their management), diagnosis and treatment of nutritional failure, obesity (risk factors, biochemical and clinical features, symptoms, diagnosis, treatment).	3	2
5	**Energy metabolism:** Energy requirement and energy expenditure, determination of caloric value of foods, basal metabolic rate, specific dynamic action of foods, respiratory quotients, energy requirement of a man doing various types of activities.	5	3
6	**Assessment of nutritional status of a population**, nutritional problems of Bangladesh and their possible remedies, nutrition in emergencies, planning, preparedness and management for development out of disaster.	5	3

Teaching-Learning approach	Assessment strategy	Reinforcement assignment/Tasks
Lecture followed by discussion Participatory question-answer Text books Lecture notes Online resources Video documentation	Class assessment Assignment quiz presentation written exam Attendance	Feedback Individual discussion Counseling

Learning References:

1. Trace elements in Human and animal nutrition: Underwood
2. The vitamins: Sebrell and Harris
3. Chemistry and physiology of the vitamins: Rosenberg.
4. The biochemistry of B-vitamins by Williams
5. Human nutrition and dieteties: Davidson and Passmore
6. Newer methods of nutritional biochemistry: Albanese
7. Proteins and amino acids in nutrition: Albanese
8. Vitamins and coenzymes L. Wegner and Folker

Course Code	**: BMB-203**		
Course Title	**: Enzymes**		
Course Type	**: Core**		
Year/Semester	**: 2nd Year**		
Course Teacher	**: Professor Dr. Ranajit Kumar Shaha** **Professor Dr. Shahanaz Khatun**		
Credit Value	**: 2**	**Credit hours/week: 2**	**Total credit hours: 30 (minimum)**
Total Marks	**: 50 (Final Exam: 40 and In-course: 10)**		

Course Description:

Enzymes enable many chemical reactions to take place at any second inside the body of a plant or animal. They are present in a surprising number of activities in our day to day lives. Enzyme kinetics is an essential topic in undergraduate biochemistry courses. Steady-state kinetic studies, usually initial rate measurements, are a first approach in the characterization of enzyme function. The variation of initial rate with substrate and/or product concentration provides important information about the mechanism involved in the catalysis. By taking this course, students are expected to have some knowledge about nature, quality and quantity of the desired enzymes and gather knowledge about different drugs that are used as inhibitors/antagonists of different diseases.

Course objective:

The overall goals of this course are to:

- understand the properties and activities of enzymes and coenzymes and to the enzyme kinetics and enzyme inhibitions
- make awareness about all the enzymatic reactions in living cells and to gather knowledge about the application of enzymes in food, pharmaceuticals and biochemical industries
- project a clear emphasis on themes, especially the factors that affects the rate of enzymatic reactions
- train the students to synthesize enzymes and coenzymes from biological samples and to understand the mechanism of enzyme actions
- develop skills in clinical analysis of enzymes to determine levels of blood parameters to diagnosis diseases

Course Learning Outcomes **(CLOs):**

CLO No.	Expected Course Outcomes Upon completion of this course, the students will be able to:
CLO1	demonstrate an understanding of fundamental principles of enzymes and measuring initial reaction rate in steady-state studies and to determine the dependence of initial rate with substrate and enzyme concentrations and to employ nonlinear regression to obtain K_m, V_{max} and K_{cat} values of the Michaelis-Menten equation
CLO2	immediately recognize different types of inhibitors and know their essential characteristics to cure diseases, definition and importance of initial reaction velocity, initial rate dependence with substrate and know the factors affecting the rate of enzymatic reactions and mechanisms of enzyme action
CLO3	know the structure of coenzymes and how these play different roles in the metabolism and other cell functioning

Course Plan:

Module	Course contents	Credit hrs	CLOs
1	**Enzymes:** Definition, classification, catalytic properties of enzymes, enzyme activity and its unit, active site of enzymes and its common features and enzyme assay.	2	1
2	**Specificity of enzymes:** Absolute and broad specificity, intermediate and stereo specificity.	2	1
3	**Factors contributing to the catalytic efficiency of enzymes:** Proximity and orientation, covalent catalysis, acid-base catalysis, strain and distortion.	2	1
4	**Enzyme kinetics:** Energy of activation, Monosubstrate reaction, Michaelis-Menten equation and their linear transformations, Lineweaver-burk equation. Definition, determination, significance and kinetic perfection of K_m and V_{max}	4	1
5	**Enzyme inhibition:** Reversible (competitive, non-competitive, un-competitive) inhibition, irreversible inhibition, identification of functional groups essential for catalysis with biological examples.	3	2
6	**Factors affecting the rate of enzymatic reactions:** Substrate concentration, enzyme concentration, p^H, temperature, coenzymes and cofactors.	2	2

7	**Enzyme regulation:** i) Allosteric enzymes-cooperativity, special characteristics, Monod and Koshland models. Some examples of enzymes-aspartate transcarbamoylase, phosphorylase. ii) Regulation by covalent modification of enzymes, phosphorylation-dephosphorylation, reversible covalent modification. Some examples of enzymes-pyruvate dehydrogenase, phosphofructokinase, lactate dehydrogenase, hexokinase.	5	2
8	**Mechanism of enzyme action:** Evidence for enzyme transition state complementarity, structure activity, transition-state analog, chymotrypsin, lysozyme, ribonuclease A, carboxypeptidase.	5	2
9	**Coenzymes:** Definition, chemistry, synthesis and functions of TPP, NAD^+, $NADP^+$, FMN, FAD, CoA, PLP.	5	3

Teaching-Learning approach	**Assessment strategy**	**Reinforcement assignment/Tasks**
Lecture followed by discussion Participatory question-answer Text books Lecture notes Online resources Video documentation	Class assessment Assignment quiz presentation written exam Attendance	Feedback Individual discussion Counseling

Learning References:

1. Enzyme structure and mechanism, Alan Fersht
2. Biochemistry, Lehninger
3. Enzymes, Malcom Dixon and Edwin C. Webb
4. Enzymatic reaction mechanisms, Christopher Walsh

Course Code	**: BMB-204**		
Course Title	**: Metabolism - I**		
Course Type	**: Core**		
Year/Semester	**: 2nd Year**		
Course Teacher	**: Professor Dr. Md. Matiar Rahman** **Dr. Md. Abdur Rakib**		
Credit Value	**: 4**	**Credit hours/week: 4**	**Total credit hours: 60 (minimum)**
Total Marks	**: 100 (Final Exam: 80 and In-course: 20)**		

Course Description:

This course is pivotal to Biochemistry that describes all reactions concerned with the storage and generation of metabolic energy required for the biosynthesis of low-molecular weight compounds and energy storage compounds. The course outline includes a general survey of intermediary metabolism, Glycolysis, the Tricarboxylic Acid Cycle (TCA), the Phosphogluconate pathway, the Pentose Phosphate pathway, the Glyoxylate pathway, the Cori cycle, the Calvin pathway; Gluconeogenesis and glycogenolysis; Disorders of carbohydrate metabolism; Amino acids as building blocks of proteins, biological functions of proteins; Oxidative degradation of amino acids and metabolism of one carbon unit, biosynthesis of amino acids and some derivatives; The Urea cycle, metabolism of inorganic nitrogen and disorders of amino acid metabolism and metabolism of some special nitrogen.

Course objective:

The overall goals of this course are to:

- give students understanding of the reactions involved in the breaking down and building up of biomolecules
- make the student familiar with an understanding of the molecular basis of the control of metabolism
- afford students opportunity to appreciate the relevance/applications of biochemistry in our daily activities

Course Learning Outcomes **(CLOs):**

CLO No.	**Expected Course Outcomes** Upon completion of this course, the students will be able to:
CLO1	define the major pathways of intermediary metabolism of biomolecules, and discuss their bioenergetics, physiological adaptation, metabolic and main hormonal regulation, localization and cellular compartmentalization
CLO2	explain some of the molecular events that occur during normal and abnormal biomolecular activities
CLO3	correlate the metabolic activity of tissues and organs with their functions

Course Plan:

Module	Course contents	Credit hrs	CLOs
1	**A survey of intermediary metabolism:** Flexibility and economy of intermediary metabolism, multienzymes systems, catabolic, anabolic and amphibolic pathways, energy cycles of cells, metabolic turnover, experimental approaches to intermediary metabolism.	10	1
2	**Carbohydrate metabolism** **a) Glycolysis:** Aerobic and anaerobic fate, regulation of glycolytic pathway, metabolism of disaccharides, pentoses, hexoses other than glucose, physiological importance of aerobic and anaerobic glycolysis. Allostcric and hormonal regulation of both aerobic and anaerobic glycolysis. Fructose intolerance, anaerobic glycolysis and tumour cell, anaerobic glycolysis and heart attack, hypoglycemia and premature infant. **b) Tricarboxylic acid cycle**: Cycle overview, discovery of the TCA cycle, amphibolic nature of the cycle, regulation of TCA cycle, and glucose-6 - phosphate dehydrogenase deficiency. **c) Other pathways of carbohydrate degradation:** The pentose phosphate pathway, the glyoxylatic pathway, glucose to glucuronic acid and vitamin C. **d) Glycogen metabolism:** Glycogenolysis, glycogenesis, control of glycogen metabolism. **e) Biosynthesis of carbohydrate:** Gluconeogensis, and its regulation, biosynthesis of di, oligo and polysaccharides, glycoproteins, proteoglycan, sugar interconversions.	20	1,2
3	**a) Lipids:** Digestion, mobilization and transport of fatty acids, oxidation of fatty acids (saturated and unsaturated), propionate metabolism, regulation of fatty acid oxidation, utilization of fatty acid, for energy production, functional role of polyunsaturated fatty acids and ketone bodies. **b) Disorders of lipid metabolism:** Stress, fatty acids and myocardial infarction, genetic deficiencies in carnitine or Carnitine palmitoyl transferase, Sudden infant death syndrome (SIDS), Refsums disease, respiratory distress syndrome.	10	1,2,3
4	**Proteins:** Pathways of amino acids degradation-decarboxylation, oxidative deamination, transamination,	7	1,2.3

	and metabolic fates of amino groups, urea cycle, toxicity of ammonia (hyperammonemia), deficiencies of the urea cycle enzymes.		
5	**Biosynthetic pathways:** One carbon metabolism, biosynthesis of fatty acids (saturated and unsaturated), biosynthesis of plasma lipoproteins (LDL, HDL), cholesterol, regulation of cholesterol biosynthesis, uses of cholesterol, biological significance of HDL and LDL, β-carotene, and triglycerides, steroid hormones, prostaglandins, prostacycline, thromboxane, leuko-trienes, phospholipids.	8	1,2,3
6	**Special nitrogen metabolism:** Introduction, non-protein amino acids, amines (aliphatic monoamines), glucosinolates, auxins, cytokinins and ethylene (biosynthesis and function).	5	1,2

Teaching-Learning approach	**Assessment strategy**	**Reinforcement assignment/Tasks**
Lecture followed by discussion Participatory question-answer Text books Lecture notes Online resources Video documentation	Class assessment Assignment quiz presentation written exam Attendance	Feedback Individual discussion Counseling

Learning References:

1. Albert Lehninger_ David L. Nelson_ Michael M. Cox-Lehninger Principles of Biochemistry-W. H. Freeman (2012)
2. Plant Biochemistry edited by P.M. Dey and J.B. Harborne.
3. Biochemistry, 3rd edition, by Lubert Stryer.

Course Code	**: BMB-205**		
Course Title	**: Microbiology**		
Course Type	**: Core**		
Year/Semester	**: 2nd Year**		
Course Teacher	**: Dr. Subed Chandra Dev Sharma** **Dr. Imtiaj Hasan**		
Credit Value	**: 4**	**Credit hours/week: 4**	**Total credit hours: 60 (minimum)**
Total Marks	**: 100 (Final Exam: 80 and In-course: 20)**		

Course Description:

This course is designed to provide a strong grounding in fundamental aspects of the basic biology of fungi and viruses, microbial control as well as in environmental and industrial microbiology. Emphasis is placed on the study of infectious diseases of humans. It will provide principle information concerning the future battle against infectious diseases worldwide, understanding the environmental importance of microbes and to exploit them for food production, biotechnological and industrial applications. Students enrolled in this course will attend one or more of Practical classes.

Course objective:

The overall goals of this course are to:

- describe the students how microorganisms are used as model systems to study basic biology, genetics, metabolism and ecology
- make the students familiar with the ways microorganisms play an integral role in disease, and microbial and immunological methodologies are used in disease treatment and prevention
- explain the students why microorganisms are ubiquitous in nature; inhabiting a multitude of habitats and occupying a wide range of ecological habitats
- aware the students of the vital role of microorganisms in biotechnology, fermentation, medicine, and other industries important to human well being
- demonstrate the students that microorganisms have an indispensable role in the environment, including elemental cycles and biodegradation

Course Learning Outcomes **(CLOs):**

CLO No.	**Expected Course Outcomes** Upon completion of this course, the students will be able to:
CLO1	explain within multiple microbiology disciplines the core theories and practices and describe the processes used by microorganisms for their replication, survival, and interaction with their environment, hosts, and host populations
CLO2	acquire and demonstrate competency in laboratory safety and in routine and specialized microbiological laboratory skills applicable to microbiological research or clinical methods, including accurately reporting observations and

	analysis
CLO3	demonstrate practical skills in the use of tools, technologies and methods common to microbiology, and apply the scientific method and hypothesis testing in the design and execution of experiments through involvement in research or internship activities and outreach or mentoring activities specific to microbiology

Course Plan:

Module	Course contents	Credit hrs	CLOs
1	**Fungi:** Classification, general organization and ultra-structure of fungal cells, cell wall structure, growth and growth media, nutritional requirement, metabolism and reproduction, economic importance of fungus.	8	1,2
2	**Viruses:** Nature and general properties of viruses, classification, culture and assay of viruses, effect of chemical and physical agents on viruses, virus-host interaction, plant and fungal viruses, general studies on viruses and bacteriophage, lytic and lysogenic cycle.	10	1,2
3	**Microbes and diseases:** Natural resistance, pathogenicity and virulence, defense mechanism, microbial toxins, diseases caused by bacteria, fungi, protozoa and viruses, transmission and prevention of common infectious diseases (cholera, tuberculosis, tetanus, typhoid, malaria), epidemiology of dengue, laboratory diagnosis and antimicrobial therapy.	10	1,2,3
4	**Control of microorganisms**: Fundamentals of microbial control, physical (temperature, radiation, and filtration) and chemical agents used in control of microorganisms.	6	1,2.3
5	**Environmental microbiology:** Microbial evolution, interactions among microbial populations, plant-microbe interactions, microbe-animal interactions. (i) Microbiology of the soil: Micribial flora of soil, isolation of soil microorganisms, rhizosphere, interactions among soil microorganisms, biochemical transformation of N, S and C and their compounds. (ii) Aquatic microbiology: Distribution of microorganisms in the aquatic environment, role of aquatic	10	1,3

	microorganisms.		
6	**Industrial microbiology:** (i) Microbiology of food: Microorganisms in fresh foods, spoilage of foods, foods produced by microorganisms. (ii) Industrial microbiological products: Products of microbial dissimilation and synthesis, pharmaceuticals from genetically engineered cells, microbial cells and products for immunization. (iii) Microorganisms for pest control: pest control by Bt-toxin	10	2,3
7.	**Role of microorganisms** in cyclic changes of matter, carbon, nitrogen, and sulfur cycles.	6	1,3

Teaching-Learning approach	**Assessment strategy**	**Reinforcement assignment/Tasks**
Lecture followed by discussion Participatory question-answer Text books Lecture notes Online resources Video documentation	Class assessment Assignment quiz presentation written exam Attendance	Feedback Individual discussion Counseling

Learning References:

1. Microbiology-Application and Concept- Pelczar, Chan and Crieg
2. Microbiology-- Pelczar, Chan and Crieg
3. Microbiology – Prescott, Haley and Klein
4. General Microbiology - Stainer
5. Fundamentals of Microbiology - Frobisher
6. Prescott and Dunn’s Industrial Microbiology

Course Code	**: BMB-Bot-206**		
Course Title	**: Botany-II**		
Course Type	**: Related**		
Year/Semester	**: 2nd Year**		
Course Teacher	**: Professor Dr. Mst. Ferdowsi Mahal and Dr. Umme Qulsum**		
Credit Value	**: 4**	**Credit hours/week: 4**	**Total credit hours: 60 (minimum)**
Total Marks	**: 100 (Final Exam: 80 and In-course: 20)**		

Course Description:

Botany is concerned with the study of plants at all levels of biological organization, from molecular and cellular processes to the global ecosystem. This course will enable the students to be acquainted with the latest knowledge of the plant sciences, especially, economic botany, plant anatomy, physiology, ecology, cytology and cytogenetics.

Course objective:

The overall goals of this course are to

- acquire knowledge the student about sources, method of cultivation, processing and use of oil, fiber, tea and medicinal items, tobacco, sugar, pulses and fruit and their economic importance
- provide the students understanding about anatomical features of plants
- develop comprehensive knowledge of physiological process of plants and their importance and role of nutrients in plant growth
- provide comprehensive knowledge of ecosystem ecology, plant succession, adaptation of mesophytes, xerophytes of hydrophyces, distribution, ecological condition and floristic composition of major forests of Bangladesh
- give comprehensive and advance knowledge of cell and its organelles, Mendel's laws of inheritances, linkage and crossing over, mutation, polyploidy

Course Learning Outcomes **(CLOs):**

CLO No.	**Expected Course Outcomes** Upon completion of this course, the students will be able to:
CLO1	describe the basic knowledge on cultivation methods, processing and use of oil, fibre, tea and medicinal items, tobacco, sugar, pulses and fruit and their economic importance

CLO2	analyze morphologically and anatomically plant samples
CLO3	apply different techniques and morphological tools in practical and real life situations

Course Plan:

Module	Course contents	Credit hrs	CLOs
1	**A. Economic Botany** 1. Sources, method of cultivation, processing, use and economic importance of tea. 2. Sources, method of cultivation, processing, use and economic importance of tobacco. 3. Sources, method of cultivation, processing, use and economic importance of sugarcane. 4. Sources, method of cultivation, processing, use and economic importance of jute. 5. Scientific names, sources, use and economic importance of oil, fibre, pulses and fruit yielding plants. 6. Importance of (all with particular reference to Bangladesh) plants in maintaining the balance of nature.	12	1
2	**B. Anatomy** 1. Define cell, cell types, tissue, and tissue system. 2. Functions of cell, cell types, tissue, and tissue system 3. Structure of primary stem and root. 4. Functions of primary stem and root 5. Normal secondary growth.	10	1,2
3	**C. Plant physiology** 1. Definition, function and importance of osmosis. 2. Definition, method and importance of absorption of water. 3. Definition, function and role of nutrients. 4. Definition, function and importance of transpiration. 5. Types and factors affecting transpiration.	14	1,2,3

	6. Definition, reaction, function and importance of photosynthesis. 7. Mechanism in C-3 and C-4 plants and factors affecting the rate of photosynthesis. 8. Definition, reaction and types of respiration and mechanisms of anaerobic and aerobic respiration. 9. Definition, physicochemical nature, nomenclature and classification of enzymes 10. Germination of seeds and viability of seeds.		
4	**D. Ecology** 1. Definition, classification, and components of ecosystem. 2. Description of different ecosystems in Bangladesh. 3. Edapnic micro and macro climatic and biotic factors in relation to growth, development and distribution of plants. 4. Definition and classification plant succession. 5. xero and hydro-sere. 6. Adaptation of mesophytes, xerophytes of hydrophyces. 7. Distribution, ecological condition and floristic composition of major forests of Bangladesh.	12	1,2,3
5	**E. Cytology and Genetics** 1. Cell and its organelles 2. Definition, classification, function and importance of cell divisions. 3. physical and chemical structure of chromosomes. 4. Mendel's laws of inheritances. 5. Linkage and crossing over. 6. Definition, classification, function and importance of mutation. 7. Definition, classification, function and importance of polyploidy.	12	2,3

Teaching-Learning approach	Assessment strategy	Reinforcement assignment/Tasks
Lecture followed by discussion Participatory question-answer Text books Lecture notes Online resources Video documentation Small group discussion	Class assessment Assignment quiz presentation written exam Attendance	Feedback Individual discussion Counseling

Learning References:

1. Introductory Mycology by C. J. Alexopoulos and C. W. Mims.
2. Lawrence, G. H. M. 1951. Taxonomy of Vascular Plants.The Macmillan Co. New York.
3. Sivaranjan, V. V. and N. K. P. Robson, 1991. Introduction to the Principles of Plant Taxonomy (12nd ed.). Oxford and IBH Publishing Co. Pvt. Ltd. Calcutta, New Delhi.
4. Pandey, B. P. 2000. Economic Botany (6thed.) S. Chand and Co. Ltd. New Delhi.
5. Pandey, S. N. and Sinha, B. K. Plant Physiology.
6. Razdan M. K. 1993. An Introduction to Plant Tissue Culture; Oxford and IBH Publication, New Delhi.
7. Chaudhury, R. C. 1993.Introduction to Plant Breeding Oxford, Publishing House, New Delhi.

Course Code	**: BMB-Bot-207**		
Course Title	**: Botany Practical**		
Course Type	**: Related**		
Year/Semester	**: 2nd Year**		
Course Teacher	**: Professor Dr. Mst. Ferdowsi Mahal and Dr. Umme Qulsum**		
Credit Value:	**: 2**	**Credit hours/week: 2**	**Total credit hours: 30 (minimum)**
Total Marks	**: 50 (Final Exam: 40 and Class assessment: 10)**		

Course Description

Graduates preparing their career as botanist need to be skilled in analyzing and interpreting biological problems. This course has been designed to provide the students of 2nd year with hand on training in various morphological and anatomical operations to get them skilled in solving different biological problems. This course actually contains some laboratory works related to theoretical knowledge given to them through the courses designed for 2nd year.

Course objective:

The overall goals of this course are to:

- train the students how to identify different microorganism and plants group (e.g. fungi, algae, hydrophytes, xerophytes, mangrove plants etc.) and know their taxonomy
- develop in student the skill of analyzing morphologically and anatomically plant samples and interpreting the data
- develop in students skills of using different techniques for future research and development purposes
- build in students the capability of isolating and analyzing different plant group for taxonomic purpose

Course Learning Outcomes **(CLOs):**

CLO No.	**Expected Course Outcomes** Upon completion of this course, the students will be able to:
CLO1	identify different microorganism and plants group (e.g. fungi, algae, hydrophytes, xerophytes, mangrove plants etc.) and know their taxonomy
CLO2	analyze morphologically different plant samples and interpreting the obtained data
CLO3	apply different techniques and morphological tools in practical and real life situations

Course Plan:

Module	**Course contents**	**No. of classes (1 class = 3 credit hrs)**	**CLOs**
1	Study of different cell type and anatomy of dicot and monocot root and stem by hand section.	2	2
2	Microscopic examination of water for algae.	2	1
3	Study of slime would (somatic and reproductive structure).	2	1

4	Identification of plants and their taxonomy.	1	1,2
5	Preparation of slide and identity different stages of mitosis cell division.	2	1,2
6	Spotting (Plant samples, diseased Plant samples etc.)	1	1
7	Class records.		
8	Continuous laboratory assessment.		
9	Lab. attendance.		

Teaching-Learning approach	Assessment strategy	Reinforcement assignment/Tasks
Lecture, hand on training by providing unknown samples, peer learning, exercise, small group discussion.	Continuous class assessment, SAQ written exam, viva voce, reports, final practical exam, attendance	Feedback, Individual discussion, Counseling

Learning References:

1. Sharma, O. P., K.D. Sharma, K. D. 2017. Practical Botany- I, Pragati Prakashan Meerut, India.

2. Pandey, B. P. Modern Practical Botany Vol-1,S. Chand Publishing, India.

Course Code	**: BMB-Biostat-208**		
Course Title	**: Biostatistics**		
Course Type	**: Related**		
Year/Semester	**: 2nd Year**		
Course Teacher	**: Professor Dr. Md. Kamruzzaman**		
Credit Value:	**: 2**	**Credit hours/week: 2**	**Total credit hours: 30 (minimum)**
Total Marks	**: 50 (Final Exam: 40 and In-course: 10)**		

Course Description:

Biostatistics is the integral to the advanced knowledge in biology, health policy, clinical medicine, public health policy, health economics, proteomics, genomics, and other

disciplines. In these sciences, subjects (patients, mice cells, etc.) display considerable variation in their response to motivations. Well-known probability sampling designs and sampling distributions are also provided in this course.

Course objective:

The overall goals of this course are to:

- develop ideas about sampling distributions with their properties and applications in hypothesis testing
- know classification models, construct ANOVA and also develop a strong knowledge for analyzing data using CRD, RBD and LSD; to understand probability sampling designs and estimate different characteristics from these probability sampling designs
- perform the statistical tests accurately and improve the knowledge of demography

Course Learning Outcomes **(CLOs):**

CLO No.	**Expected Course Outcomes** Upon completion of this course, the students will be able to:
CLO1	apply selected sampling distributions to solve the problems
CLO2	explain the necessity of an experimental design and how to construct a good experimental design; and also choose appropriate sampling designs for different selection problems
CLO3	draw valid conclusions about hypotheses from the results of different statistical tests and unfold the fundamental concepts of demography

Course Plan:

Module	**Course contents**	**Credit hrs**	**CLOs**
1	**Sampling Distributions:** Definition of sampling distribution, examples, Type of sampling distributions**,** Study of χ^2–distribution, t-distribution and F-distribution, Properties and applications in hypothesis testing.	10	1
2	**Analysis of Variance:** Concept of Randomization, Replication, Treatments, Analysis of variance (ANOVA) corresponding to one way, two-way and three-way classifications, Completely Randomized Design (CRD), Randomized Block Design (RBD) and Latin Square	6	2

	Designs (LSD).		
3	**Sample Surveys:** Basic concept of Surveys, Preparation of Questionnaire, Probability and non-probability sampling, sampling with and without replacement, sampling technique, Study of simple random sampling, stratified random sampling, systematic sampling and cluster sampling with applications.	4	2
4	**Large Sample Test:** Equality of K≥2 proportions, Means and Variances. Test for regression and correlation coefficients. Test for r×c contingency tables. Exact Test for 2×2 contingency tables.	4	3
5	**Non-parametric Test:** Definition, Study of Sign test, Run test and Rank Sum test.	3	3
6	**Demography:** Basic concept of Demography, Birth, Death and Growth rates, Components of population growth rates, Fertility and Mortality and their measures, Life tables, Population projection.	3	3

Teaching-Learning approach	**Assessment strategy**	**Reinforcement assignment/Tasks**
Lecture followed by discussion Participatory question-answer Text books Lecture notes Online resources Video documentation	Class assessment Assignment quiz presentation written exam Attendance	Feedback Individual discussion Counseling

Learning References:

1. Biswas S. (1994): Stochastic Process in Demography and Applications. Wiley Eastern.
2. Brass, W (1985): Advances in Methods for Estimating Fertility and Mortality from limited and defective data for population studies.
3. Cochran and Cox (2000): Experimental designs, 2nd Ed., Wiley, N.Y.
4. Cochran, W.G. (2002): Sampling Techniques, 4th Ed., Wiley, N.Y.
5. Gupta, S.C. and V.K. Kapoor (2001): Fundamentals of Applied Statistics, 3rd Ed., Sultan Chand and Sons, New Delhi, India.
6. Gupta, S.C. and V.K. Kapoor (2004): Fundamentals of Mathematical Statistics, Revised Ed. Sultan Chand and Sons, New Delhi, India.
7. Histon, A. (1995): The Analysis of Variance, 3rd Ed. Wiley, N.Y.
8. Hans Raj (1988): Fundamentals of Demography.

9. Hogg, R. V. and A. T. Craig (2002): Introduction to Mathematical Statistics, 5th ed., Pearson, Education, Asia.
10. Kendall, M.G. and Stuart, A. (2004): Advanced Theory of Statistics, 14th Ed.
11. Edward Arnold, N.Y. Lehmann, E. L. (2000): Testing of Statistical Hypothesis 4th ed., Wiley, N.Y.
12. Lehmann, E.L. and H.J.M D'Abrera (1981): Non parametric Statistics. McGraw-Hill, N.Y.
13. Montgomery D. C. (2005): Designs and Analysis of Experiments, 6th Ed. Wiley, N.Y.

Course Code	**: BMB-209**		
Course Title	**: Biostatistics Practical**		
Course Type	**: Related**		
Year/Semester	**: 2nd Year**		
Course Teacher	**: Professor Dr. Md. Kamruzzaman**		
Credit Value:	**: 2**	**Credit hours/week: 2**	**Total credit hours: 30 (minimum)**
Total Marks	**: 50 (Final Exam: 40 and Class assessment: 10)**		

Course Description

The biostatistics practical has gained significant importance in recent years, being one of the mainstays of current scientific research. It is the branch of statistics responsible for the proper interpretation of scientific data generated in the biology, public health and other health sciences (i.e., the biomedical sciences).

Course objective:

The overall goals of this course are to:

- To process and condense the data and to apply appropriate statistical tools and techniques to analyze the data.
- To calculate correlation and simple regression; and to perform the statistical tests accurately.
- To estimate different characteristics from selected probability sampling designs and to construct ANOVA for CRD, RBD and LSD.

Course Learning Outcomes **(CLOs):**

CLO No.	**Expected Course Outcomes** Upon completion of this course, the students will be able to:
CLO1	organize and condense the data and present these data in suitable manner.

CLO2	solve problems related to the correlations and regression and interpret about the results; draw valid conclusions about hypotheses from the results of different statistical tests.
CLO3	choose appropriate sampling designs for different selection problems; analyzing data using CRD, RBD and LSD; and calculate different characteristics in demography.

Course Plan:

Module	Course contents	No. of classes (1 class = 3 credit hrs)	CLOs
1	1. Construction of frequency table, drawing histogram, frequency polygon, frequency curves and ogive curve. 2. Computation of mean, median and mode from grouped and ungrouped data, graphical representation of median and mode. 3. Computation of variance, standard deviation, co-efficient of variation, skewness and kurtosis.	4	1
2	1. Computation of simple correlation coefficient and regression coefficient and fit simple regression line. 2. Test of significance concerning mean, variance, proportion, correlation and regression coefficients. 3. Test of r x c and 2 x 2 contingency tables for independence of attributes.	3	2
3	1. Sample selection of with and without replacement for SRS, stratified and systematic sampling. 2. Construction of ANOVA for CRD, RBD and LSD. 3. Computation of birth, death and growth rates, fertility and mortality rates.	3	3

Teaching-Learning approach	Assessment strategy	Reinforcement assignment/Tasks
Lecture, hand on training by providing unknown samples, peer learning, exercise, small group discussion.	Continuous class assessment, SAQ written exam, viva voce, reports, final practical exam, attendance	Feedback, Individual discussion, Counseling

Learning References:

1. Gupta, S.C. and Kapoor, V.K. (2001): Fundamentals of Applied Statistics, 3rd ed., Sultan Chand and Sons, New Delhi, India.

2. Gupta, S.C. and Kapoor, V.K. (2004): Fundamentals of Mathematical Statistics, Revised Ed. Sultan Chand and Sons, New Delhi, India.

3. Mostafa, M.G. (1994): Methods of Statistics, Karim Press & Publications, Dhaka, Bangladesh.

Course Code	**: BMB-210**		
Course Title	**: Laboratory Work**		
Course Type	**: Core (Practical)**		
Year/Semester	**: 2nd Year**		
Course Teacher	**: Assigned Course Teachers**		
Credit Value:	**: 8**	**Credit hours/week: 6**	**Total credit hours: 60 (minimum)**
Total Marks	**: 200 (Final Exam: 140 and Class assessment: 60)**		

Course Description

Laboratory practice is the important part of the courses like biochemistry and provides hands-on opportunities to develop and apply the subjective knowledge. This course is designed to provide a strong grounding in fundamental aspects of biochemistry, from simple solution preparation to estimation and characterization of macromolecules/biomolecules from natural sources. This course will introduce briefly with techniques used in molecular biology and microbiology and measurement of the nutritional status of adults.

Course objective:

The overall goals of this course are to:

- familiarize students with the characterization of biomolecules and their estimation from supplied samples

- develop skills in students to prepare buffers and different percentages of agarose and polyacrylamide gels used in biochemistry and molecular biology lab
- train students to use microscopes, to prepare different types of media maintaining the aseptic condition inside the laboratory and to study the morphology of different bacteria and fungi through microscopic examination
- demonstrate students the attributes of a healthful lifestyle that are consistent with healthy people

Course Learning Outcomes **(CLOs):**

CLO No.	**Expected Course Outcomes** Upon completion of this course, the students will be able to:
CLO1	prepare standard solutions, solutions of specific strength and different types of buffers, to characterize and identify biomolecules (carbohydrates, proteins, lipids, minerals etc.), to synthesize drugs, to detect nucleic acids and proteins in biological samples to know how these molecules interact within the cell to promote proper growth, division, and development
CLO2	communicate biochemical methods and analyses used in nutritional research, nutritional aspects of various classes of food, nutritional status in relation to physical activity and learn about obesity as well as its prevention and cure
CLO3	demonstrate practical skills in the use of tools, technologies and methods common to microbiology, and apply the scientific method and hypothesis testing in the design and execution of experiments through involvement in research or internship activities and outreach or mentoring activities specific to microbiology

Course Plan:

Module	**Course contents**	**No. of classes (1 class = 3 credit hrs)**	**CLOs**
1	**General Biochemistry:** 1. Physical and chemical characterization of fats and oils. Estimation of Iodine value and saponification value of fats and oils. 2. Estimation of iron content of Mohr's salt by dichromate method. 3. Estimation of copper iodometrically with sodium thiosulphate solution. 4. Determination of equilibrium constant. 5. Synthesis of aspirin, acetamide and paracetamol. 6. Estimation of glucose from supplied sample. 7. Determination of specific rotation of sucrose and estimation of sugar content of solutions with the help of polarimeter.	10	1

	8. Preparation of buffer solution and pH measurement.		
2	**Nutrition:** 1. Measurement of body mass index (BMI).	1	2
3	**Molecular Biology:** 1. Detection of nucleic acid in biological sample (Ethidium bromide staining method)	1	1
4	**Microbiology:** 1. Culture of bacteria on nutrient agar plate and morphology study 2. Gram staining 3. Isolation of pure colony by streak plate method. 4. Determination of antibacterial activity by disk diffusion method 5. Growth curve study by turbidometry 6. Fungi: Growth of bread mold and observation under microscope	8	1,4

Teaching-Learning approach	Assessment strategy	Reinforcement assignment/Tasks
Lecture, hand on training by providing unknown samples, peer learning, exercise, small group discussion.	Continuous class assessment, SAQ written exam, viva voce, reports, final practical exam, attendance	Feedback, Individual discussion, Counseling

Learning References:

1. Essentials of Practical Biochemistry. Lalit M. Srivastav, Nibhriti Das and Subrata Sinha. CBS Publishers and Distributors, India.

2. Practical Clinical Biochemistry Methods and Interpretations. Ranjna Chawla; (4th Edition) Jaypee Brothers Medical Publishers (P) LTD, New Delhi. London. Philadelphia. Panama.

3. G.H. Jeffery, J. Bassett, J. Mendham and R.C. Denney: Vogel's Qualititative Inorganic Analysis, Longman Scientific & Technical, New York.

4. E.S. Gilreath, Experimental Procedures in Elementary Qualitative Analysis, Mcgraw-Hill.

5. Human Nutrition and Dietetics, Churchill Livingstone, 1993.

6. Practical Microbiology. Dr. R. C. Dubey and Dr. D. K. Maheshwari, S. Chand Publishing, India, 2002.

Course Code	**: BMB-211**
Course Title	**: Viva-voce**
Course Type	**: Core**
Year/Semester	**: 2nd Year**
Course Teacher	**:Assigned Examination Committee**
Credit Value:	**: 2**
Total Marks	**: 50**

Course Description:

Viva Voce is a Latin expression that was used in Catholic seminary education to refer to oral exams (it literally means, "living voice"). Oral exams are used not as a substitute, but as a complement to written exams. They are a way to ask what is not feasible through the written format. Ostensibly, the rationale is that teachers can use the oral format to probe, challenge, and critically assess what a student really knew about a particular topic.

Course objective:

Viva voce will be conducted towards the end of the each semester in the form of oral questions-answers and discussions with the expert academic body (the exam committee) which covering the complete syllabus. This course aims at evaluating the basic understanding of the taught courses.

Course Learning Outcomes **(CLOs):**

CLO No.	**Expected Course Outcomes** Upon completion of this course, the students will be able to:
CLO1	Demonstrate verbally the depth of understanding, thinking and problem solving ability
CLO2	Interact with courage and spontaneity beyond nervousness in face to face interview.
CLO3	Present their concepts systematically in oral form and exhibit preparedness for future job interview.

Assessment Strategies:

Students will have to appear the interview board (the examiners panel) and the panel will judge them based on their understanding the courses that they had attended and grade them in marks.

B.Sc. (Hons.) 3rd Year Examination, 2022

Honours Theory	: 800
Honours Practical	: 200
Honours Viva Voce	: 50
Total : 1050	

Course	Title	Full marks	Unit	Credit
Honours Theory				
BMB – 301	Molecular Biology-II	100	1	4
BMB – 302	Cell Biology	100	1	4
BMB – 303	Physiology-II	100	1	4
BMB – 304	Endocrinology	100	1	4
BMB –305	Protein Technology	100	1	4
BMB –306	Immunology-I	50	0.5	2
BMB –307	Clinical Biochemistry	100	1	4
BMB –308	Metabolism - II	100	1	4
BMB –309	Bioenergetics	50	0.5	2
Honours Practical and Viva Voce				
BMB –310	Laboratory work [Practical + class assessment] (140 + 60)	200	2	8
BMB –311	Viva-voce	50	0.5	2
	Total =	**1050**	**10.5**	**42**

Course Code	**: BMB-301**		
Course Title	**: Molecular Biology-II**		
Course Type	**: Core**		
Year/Semester	**: 3rd Year**		
Course Teacher	**: Professor Dr. Md. Rezaul Karim-3 and Professor Dr. Md. Zahangir Alam Saud**		
Credit Value	**: 4**	**Credit hours/week: 4**	**Total credit hours: 60 (minimum)**
Total Marks	**: 100 (Final Exam: 80 and In-course: 20)**		

Course description:

Molecular Biology is the field of biology that studies the composition, structure and interactions of cellular molecules– such as nucleic acids and proteins – that carry out the biological processes essential for the cell's functions and maintenance. The course will focus on the fundamental principles and technique of molecular biology. Students will gain an in-depth knowledge of nucleic acid structure, molecular genetics and the biochemistry of replication, transcription and protein synthesis. Based on the foundation, students will also explore the mechanisms of gene regulation in prokaryotes and eukaryotes. The topics and contents will also connect between the genotypeand the phenotypein terms of a general and comprehensive molecular theory.

Course objectives:

The overall goals of this course are to

- provide a detailed look at the molecular mechanisms underlying in DNA replication, transcription and translation processes
- explain the principles and mechanisms of gene regulation in prokaryotic and eukaryotic cells
- help to understand the mechanism of gene transfer and consequences of DNA-repair systems

Course Learning Outcomes **(CLOs):**

CLO No.	**Expected Course Outcomes** Upon completion of this course, the students will be able to:
CLO1	understand DNA as genetic material and how the sequence of DNA is connected in cellular structure and functions
CLO2	describe the processes and patterns of information pathways in biological system and the regulation of those pathways
CLO3	explain the processes of gene transfer and recombination along with the mechanism of DNA repairing

Course Plan:

Module	Course contents	Credit hrs	CLOs
1	**Central dogma of molecular Biology:** **a) DNA replication:** DNA polymerases, mode of DNA replication, DNA synthesis, bacterial and eukaryotic DNA replication, inhibitors of replication. **b) Repair mechanisms of DNA:** Mechanism of different types of DNA repair system in E coli **c) Transcription:** Prokaryotic and eukaryotic RNA polymerase, promoter, promoter assay enhancers and terminators, mechanism of transcription, mechanism of RNA splicing, reverse transcription, inhibitors of transcription. **d) Genetic code:** Characteristic features of genetic code, Wobble hypothesis with experimental evidence, gene-protein colinearity. **e) Translation:** Structure of ribosome, initiation, elongation and termination of protein synthesis, inhibitor of protein synthesis, post-translational modification, signal hypothesis.	36	1,2,3
2	**Genetic transformation:** Transduction, conjugation, transfection	10	3
3	**Regulation of gene expression:** Types of gene regulation, regulation of gene expression in prokaryotes, operon model, lactose operon, arabinose operon and tryptophan operon, mechanism of transcription attenuation, catabolite repression. Regulation of gene expression in eukaryotes- gene expression regulation by intercellular and intracellular signals, phosphorylation of nuclear transcription factors. Regulation of the genes of galactose metabolism in yeast.	14	2

Teaching-Learning approach	Assessment strategy	Reinforcement assignment/Tasks
Lecture followed by discussion Participatory question-answer Text books Lecture notes Online resources Video documentation	Class assessment Assignment quiz presentation written exam Attendance	Feedback Individual discussion Counseling

Learning References:

1. Principles of Biochemistry – Lehninger, Nelson and Coxs
2. Molecular Biology of Cell – Bruce Alberts, D. Bray, J. Lewis, M. Raff, K. Roberts, J. D. Watson
3. Biochemistry - Lubert Stryer
4. Genes VI and VII – Benjamin and Lewin
5. Molecular cell biology – Darnell J.; Loddis H. and Baltimore D.

Course Code	**: BMB-302**		
Course Title	**: Cell Biology**		
Course Type	**: Core**		
Year/Semester	**: 3rd Year**		
Course Teacher	**: Professor Dr. Md. Matiar Rahman and Professor Dr. Syed Rashel Kabir**		
Credit Value	**: 4**	**Credit hours/week: 4**	**Total credit hours: 60 (minimum)**
Total Marks	**: 100 (Final Exam: 80 and In-course: 20)**		

Course Description:

Cell biology is the study of cell structure and function, and it revolves around the concept that the cell is the fundamental unit of life. This course will provide an understanding of cell structure and function of various subcellular organelles like mitochondria, lysosome and also the mechanism of vesicular transport system. Students will learn about cell theory, basic cell structure, cell fractionation and cell visualization techniques. Besides, students will have an understanding of membrane transport system of the cell. The process of cell signaling, cell cycle and cell division mechanism will also be discussed in this course.

Course objective:

The overall goals of this course are to

- help the students to understand common features of cellular structure and function – how they obtain energy, synthesize new molecules, communicate, proliferate and survive
- make the student familiar with the structures and purposes of basic components of cells, especially macromolecules, membranes and different organelles
- train the students to understand how to isolate cell and grow it in culture, how to visualize cell structure through microscopic process and how to visualize the molecules in living cells through different techniques
- make the students to understand the cell signaling process and the cellular components underlying mitotic and meiotic cell division

***Course Learning Outcomes* (CLOs):**

CLO No.	Expected Course Outcomes Upon completion of this course, the students will be able to:
CLO1	describe cell structure and its function with giving special emphasis on mitochondria, lysosome, vesicular transport system, cell isolation and growth in culture, cell visualization with microscope and visualization of molecules in living cells with chemical methods
CLO2	analyze and identify the chemical composition of cell membrane and various ways of membrane transport system, cell signaling, cell cycle and cell division
CLO3	solve problems related to the cell structure and the mechanism of different part of the cell

Course Plan:

Module	Course contents	Credit hrs	CLOs
1	**Cell Structure and Function:** Structure and function of cells, isolation and separation of sub-cellular organelles. **(a) Mitochondria:** Organization, function and genetic system of mitochondria; protein import and mitochondrial assembly. **(b) Lysosomes:** Lysosomal acid hydrolases; endocytosis and lysosome formation; phagocytosis and autophagy. **(c) The mechanism of vesicular transport:** Experimental approaches to understanding vesicular transport; Coat proteins and vesicle budding; vesicle fusion.	10	1, 3
2	**Methods used to study cells:** **a) Cell isolation and growth in culture:** Cell isolation by fluorescence-activated cell sorter, cell grown in culture dish, composition of medium for mammalian cell cultivation, eukaryotic cell line, formation of hybrid cell, hybridoma cell line and monoclonal antibodies. **b) Cell visualization:** Looking at the structure of cells in the microscope- light microscopy, fluorescence microscopy, electron microscopy. **c) Visualization of molecules in living cells:** Measurement of intracellular ion concentration with light-emitting indicators, study of intracellular dynamics by light-induced activation of "caged" precursor molecule, use of isotope to trace molecules in cells and organisms by autoradiography.	10	1, 3

3	**Biological membrane and transport:** **(i) Biological membrane:** Chemical composition of cell membrane, major classes of membrane lipid, lipid bilayers and their common structural theme, membrane proteins, membrane models, membrane carbohydrates **(ii) Membrane transport:** Various ways of membrane transport. simple diffusion, facilitated diffusions, active transport its types, primary active transport (Na - K pump), secondary active transport, glucose - Na cotransport system, active transport of sugars into bacteria by group translocations, carrier proteins such as uniports, coupled transporters, symport and antiports.	10	2, 3
4	**Cell signaling:** Signaling molecules and their receptors; function of cell surface receptors; pathways of intracellular signal transduction; signal transduction and the cytoskeleton; signaling in development and differentiation.	10	2, 3
5	**The Cell Cycle:** Phases of the cell cycle, regulation of the cell cycle by cell growth and extracellular signals, cell cycle checkpoints, coupling of S phase to M phase and regulators of cell cycle.	10	2, 3
6	**(a) The Events of mitosis:** Stages of mitosis, MPF and progression to metaphage, proteolysis and inactivation of MPF-anaphase and telophase, cytokinesis. **(b) Meiosis:** Definition, phases of meiosis, synaptonemal complexes, differences between mitosis and meiosis.	10	2, 3

Teaching-Learning approach	**Assessment strategy**	**Reinforcement assignment/Tasks**
Lecture followed by discussion Participatory question-answer Text books Lecture notes Online resources Video documentation	Class assessment Assignment quiz presentation written exam Attendance	Feedback Individual discussion Counseling

Learning References:

4. Molecular Biology of The Cell, 3rd edition. By Bruce Alberts and Danis Bray, et. al.
5. Biochemistry, 3rd edition. By Lubert Stryer
6. Lehninger Principle of Biochemistry by David L. Nelson and Michael M. Cox
7. Genes VI by Benjamin Lewin.

8. Cell and Molecular Biology, 8th edition, E.D.P. De Robertis and E.M.F. De Robertis, Jr.
9. The Cell: A Molecular Approach (4th Edition), Geoffrey M. Cooper and Robert E. Hausman

Course Code	**: BMB-303**		
Course Title	**: Physiology II**		
Course Type	**: Core**		
Year/Semester	**: 3rd Year**		
Course Teacher	**: Professor Dr. Farzana Pervin and Professor Dr. Md. Masudul Hasan Khan**		
Credit Value	**: 4**	**Credit hours/week: 4**	**Total credit hours: 60 (minimum)**
Total Marks	**: 100 (Final Exam: 80 and In-course: 20)**		

Course description:

Physiology is the study of the functions and activities of life and living matter at all levels within an organism. The course aims to introduce the anatomy and physiology of different parts of the body like heart, liver, lymphoid, sensory organs, nervous and reproductive systems. Moreover, this course helps the students to gain in-depth knowledge about how the different parts of body system works. Signs, symptoms and treatment procedures will also be discussed here when malfunctions of different body systems occur.

Course objective:

The overall goals of this course are to

- learn the students to the fundamentals of anatomical structures and physiology of different body organs such as liver, heart, sensory and lymphoid organs, nervous and reproductive systems
- demonstrate the interrelationship between different body systems
- impart knowledge on heart walls, chambers, valves and explain cardiac conduction system, cardiac rhythm and try to make students understand the structure and routes of different blood vessels
- predict and explain the integrated responses of the organ systems of the body to physiological and pathological stresses
- make students understand about the pathological conditions arising from malfunction of the cardiovascular, liver, sensory, lymphatic and reproductive systems

***Course Learning Outcomes* (CLOs):**

CLO No.	Expected Course Outcomes Upon completion of this course, the students will be able to:
CLO1	understand the structure of different body systems and their role in the maintenance of homesotasis
CLO2	explain the functional relationships between various organ systems of the body
CLO3	identify the pathological conditions arising from malfunction of different parts of the body

Course Plan:

Module	Course contents	Credit hrs	CLOs
1	**Liver and biliary system**: **(i)** Physiology and anatomy of liver, functions of liver (storage, metabolic, synthetic and secretory function) **(ii)** Structure and functions of gall bladder and biliary ducts, regulation of biliary secretions, diseases of liver and biliary systems (Hepatitis, Jaundice, Gallstones, etc.)	9	1,2,3
2	**Sensory organs:** **(i) Eye:** Anatomy and function of eye, refractive media of eye ball, error of refraction, visual pathway, photochemical change in rods and cones, visual pigments, dark and light adaptation, colour vision and physiology of vision. **(ii) Ear:** Physiology and anatomy of ear: external, middle and internal ear, mechanism of hearing, audiometry, loss of hearing, hearing aids. **(iii) Skin:** Physiology and anatomy of skin, types and function of skin, sweat glands, physiology of secretion and its regulation, regulation of body temperature, hyper and hypothermic, hibernation.	12	1,2,3
3	**Cardiovascular system:** Heart, chambers of heart and its valves, their functions and locations, cardiac tissues, sino atrial node, (SA node), atrio-ventrichlar node (AV node), Bundle of His. pace maker, artificial and natural cardiac output, systemic pulmonary and coronary blood circulation, blood pressure, structure and function of arteries and veins, systemic cardiovascular diseases (Angina pectoris, Hypertension, MI etc.).	9	1,2,3

4	**Lymphoid system:** Lymph and lymph vessels, lymphatic circulation, primary and secondary lymphoid organs and their structure and functions, lymph nodes, spleen, thymus and bone marrow in immunity.	9	1,2
5	**Reproductive system:** **(i) Male reproductive system:** Spermatogenesis, hormone stimulating spermatogenesis, regulation of male reproductive functions by various hormones, impotency. **(ii) Female reproductive system:** Menstrual cycle, functions of gonadotropic hormones (estrogens, progesterone and luteinizing hormone), ovulation, fertility, functions of placenta, hormonal regulation of pregnancy, lactation, menopause, puberty and SID (Sexual identity disorders) **(iii) Use of contraceptives**: Chemistry and mode of action, their side effects.	12	1,2,3
6	**Nervous system**: Classification of nervous system, Gross structure of the brain (cerebral cortex, hypothalamus, brain stem, cerebellum and spinal cord) and fine structure of the brains (structure and functions of neurons and glial cells)	9	1,2

Teaching-Learning approach	**Assessment strategy**	**Reinforcement assignment/Tasks**
Lecture followed by discussion Participatory question-answer Text books Lecture notes Online resources Video documentation	Class assessment Assignment quiz presentation written exam Attendance	Feedback Individual discussion Counseling

Learning References:

1. Text Book of Medical Physiology. By Guyton and Hall
2. Human Physiology. By C.C. Chatterjee, Vol. 1 and 2.
3. Human Physiology. By Chakrabarti, Ghosh and Sahana.
4. Review of Medical Physiology. By William F. Ganong.

Course Code	**: BMB-304**		
Course Title	**: Endocrinology**		
Course Type	**: Core**		
Year/Semester	**: 3rd Year**		
Course Teacher	**: Professor Dr. Kamal Krishna Biswas and Dr. Md. Ismail Hossain**		
Credit Value:	**: 4**	**Credit hours/week: 4**	**Total credit hours: 60 (minimum)**
Total Marks	**: 100 (Final Exam: 80 and In-course: 20)**		

Course Description:

The subspecialty of endocrinology encompasses a wide array of clinical conditions, from disorders commonly seen in primary care such as diabetes, obesity, thyroid disease, osteoporosis, hypogonadism and secondary adrenal insufficiency, to other disorders such as primary adrenal insufficiency, parathyroid, pituitary, adrenal and pancreas. The course will provide an understanding of the structures and function of endocrine glands. Vast amounts of information and knowledge are accumulating rapidly concerning metabolism and endocrinology. Their tremendous importance is being increasingly recognized, especially in the light of new advances in medicine, because all diseases, including psychiatric and genetic abnormalities, are associated with metabolic changes. Furthermore, in all body cells, hormones influence the metabolism of nucleotides, proteins, lipids, carbohydrates, vitamins, water, and therefore, knowledge of endocrinology and metabolism is important in every branch of medicine.

Course objective:

The overall goals of this course are to

- provide the students with a broad understanding of the major human endocrine glands and their hormones, together with understanding of hormones action and their effect on target cell
- become familiar the students with the medical conditions resulted from abnormal hormone secretion and the laboratory tests that are used to diagnose these conditions
- aware the students of clinical problem-solving skills needed to evaluate and manage common endocrine disorders

Course Learning Outcomes **(CLOs):**

CLO No.	**Expected Course Outcomes** Upon completion of this course, the students will be able to:
CLO1	identify the location, innervations, anatomical relations and development of the endocrine glands and describe clinical manifestations of conditions resulting from hyper- and- hypo secretion of each endocrine gland
CLO2	know the chemical nature of hormones, the relationship between structure, function and synthesis of hormones

CLO3	know quantitative aspects of hormonal action in relation to endocrine disorder, the role of hormones as a regulatory factor of a living system, the neurotransmitters and their relation with some diseases

Course Plan:

Module	Course contents	Credit hrs	CLOs
1	**Characteristics of hormonal system:** Introduction, general functions of hormones, major endocrine glands, paracrine, autocrine, juxtacrine and intracrine actions of hormone, hormone receptors and its abnormalities, factors affecting hormonal secretion.	6	1,2
2	**Hormone receptors and their mode of action:** Intracellular messengers, synthesis and mode of action of 3'5' cyclic AMP and functions of 3^{-} 5^{-} cyclic AMP, adrenergic receptor, mechanism of action of peptide hormone, amine hormones, and steroid hormones.	6	1,2,3
3	**Pituitary and hypothalamic hormones:** Introduction, structure and synthesis, physiological and biochemical action of pituitary and hypothalamic hormones. Abnormalities of growth hormone secretion.	7	1,2
4	**Thyroid and parathyroid hormones:** Introduction, structure, synthesis, transportation, mechanism of action and pathophysiology.	7	1,2,3
5	**Hormones of adrenal cortex:** Introduction, chemistry, biosynthesis, regulation, transport, mechanism of action and pathophysiology, physiological functions of cortisol and aldosterone.	6	1,2,3
6	**Hormones of adrenal medulla:** Introduction, structure, biosynthesis, release, metabolism and mechanism of action.	7	1,2
7	**Hormones of gonads:** Structure, biosynthesis, metabolism, mechanism of action.	5	1,2
8	**Pancreatic hormones (insulin, glucagons):** Structure, synthesis, secretion, distribution and degradation and mode of action.	7	1,2,3
9	**Gastrointestinal hormone family:** Cholecystokinin, gastrin, secretin, leptin, VIP (vasoactive intestinal polypeptides).	5	1,2

10	**Hormone assay techniques:** RIA, ELISA.	4	3

Teaching-Learning approach	**Assessment strategy**	**Reinforcement assignment/Tasks**
Lecture followed by discussion Participatory question-answer Text books Lecture notes Online resources Video documentation	Class assessment Assignment quiz presentation written exam Attendance	Feedback Individual discussion Counseling

Learning References:

1. Text Book of Medical Physiology by Guyton
2. Text Book of Biochemistry with Clinical Correlation by Thomas M. Delvin
3. Human Physiology by Chakrabarti, Gosh and Sahana
4. Harper's Biochemistry by Robert K. Murray et. al.
5. Textbook of Biochemistry: A.S. Saini
6. Lecture Notes on Endocrinology: Willium Jeffcoate.

Course Code	**: BMB-305**		
Course Title	**: Protein Technology**		
Course Type	**: Core**		
Year/Semester	**: 3rd Year**		
Course Teacher	**: Professor Dr. Narayan Roy and Md. Nurujjaman**		
Credit Value:	**: 4**	**Credit hours/week: 4**	**Total credit hours: 60 (minimum)**
Total Marks	**: 100 (Final Exam: 80 and In-course: 20)**		

Course Description:

This course will focus on the development of skills in protein isolation, purification and characterization from animal and plant sources. This course helps students to know how to use the techniques and methodologies of cell disruption, centrifugation, various kinds of chromatography, electrophoresis, sequence determination, X-ray and crystallography. The topics and contents are designed to satisfy for adequate exposure in the areas of protein

technology as well as this technology is a key innovator in the fields of recombinant protein, protein engineering, biotherapeutics and biosensors.

Course objectives:

The overall goals of this course are to

- provide knowledge on isolation and purification of protein from animal and plant sources.
- aware the students using the protein purification techniques consciously.
- train the students to determine sequence and form crystal from proteins.
- develop the skills of proper application of the techniques discussed in this course.

Course Learning Outcomes (CLOs):

CLO No.	Expected Course Outcomes Upon completion of this course, the students will be able to:
CLO1	describe the techniques of isolation, purification and characterization of proteins
CLO2	analyze, purify and sequence the isolated proteins from animal and plant sources
CLO3	solve problems related to the character and purity of proteins with industrial and medicinal importance

Course Plan:

Module	Course contents	Credit hrs	CLOs
1	**Isolation of Proteins:** Cell disruption techniques, solubilization and stabilization of proteins, precipitation with organic solvent, organic polymers and others affinity precipitation, precipitation by selective denaturation.	8	1
2	**Purification and Characterization of Proteins:** **(i) Basic idea on Chromatography:** TLC and Column chromatography, HPLC and FPLC. **a) Gel-permeation chromatography:** Principle, choice of gel, determination of molecular weight of protein by gel filtration chromatography. **b) Ion-exchange and Affinity chromatography:**	15	1, 2

	Synthetic resins, CM- and DEAE, cellulose, sephadex, sephacel and agarose. **c) Adsorption chromatography:** Hydroxylapatites, procion dye- ligand agarose. **d) Hydrophobic chromatography:** Theory and application of the true form, mixed function ion-exchange/hydrophobic columns. **(ii) Electrophoresis:** Principle, matrix constituents of gels, polymerization and pore size, buffer system, gels with additives, fixation, staining and destaining of gel, determination of molecular weight of protein.		
3	**Ultracentrifugation:** Sedimentation coefficient, Svedberg units, sedimentation equilibrium, density gradient sedimentation, and determination of molecular weight by ultracentrifugation.	8	1, 2
4	**Sequence determination of proteins:** Homologus proteins, folding mechanism of proteins, factor affecting the thermal stability of proteins, structure of myoglobin and ribonuclease.	9	2, 3
5	**X-ray and neutron diffraction techniques:** Structural studies of macromolecules, Crystallization, crystals and their properties, X-ray sources and detectors, X-ray data collection, theory of X-ray diffraction by a crystal.	9	1, 2, 3
6	**Protein Engineering:** Basic outlines and rationale of protein (enzyme) engineering, steps involved, protein modeling, protein engineering methods (Site selection, mutagenesis and gene modification for protein engineering), development of multienzyme systems (bi-and polyfunctional enzymes) by gene fusion, advantages of multienzymes. Chemical modification of enzymes. Application of protein engineering.	11	2, 3

Teaching-Learning approach	**Assessment strategy**	**Reinforcement assignment/Tasks**
Lecture followed by discussion Participatory question-answer Text books Lecture notes Online resources Video documentation	Class assessment Assignment quiz presentation written exam Attendance	Feedback Individual discussion Counseling

Learning References:

1. Protein Purification by Robert K. Scopes.
2. Protein purification protocols by Shawn Doonan
3. Protein Biochemistry and proteomics by Hubert Rehm.
4. Physical Biochemistry by David Freifelder.
5. Principles of Protein X-ray Crystallography, by Jan Drenthe.
6. Principles of Biochemistry- Lehninger, Nelson and Coxs.
7. Gel Chromatography – Tibor Kremmer and Laszlo Boross.
8. Introduction to Chromatography- Subhas Chandra paul.

Course Code	**: BMB-306**		
Course Title	**: Immunology-I**		
Course Type	**: Core**		
Year/Semester	**: 3rd Year**		
Course Teacher	**: Professor Dr. Farjana Nikkon** **Professor Dr. Md. Khaled Hossain**		
Credit Value:	**: 2**	**Credit hours/week: 2**	**Total credit hours: 30 (minimum)**
Total Marks	**: 50 (Final Exam: 40 and In-course: 10)**		

Course Description:

Immunity is a defense system of human body that plays a central role against infectious diseases. Moreover, immunity is found to be implicated in other non-infectious diseases including cancer, diabetes, arthritis, and a variety of congenital and life-style-related diseases. Biochemistry deals with the molecular basis of living organism. Since immune system is an integral part of living organism, understanding immunology is critically important for the students who undertake the course of Biochemistry and Molecular Biology. The courses of immunology has been designed to take students step by step through fundamental components of immune system, activation and effector functions of the immune components, development of vaccines, immunopathogenesis and immunological techniques used for laboratory research and clinical diagnosis. As an initial step, we offer basic immunology course for the undergraduate students. The major contents of the initial course are historical background of the development of immunology and basic components of immune system and their fundamental functions.

Course objective:

The overall goals of this course are to

- provide students with historical background and basic concept of immunology
- gain a basic understanding on types and components of immune system
- learn about the structures and their function of immune components
- learn about activation, proliferation and differentiation of immune components
- have a good understanding of antigen recognition, processing, and presentation

Course Learning Outcomes **(CLOs):**

CLO No.	Expected Course Outcomes Upon completion of this course, the students will be able to:
CLO1	demonstrate the basic knowledge about immunology and outline the cells and molecules that are being a part of the innate and adaptive immune defense
CLO2	understand the development of T and B cell, functions and some special tasks of other immune cells involved in immune system
CLO3	describe the molecular structures of antibodies, antigens, and chemical basis of the binding with their receptors and explain antigen processing, presentation and functions of antigen-presenting molecules

Course Plan:

Module	Course contents	Credit hrs	CLOs
1	**1. Introduction to immunology:** i) Historical development of immunology, contribution of Edward Jenner and Louis Pasteur in the development of immunology, definition of immunology, immunity, immune system, ii) Innate and adaptive immunity, principal components of the innate and adaptive immunity, types of adaptive immune response, active and passive immunity, cardinal feature of adaptive immune response, clonal selection hypothesis, two signal hypothesis of lymphocyte activation, role of costimulator and CD40 in T and B cell activation, proliferation and differentiation of lymphocytes.	7	1
2	**Cells and tissues involved in immuneresponse:** Lymphocytes, classification of lymphocytes, hematopoiesis, maturation stages of B and T lymphocytes, role of thymus in T cell maturation, natural killer cell, antigen-presenting cells, langerhans cell, dendritic cells, mononuclear phagocytes, polymorphonuclear granulocytes (neutrophils, eosinophils, basophils, mast cell), platelets.	7	1, 2
3	**Antibodies and antigens:** Definition, classification, functions, general and molecular structure of antibody, theories of antibody diversification, antibody receptors, definition of antigen, determinants (epitopes), hapten, immunogen, structural and chemical basis of antigen binding, structure-function relationship within antibody molecules.	5	3
4	**The Major Histocompatibility Complex (MHC):**	5	3

	Discovery of MHC molecules, general features of MHC genes, structure of MHC molecules (class-I and class-II), binding of peptides to MHC molecules.		
5	**Antigen processing and presentation of T lymphocytes:** Properties of antigen recognized by T lymphocytes, processing and presentation of antigen to $CD4^+$ helper T lymphocytes and $CD8^+$ cytolytic T lymphocytes.	6	3

Teaching-Learning approach	**Assessment strategy**	**Reinforcement assignment/Tasks**
Lecture followed by discussion Participatory question-answer Text books Lecture notes Online resources Video documentation	Class assessment Assignment quiz presentation written exam Attendance	Feedback Individual discussion Counseling

Learning References:

1. Cellular and Molecular Immunology – A. K. Abbas, A. H. Licistman, J. S. Pober
2. Roitt's Essential Immunology – Ivan Roitt
3. Immunology – Roitt and Brostoff
4. Understanding Immunology- Peter Wood
5. Medical Immunology – Daniel P. Stites, Abba I. Terr, Tristram G.
6. Molecular Biology of Cell – Bruce Alberts, D. Bray, J. Lewis, M. Raff, K. Roberts, J. D. Watson
7. Microbiology Concepts Application M.J. Pelczer, E.C. Chan, Noel R. Krieg

Course Code	**: BMB-307**		
Course Title	**: Clinical Biochemistry**		
Course Type	**: Core**		
Year/Semester	**: 3rd Year**		
Course Teacher	**: Professor Dr. Md. Rezaul Karim-2 and Professor Dr. Md. Amirul Islam**		
Credit Value:	**: 4**	**Credit hours/week: 4**	**Total credit hours: 60 (minimum)**
Total Marks	**: 100 (Final Exam: 80 and In-course: 20)**		

Course Description:

Clinical Biochemistry will provide a solid background in the discipline to prepare students to undertake further advanced studies or to commence work in either a diagnostic or research setting. This course builds on the foundational knowledge acquired in the clinical biochemistry studies with a more in-depth study of human biochemistry in health and disease. Clinical Biochemistry explores the physiology and pathophysiology of major human organ systems and the metabolism of important macro and micronutrients. This course also provides an overview of the major homeostatic mechanisms in the human body and explores the pathophysiology and associated laboratory investigation of homeostatic disturbances. The effect of pre-analytical, analytical and post-analytical factors on biochemical data, the establishment and use of reference ranges and the nature and importance of quality control and quality assurance procedures are also investigated. This course also provides an overview of the analytical methods, and analytical instrumentation used in clinical biochemistry laboratories and investigates the health and safety issues associated with working in a clinical biochemistry laboratory.

Course objective:

The overall goals of this course are to

- familiarize students with the specific characteristics of a laboratory of clinical biochemistry
- develop understanding on the patho-physiology and molecular basis of the most prevalent diseases
- learn the analytical methods commonly used in the clinical laboratory
- aware student of the application of metabolites and enzymes as tools for clinical diagnosis

Course Learning Outcomes **(CLOs):**

CLO No.	**Expected Course Outcomes** Upon completion of this course, the students will be able to:
CLO1	examine acid-base balance and the regulatory mechanisms within the body to calculate and interpret the anion gaps from different case scenarios
CLO2	identify inborn defects in metabolism and correlate them with deficiency of key metabolic enzymes assayed in the clinical laboratory, and describe their common methods of analysis, and clinical significance
CLO3	solve problems related to the basic laboratory mathematics necessary to perform tests, make dilutions, and prepare solutions

Course Plan:

Module	Course contents	Credit hrs	CLOs
1	**Introduction:** Clinical Biochemistry and its relationship with surgery, medicine, clinical pathology etc; hazards in clinical laboratory and preventive measures.	5	**1**
2	**The acquisition and interpretation of biochemical data:** Introduction, pre-analytical factors, analytical factors, the quality of results (normal and abnormal), the interpretation of results and the predictive value of test.	6	**1, 3**
3	**Handling of Specimen:** Collection, storage, handling and processing of blood, CSF, urine, feces and swab samples for clinical tests.	6	**1**
4	**Clinical application of enzymes and isoenzymes:** alanine aminotransferase (ALT), aspertate aminotransferase (AST), creatine Kinase (CK), lactate dehydrogenase (LDH), amylase, acid phosphatase (ACP); alkaline phosphatase	6	**1, 2, 3**
5	**Investigation of acute chest pain and the acute abdomen:** Introduction, chest pain, the acute abdomen (acute pancreatitis, acute porphyria, ectopic pregnancy) causes and diagnosis.	6	**1, 3**
6	**Metabolites and electrolytes as diagnostic tools:** Metabolites-glucose, bilirubin, blood urea nitrogen (BUN), creatinine and lipids profiles; electrolytes- sodium, potassium, chloride and bicarbonate, theirclinical applications.	8	**1**
7	**Genetic disorders and their diagnosis:** Definition, classification, genetic basis of biochemical disorders and their transmission, diagnosis and apparent treatment examples; PKU, alkaptonuria; galactosemia, fructose intolerance, lipid storage disease (Gaucher's, Niemen Pick), hypercholesterolmia, glycogen storage diseases (Gierke's disease, Pompe's disease, Curi's disease), sickle cell anemia, thalassemia, hemolytic anemia.	8	**3**
8	**Multifactorial diseases and their management:** Diabetes, rheumatoid and osteoarthritis, gout, acidosis and alkalosis, tropical and non tropical sprue and atherosclerosis, hypercholesteromia.	8	**1, 2, 3**
9	**Diseases of the muscle and their investigation:** Routine biochemical studies, non-metabolic genetically determined myopathies, genetically determined metabolic myopathies	7	**1, 2**

	(disorders of carbohydrate metabolism, defects of the respiratory chain, and defects of fatty acid oxidation).		

Teaching-Learning approach	Assessment strategy	Reinforcement assignment/Tasks
Lecture followed by discussion Participatory question-answer Text books Lecture notes Online resources Video documentation	Class assessment Assignment quiz presentation written exam Attendance	Feedback Individual discussion Counseling

Learning References:

1. Clinical Biochemistry, J, MARSHAL and K. BANGERT.
2. Clinical Biochemistry, A, L. LATNER.
3. Practical Clinical Biochemistry, Gowen Lock and Others.
4. Advanced Text Book on Food and Nutrition Vol-I and II, Dr.M. Swaminathan
5. Fundamentals of Biochemistry, Dr. A.C. DEV.

Course Code	**: BMB-308**		
Course Title	**: Metabolism-II**		
Course Type	**: Core**		
Year/Semester	**: 3rd Year**		
Course Teacher	**: Professor Dr. Md. Shahidul Haque and Dr. Subed Chandra Dev Sharma**		
Credit Value:	**: 4**	**Credit hours/week: 4**	**Total credit hours: 60 (minimum)**
Total Marks	**: 100 (Final Exam: 80 and In-course: 20)**		

Course Description:

Consumption of different food stuffs and their degradation as well as resynthesis are major and important aspects of metabolism. Among the food stuffs, carbohydrate, protein and lipids are the macromolecules. These molecules are degraded in the GIT to produce very small molecules which are utilized by the body to get energy to do mechanical works. The smaller units of foods are used again to make macromolecules for the growth of body. Liver is a major organ for metabolism of glucose, amino acids, fatty acids and nucleotides. Blood is also recognized to be as a major tissue where diverse molecules are present. Therefore, the metabolism of these molecules is very important. This course deals with the study of metabolism of amino acids, nucleotides and other compounds such as folic acid, glutathione, xenobiotics etc. Students taking this course are expected to have some knowledge on

metabolic disorders related to glucose, amino acids, fats and nucleotides and their preventive approaches. The students will learn regarding the uptake of glucose into the different tissues. This course will also discuss the generation of heat by the utilization of fat in living organisms in adverse environment.

Course objectives:

The overall goals of this course are to

- make the students familiar with the catabolism of amino acids, nucleotides, xenobiotics, heme and bile pigments as well as their anabolic processes
- aware the students about the metabolic disorders, their causes and prevention
- develop knowledge about metabolic regulation and integration in different peripheral tissues as well as central tissues
- make the concept on the utilization of glucose in the peripheral tissues through different glucose transporter system and the regulatory mechanism on enhancing glucose uptake in certain peripheral tissues
- introduce about thermogenesis process during adverse environmental circumstances and how the different fuel molecules like glucose and fat involved in this process

Course Learning Outcomes **(CLOs):**

CLO No.	**Expected Course Outcomes** Upon completion of this course, the students will be able to:
CLO1	describe the metabolic reactions of amino acids, nucleotides and other endogenous substance in different tissues
CLO2	analyze, interrelate and identify the metabolic reactions that are vital for healthy life
CLO3	solve the problems related to amino acids, nucleotides, glucose and fat metabolism

Course Plan:

Module	**Course contents**	**Credit hrs**	**CLOs**
1	**Amino acid metabolism:** Glucogenic and ketogenic amino acids, oxidative degradation of amino acids to specialized products, amino acid biosynthesis, regulation of amino acid metabolism, metabolism of folic acid, glutathione, methylmalonate.	8	1,3
2	**Nucleotide metabolism:** Over view of metabolism, functions of nucleotide, synthesis of purine and pyrimidine nucleotides, formation of deoxyribonucleotides, regulation of nucleotides biosynthesis. Nucleotide degradation, biosynthesis of nucleotide coenzymes, nucleotide metabolizing enzymes as a function of cell cycle and rate of cell division, antimetabolites of purine and pyrimidine nucleotide metabolism, Lesch Nyhan syndrome,	8	1,3

	orotic aciduria.		
3	**Metabolic interrelationship:** Overview, starve-feed cycle, mechanisms involved in switching the metabolism of the liver between the well fed state and starved state, metabolic interrelationship of tissues in various nutritional and hormonal states, metabolism in exercise.	8	2,3
4	**Metabolism of porphyrins, heme and bile pigments**	6	1
5	**Metabolism of individual tissues (in brief):** Skeletal muscle, cardiac muscle, adipose tissue, liver, kidney, nervous tissue, lung, blood cells and skin.	7	1
6	**Xenobiotics:** Introduction, general properties of xenobiotic metabolites, role of liver in such metabolism. Characteristics of P_{450}, conjugation, reduction, hydrolysis and oxidation as methods of xenobiotic metabolism.	7	1
7	**Integration and hormonal regulation of mammalian metabolism:** Glucose transporters, glucose uptake through glucose transporters and its regulation by hypothalamus; β-adreno-receptors (β_1, β_2, β_3), β-adreno-receptor-agonists and antagonists, β_3 adrenergic systems on glucose uptake in peripheral tissues, impact of catecholamines on white and brown fat cell functions, involvement of adrenoreceptor sub-types, 2-deoxyglucose method, hormonal regulations of fuel metabolism; signaling by the neuroendocrine system, signal processing by peptide and catecholamine hormones.	8	2,3
8	**Adaptive thermogenesis:** Definition, factors influencing adaptive thermogenesis, cold-induced thermogenesis, diet-induced thermogenesis, regulation of adaptive thermogenesis by the brain, mitochondrial energy metabolism during adaptive thermogenesis, mechanism of cold-induced thermogenesis in BAT, adaptive thermogenesis in skeletal muscles and regulation of mitochondrial genes in adaptive thermogenesis.	8	2,3

Teaching-Learning approach	**Assessment strategy**	**Reinforcement assignment/Tasks**
Lecture followed by discussion Participatory question-answer Text books Lecture notes Online resources Video documentation	Class assessment Assignment quiz presentation written exam Attendance	Feedback Individual discussion Counseling

Learning References:

1. Principles of Biochemistry, Albert Lehninger.

2. The Pharmacological Basis of Therapeutics by Goodman and Gilman.

3. Biochemistry, 3rd edition. By Lubert Stryer

4. Fundamental of Biochemistry. By Dr. A. C. Dev

Course Code	**: BMB-309**		
Course Title	**: Bioenergetics**		
Course Type	**: Core**		
Year/Semester	**: 3rd Year**		
Course Teacher	**: Professor Dr. M. Mominul Haque and Dr. Imtiaj Hasan**		
Credit Value:	**: 2**	**Credit hours/week: 2**	**Total credit hours: 30 (minimum)**
Total Marks	**: 50 (Final Exam: 40 and In-course: 10)**		

Course Description:

This course is designed to familiarize the students with the relationship between bioenergetics and metabolism. It will provide principle information concerning the importance of order (organization) to living systems and explain the theoretical concept of energy. Utilization of energy-rich compounds, their assembly and energetics of biomolecules will be discussed. Biological oxidation-reduction reactions and oxidative phosphorylations will be covered and will assist the students to study molecular mechanisms in respiration and photosynthesis.

Course objective:

The overall goals of this course are to

- aware the students of the importance of organization to living systems, sources of energy supply of the processes running in the living organisms and molecular mechanisms of the energy
- make the students familiar with the basic forms of energy necessary for cellular functions, energy transformation at the cellular level, structure and role of high-energy compounds, the ways of ATP synthesis and uses of ATP energy in the cell and understanding the two-fold process of photosynthesis
- train the students using spectroscopic and other physical and analytical methods for studying membrane processes as well as biological redox processes in the laboratory/industry

Course Learning Outcomes **(CLOs):**

CLO No.	Expected Course Outcomes Upon completion of this course, the students will be able to:
CLO1	describe the common redox components and processes of electron transport proteins and explain the thermodynamic principles of biological energy conversion as well as the molecular mechanisms of photosynthesis
CLO2	analyze, identify and interpret the structure and topology of membrane protein complexes and mechanisms of different kinds of energy converting systems in living organisms
CLO3	solve problems related to the utilization of proton gradient to drive the formation of high energy bonds and mechanism of action of enzymes, redox carriers and the oxidative phosphorylation machinery

Course Plan:

Module	Course contents	Credit hrs	CLOs
1	**Bioenergetics and metabolism:** The cycling of carbon dioxide and oxygen between autotroph and heterotrophs, cycling of nitrogen in the biosphere, energy relationship between catabolic and anabolic pathways.	6	1
2	**Bioenergetics and thermodynamics:** Biological energy and law of thermodynamic- Free energy, entropy and heat content and their impact on biology, free energy changes and equilibrium constant in biochemical systems, phosphate group transfer and ATP; other phosphorylated compounds and free energy of hydrolysis, utilization of ATP in firefly flashes, assembly of informational macromolecule, active transport and muscle contraction, energetics of glucose and fatty acid metabolism and thermodynamic efficiency, comparison of the energetics of fermentation and respiration.	9	1, 3
3	**Biological oxidation-reduction reaction:** Flow of electron and biological work, oxidation-reduction reaction and half reaction, ways of electron transfer from one molecule to another, measurement of reduction potential, relationship of standard reduction potentials with free energy, universal electron carriers.	7	1, 2, 3
4	**Oxidative Phosphorylation:** Salient feature of oxidative phosphorylation, structure of mitochondria, redox potential and free-energy change, description of electron transport chain, three dimensional structure of cytochrome c and its structural conservation, the chemiosmotic hypothesis and its evidence,	10	1, 2, 3

	evidence of generation of proton gradient, structure of ATP synthase, binding change mechanism for ATP synthase, glycerol phosphate and malate-aspartate shuttles for entry of electrons from cytoplasmic NADH into mitochondria, function of ATP-ADP translocase, respiratory control, short-circuit of proton gradient, power transmission by proton gradient.		
5	**Photosynthesis:** Definition, thylakoid membrane, discovery of basic equation of photosynthesis, trapping of solar energy by chlorophyll, photosynthetic unit, O_2 evolution in photosynthesis, Hill reaction, photosystem I and II, mechanism of formation and release of O_2, pathway of electron flow from H_2O to $NADP^+$, electron flow in cyclic photophosphorylation, ATP synthase of chloroplast, Calvin cycle, dark and light reaction, C_4 pathway of tropical plants.	8	1

Teaching-Learning approach	**Assessment strategy**	**Reinforcement assignment/Tasks**
Lecture followed by discussion Participatory question-answer Text books Lecture notes Online resources Video documentation	Class assessment Assignment quiz presentation written exam Attendance	Feedback Individual discussion Counseling

Learning References:

1. Principles of Biochemistry by Albert Lehninger, David L. Nelson and Michael M. Cox.
2. Biochemistry by Lubert Stryer.
3. Biochemistry by J. David Rawn.
4. Text Book of Biochemistry by Thomas M. Delvin.

Course Code	**: BMB-310**		
Course Title	**: Laboratory Work**		
Course Type	**: Core (Practical)**		
Year/Semester	**: 3rd Year**		
Course Teacher	**: Assigned Course Teachers**		
Credit Value:	**: 8**	**Credit hours/week: 6**	**Total credit hours: 120 (minimum)**
Total Marks	**: 200 (Final Exam: 140 and Class assessment: 60)**		

Course Description:

This course deals with some fundamental experiments related to basic and clinical biochemistry, haematology, microbiology and pharmaceutical analysis to provide students with the foundations in respective fields. This course will develop competency within student in clinical and haematological techniques conducted in clinical and pathology laboratories, including blood collection procedures, estimation of biomolecules in serum, complete blood count, blood grouping, differential count and coagulation tests. The course also aims at providing practical experiences to work with enzyme kinetics, analysis of active ingredients in pharmaceutical products and isolation of different types of bacteria.

Course objective:

The overall goals of this course are to:

- familiarize the students with isolation, estimation and identification of different biomolecules in serum and other sources
- provide a better understanding of the most important basics techniques and test procedures that are applied in routine hematology studies
- develop the practical knowledge and understanding in Enzyme kinetic behaviour and mechanisms
- train students to analyze active ingredients in pharmaceutical products

Course Learning Outcomes (CLOs):

CLO No.	Expected Course Outcomes Upon completion of this course, the students will be able to:
CLO1	demonstrate the skills and competency in the actual performance of basic hematologic tests thereby identifying and responding properly to relevant ethical issues arising in hematological patient care
CLO2	competently perform laboratory techniques and appropriately use key equipments to carry out fundamental tests of clinical biochemistry and also appreciate the

	importance of the course in the diagnosis and treatment of disease
CLO3	Study the enzyme kinetic behaviour and mechanisms in research and estimate the active ingredients of pharmaceutical products thereby assuring the quality of drugs

Course Plan:

Module	Course contents	No. of classes (1 class = 3 credit hrs)	CLOs
1	**Basic Biochemistry** 1. Estimation of calcium by titration with potassium permanganate 2. Isolation of casein by precipitation at its isoelectric point 3. Identification of amino acids and sugar by paper chromatography. **Clinical Biochemistry** 1. Estimation of protein by Lowry method. 2. Estimation of creatinine from supplied and blood serum. 3. Estimation of blood glucose 4. Estimation of serum cholesterol	18	2
2	**Hematology** 1. Determination of hemoglobin % 2. Determination of blood groups 3. Differential counts of blood cells. 4. Measurement of blood pressure. 5. Determination of blood clotting time. 6. Determination of bleeding time.	15	1
3	**Enzymology** 1. Determination of K_m and V_{max} of an enzyme. 2. Study of salivary amylase **Pharmaceutical Estimation** Estimation of cephalosporin antibiotics (ceftriaxone and cephalexin) **Microbiology** Isolation of lactose fermenting bacteria.	7	3

Teaching-Learning approach	Assessment strategy	Reinforcement assignment/Tasks
Lecture followed by discussion Text books Lecture notes Group discussion Online resources Demonstration for different Laboratory techniques Power-point demonstration	Lab assessment Presentation Viva voce Written exam Practical Exam	Feedback Individual discussion Counseling

Learning References:

1. Practical Clinical Biochemistry methods and Interpretations: Ranjana Chawla.
2. Essentials of Practical Biochemistry: Lalit M. Srivastava, Das, Sinha.
3. Essentials of Practical Biochemistry. Lalit M. Srivastava, Nibhriti Das and Subrata Sinha. CBS Publishers & Distributors, India.
4. Practical Clinical Biochemistry Methods and Interpretations. Ranjna Chawla; (4th Edition) Jaypee Brothers Medical Publishers (P) LTD, New Delhi. London. Philadelphia. Panama.

Course Code	**: BMB-311**
Course Title	**: Viva-voce**
Course Type	**: Core**
Year/Semester	**: 3rd Year**
Course Teacher	**: Assigned Examination Committee**
Credit Value:	**: 2**
Total Marks	**: 50**

Course Description:

Viva Voce is a Latin expression that was used in Catholic seminary education to refer to oral exams (it literally means, “living voice”). Oral exams are used not as a substitute, but as a complement to written exams. They are a way to ask what is not feasible through the written format. Ostensibly, the rationale is that teachers can use the oral format to probe, challenge, and critically assess what a student really knew about a particular topic.

Course objective:

Viva voce will be conducted towards the end of the each semester in the form of oral questions-answers and discussions with the expert academic body (the exam committee) which covering the complete syllabus. This course aims at evaluating the basic understanding of the taught courses.

Course Learning Outcomes (CLOs):

CLO No.	Expected Course Outcomes Upon completion of this course, the students will be able to:
CLO1	demonstrate verbally the depth of understanding, thinking and problem solving ability
CLO2	interact with courage and spontaneity beyond nervousness in face to face interview
CLO3	present their concepts systematically in oral form and exhibit preparedness for future job interview

Assessment Strategies:

Students will have to appear the interview board (the examiners panel) and the panel will judge them based on their understanding the courses that they had attended and grade them in marks.

B.Sc. (Hons.) 4th Year Examination, 2023

Honours Theory	: 750
Project work/ In-plant training	: 50
Honours Practical	: 200
Honours Viva Voce	: 50
Total : 1050	

Course	Title	Full marks	Unit	Credit
Honours Theory				
BMB – 401	Molecular Biology and Genetic Engineering	100	1	4
BMB – 402	Basic Bioinformatics	50	0.5	2
BMB – 403	Biotechniques	100	1	4
BMB – 404	Industrial Biotechnology	50	0.5	2
BMB– 405	Plant Biotechnology	50	0.5	2
BMB– 406	Pharmaceutical Biochemistry	100	1	4
BMB– 407	Immunology-II	100	1	4
BMB– 408	Oncology	100	1	4
BMB– 409	Neurochemistry	50	0.5	2
BMB– 410	Enzyme Technology	50	0.5	2
Honours Practical and Viva Voce				
BMB– 411	Laboratory work [Practical + class assessment] (140 + 60)	200	2	8
BMB– 412	Viva-voce	50	0.5	2
Project work/ In-plant training				
BMB– 413	Project work/ In-plant training	50	0.5	2
	Total =	**1050**	**10.5**	**42**

Course Code	**: BMB-401**		
Course Title	**: Molecular Biology and Genetic Engineering**		
Course Type	**: Core**		
Year/Semester	**: 4th Year**		
Course Teacher	**: Professor Dr. Md. Habibur Rahman and Dr. Md. Golam Sarowar Jahan**		
Credit Value:	**: 4**	**Credit hours/week: 4**	**Total credit hours: 60 (minimum)**
Total Marks	**: 100 (Final Exam: 80 and In-course: 20)**		

Course Description:

This course gives knowledge of molecular biology and genetic engineering and about the techniques that are used in this area. Genetic engineering is a technology that has been developed based on our fundamental understanding of the principles of molecular biology and this is reflected in the contents of this course. This technology has revolutionized the way of modern biological research and has impacted mankind with a number of biological products and processes.

Course Objective:

The overall goals of this course are to

- familiarize the students with the basic concept in genetic engineering
- acquaint the student to versatile tools and techniques employed in genetic engineering and recombinant DNA technology
- provide the platform through which students will learn about the basic tools to work with DNA and general methods for cloning of DNA sequences
- help the students to acquire knowledge on advanced strategies of genetic engineering to make biotech products

Course Learning Outcome (CLO):

CLO No.	Expected Course Outcomes
CLO1:	The students will have knowledge of tools and strategies used in genetic engineering, understanding of the applications of recombinant DNA technology and genetic engineering from academic and industrial perspective.
CLO2:	Students can use and apply the knowledge of genetic engineering in problem solving and practice and in conjugation with the practical in molecular biology and genetic engineering, the students should be able to take up biological research as well as placement in the relevant biotech industry.
CLO3:	Given the impact of genetic engineering in modern society, the students should be endowed with strong theoretical knowledge of this technology.

Course Plan:

Module	Course contents	Credit hrs	CLOs
1	Enzymes used in genetic engineering, DNA-polymerases, ligases, reverse-trascriptases, S1 nuclease, exonucleases and endonucleases.	10	1,2,3
2	Gene linkage and chromosomes mapping, gene mapping of human chromosomes.	06	2,3
3	**Transposons and Retroposons:** Bacterial transposons, definitions, differences among transposons, retroposons and IS elements, general features of transposons, structures of typical transposons (T_n3, T_n9), model for the transposition, transposons in eukaryotes (T_y element in yeast) mobile elements in eukaryotes (pseudogenes and Alu sequences)	10	2,3
4	**Gene manipulation:** **a) Genetic recombination:** General recombination by base pairing, interactions between complementary strands of two homologous DNA molecules, recA protein. **b) Models of recombination:** The Holliday model, Meselson-Radding model, Single strand uptake in E. Coli, Proteins involved in recombination (RecA), SOS repair, recombination in yeast. **c) Genetic Engineering:** Joining of DNA molecules, cohesive and blunt end joining, addition of linker, adaptors and homopolymers, constructions of genomic and cDNA library, screening, cloning and plaque hybridization, cloning of a particular fragment of gene in different vectors, expression of the recombinant DNA molecules. Applications of genetic engineering in medicine and agriculture (production of insulin, growth hormones and vitamins).	15	1,2,3
5	**Techniques in Molecular biology:** Polymerase chain reaction (PCR) Sanger's dideoxy chain termination method for DNA sequencing, radio labeling of DNA fragments, agarose and acrylamide gel electrophoresis, southern, northern and western blotting, in vitro mutagenesis, site directed mutagenesis, mutagenesis of cloned genes, importance of site directed mutagenesis, melds, PCR mutagenesis.	10	1,2,3

6	**Application of DNA markers:** RFLP, AFLP, SSR, RAPD and SNP (including assay).	04	2,3
7	**Cloning Vectors:** Construction of plasmid vectors, Lambda phage DNA and M13-based expression vectors for eukaryotic expression genomic and cDNA libraries.	05	1,2,3

Teaching-Learning approach	**Assessment strategy**	**Reinforcement assignment/Tasks**
Lecture followed by discussion Participatory question-answer Text books Lecture notes Online resources Video documentation	Class assessment Assignment quiz presentation written exam Attendance	Feedback Individual discussion Counseling

Learning References:

1. Lehninger Principles of Biochemistry by David L. Nelson Michael M. Cox
2. Principles of Gene Manipulation and Genomics – S.B. Primose and R.M. Twyman
3. Molecular Biology of Cell – Bruce Alberts, D. Bray, J. Lewis, M. Raff, K. Roberts, J. D. Watson
4. Biochemistry – Lubert Stryer
5. Genes VI and VII – Benjamin and Lewin
6. Molecular cell biology – Darnell J.; Lodis H. and Baltimore D.
7. Recombinant DNA- by J.D. Watson and M. Zoller

Course Code	**: BMB-402**		
Course Title	**: Basic Bioinformatics**		
Course Type	**: Core**		
Year/Semester	**: 4th Year**		
Course Teacher	**: Professor Dr. Md. Anowar Hossain and Dr. Md. Abdul Aziz**		
Credit Value:	**: 2**	**Credit hours/week: 2**	**Total credit hours: 30 (minimum)**
Total Marks	**: 50 (Final Exam: 40 and In-course: 10)**		

Course Description:

Now days it is very common task to generation, storing, manipulation and analysis of DNA, RNA and protein data by electronic means in molecular Biology and medical science. Further, every day the amount of DNA, RNA and protein sequence data are added to databases and is growing faster. This course is organized for students offering the opportunity to learn the useful computational way to search database, sequence alignments of DNA, RNA and protein, mechanism of molecular phylogeny, structure prediction of RNA. This course also focuses on the

application of bioinformatics tools and database for genome sequencing and mapping, evolutionary studies, functional prediction of RNAs and molecular biology experiments.

Course Objective:

The overall goals of this course are to

- provide introduction and practical experience with the basic Bioinformatics, database searching, homology, sequence alignments, BLAST, FASTA and applications of bioinformatics in advanced molecular biology
- understand the mechanisms of molecular phylogenetics, different approaches and methods for evolutionary distance and phylogenetic analysis
- train the students in the basic theory and application of programs used for database searching, sequence analysis of DNA and protein, structure prediction of RNAs

Course Learning Outcome (CLOs):

CLO No.	Expected Course Outcomes Upon completion of the course, the student should be able to:
CLO1:	gather knowledge about the history, area and scope, and basic concept of bioinformatics and generation, management, searching and analysis of biological database
CLO2:	get exposed to various tools and methodologies used in sequence alignment, phylogenetic analysis and genetic diversity analysis observed in biological sequences
CLO3:	show theoretical and practical experiences for RNA structure prediction, genome mapping, primers designing, restriction sites identification and promoter analysis

Course Plan:

Module	Course contents	Credit hrs	CLOs
1	**Fundamental of Bioinformatics:** History, area and scope of bioinfomatics. Computer programs, operating systems, connectivity web page and website, browsers and hyperlink.	3	1
2	**i) Biological Data and Management:** Characteristics of biological data - types and features. Data management - organization of data, analysis and introduction to database management system. Sequence File formats. **ii) Organization of databases:** Genome, nucleotide and protein (primary, secondary and composite) sequences,	5	1

	macromolecular structure, integrated database, bibliographic database, gene expression data.		
3	**Database Search and analysis:** Text based database searching, **Nucleotide data base Searching (using Blast Fasta, EMBL-EBI, DDBJ etc):** Retrieval of specific gene(s) from database; homology research; **Protein data base search (using SWISSPORT, PIR etc.):** Amino acid homology; conserved sequence; protein motif; secondary structure analysis; hydropath analysis; dendogram construction; microarray database.	4	1
4	**Web-based sources for biologist:** Expasy, Pedro's tool; BIOTOOLKIT; Medline Workbench TIGR; Glimmer M; Searching restriction sites within the sequence; primer designing websites: primer3.	3	2,3
5	**Genome sequencing and mapping:** Introduction to genome sequencing programs - human and rice. Genome mapping: Physical and genetic mapping; automated methods of DNA sequencing. Next (Second)-Generation Sequencing: Roche/454, Illumina and Life Technologies; Third Generation Sequencing: Pacific Biosciences, Ion Torrent, MiSeq, Oxford Nanopore; Transcriptomics, ChIP-Seq, Metagenomics, Epigenomics, NGS applications.	4	2,3
6	**RNA Structure Prediction**: Types of RNA Structures, RNA Secondary Structure Prediction Methods - *Ab Initio* Approach, Comparative Approach, and Performance Evaluation. Gene Prediction in Prokaryotes and Eukaryotes – Promoter and Regulatory Element Prediction.	4	3
7	**Sequence alignment:** Introduction and application to sequence analysis. Sequence alignment- Types- Methods of sequence alignments. Alignment Algorithms-Dot Matrix Method, Dynamic Programming Method. Amino Acid Substitution Matrices - PAM Matrices, BLOSUM Matrices, Comparison between PAM and BLOSUM. Statistical Significance of Sequence Alignment. Database Similarity Searching - Heuristic Database Searching, Basic Local Alignment Search Tool (BLAST), FASTA, Comparison of FASTA and BLAST, Database Searching with the Smith–Waterman Method. Multiple sequence alignment software tools such as CLUSTAL, PHYLIP, MUSCLE etc.	4	2

8	**Phylogenetic analysis:** Introduction to phylogenetics**,** terminology, tree topologies, Mechanism of molecular phylogeney, approaches and methods/algorithms for tree building, Construction of phylogenetic tree UPGMA–Neighbors relation, Neighbor joining, Automated tools for phylogenetic analysis.	3	2

Teaching-Learning approach	**Assessment strategy**	**Reinforcement assignment/Tasks**
Lecture followed by discussion Participatory question-answer Text books Lecture notes Online resources Video documentation	Class assessment Assignment quiz presentation written exam Attendance	Feedback Individual discussion Counseling

Books recommended:

1. Bioinformatics, Methods and Applications, 4th Edition, S. C, Rasogi, N. Mendiratta, P. Rastogi (2013)

2. Bioinformatics, Singhal & Singhal, (2013)

3. Basic Bioinformatics, S. Ignacimuthu (2005)

4. Bioinformatics: Principles and Applications, Zhumur Ghosh, Bibekanand Mallick (2012)

5. Bioinformatics: A practical Guide to the analysis of genes & proteins. Andreas D.Baxevanis, BF Francis Quellelte, Guellelte B.F. Francis

Course Code	**: BMB-403**		
Course Title	**: Biotechniques**		
Course Type	**: Core**		
Year/Semester	**: 4th Year**		
Course Teacher	**: Professor Dr.Niranjan Kumar Sana and Dr. Md. Rowshanul Habib**		
Credit Value:	**: 4**	**Credit hours/week: 4**	**Total credit hours: 60 (minimum)**
Total Marks	**: 100 (Final Exam: 80 and In-course: 20)**		

Course Description:

This course focuses on the basic principles and practical aspects of photon, proton and electron based spectroscopies to solve experimental problems. This course explains the basic instrumentation, different characteristics, analytical aspects, merits and limitations of each technique listed as content. The course describe the application of different spectroscopic techniques to identify and quantify experimental samples and build the ability within the students to solve the structure related problems through interpretation of spectral data. The basic principles of interaction of light and matter and their application in spectroscopy of atoms and molecules will be covered here.

Course objective:

The overall goals of this course are to

- develop an understanding of basic concepts, theoretical principles and instrumentation of different spectroscopic techniques in students
- train the student with enough information to be able to analyze, interpret and use data of different spectroscopic methods discussed in the course
- build the ability in student to solve problems related to the structure, purity and concentration of chemicals

Course Learning Outcome (CLO):

CLO No.	**Expected Course Outcomes** Upon completion of this course, the students will be able to:
CLO1:	describe the basic theory and principle involved in the operation of infrared (IR), UV-visible, fluorescence, nuclear magnetic resonance (NMR), mass, optical rotatory dispersion (ORD), circular dichroism (CD) and atomic absorption spectrometers
CLO2:	analyze, interpret and use spectroscopic data and determine the structure of new biomolecules
CLO3:	solve problems related to the structure, purity and concentration of chemicals

Course Plan:

Module	**Course contents**	**Credit hrs**	**CLOs**
1	**UV and visible spectroscopy:** Principle, instrumentation and application.	4	1

2	**Infrared spectroscopy:** Principle of infrared spectroscopy and its instrumentation, the mode of vibration and bending, bond properties and absorption trends, application of IR spectra.	10	1, 3
3	**Fluorescence spectroscopy:** Theory of fluorescence, instrumentation for measuring fluorescence, intrinsic fluorescence measurements for studying proteins, extrinsic fluorescence and energy transfer, special uses of fluorescence in biology and biochemistry.	10	1
4	**Nuclear Magnetic Resonance:** Principles of NMR, the chemical shift, spin-spin interactions, instrumentation of NMR, data obtained from an NMR spectrum, assignment of spectral lines of protein and polynucleotides, use of NMR to study protein and polynucleotide structure of biomolecules, spin labeling and Fourier transform NMR	15	1, 2, 3
5	**Mass spectroscopy:** Basic principles of mass spectroscopy, instrumentation of MS, production of mass spectra, high resolution mass spectroscopy, mass spectra of purine and pyrimidine bases, application of mass spectrometry of nucleotides.	9	1, 3
6	**Optical Rotatory Dispersion (ORD) and Circular Dichroism (CD):** Simple theory of ORD and CD. Techniques for measuring ORD and CD, interpretation of ORD and CD curves application of ORD and CD analysis to protein and polypeptide structure	5	1, 2
7	**Atomic absorption spectroscopy (AAS)**: Introduction and principle of atomic absorption spectroscopy (AAS), instrumentation, of AAS, preparation of samples for measurement of atomic absorption, advantages, limitation and biochemical application of AAS	7	1, 2

Teaching-Learning approach	**Assessment strategy**	**Reinforcement assignment/Tasks**
Lecture followed by discussion Participatory question-answer Text books Lecture notes Online resources Video documentation	Class assessment Assignment quiz presentation written exam Attendance	Feedback Individual discussion Counseling

Learning References:

1. Introduction to spectroscopy by Donald L. Pavia, Gray M. Lampman, Goerge S. Kriz Jr.
2. Spectroscopy by D.H. Hiffn.
3. Fundamentals of molecular spectroscopy by C.N. Banwell.
4. Physical Biochemistry by David Freifelder.
5. Biophysical chemistry by C.R. Cantor & P.R. Schimmel.
6. Biological spectroscopy by I.D Campbell and R.A. Dwek.
7. Molecular spectroscopy by Banwell.
8. Springer Handbook of Nanotechnology by Bharat Bhushan

Course Code	**: BMB-404**		
Course Title	**: Industrial Biotechnology**		
Course Type	**: Core**		
Year/Semester	**: 4th Year**		
Course Teacher	**: Professor Dr. Tanzima Yeasmin and Professor Dr. Md. Salim Uddin**		
Credit Value:	**: 2**	**Credit hours/week: 2**	**Total credit hours: 30 (minimum)**
Total Marks	**: 50 (Final Exam: 40 and In-course: 10)**		

Course description:

Industrial Biotechnology provides fundamental insights to exploit enzymes and microbes for the manufacturing of products which have a huge industrial significance. This course focuses various biochemical processes for obtaining various products of diverse fields such as chemicals, food, pharmaceuticals, bioenergy etc. The course introduces animal cell culture, fermentation, biodegradation, immobilization of enzymes approached by various methods with different operation modes. Major pathways and networks underlying the processing of biochemical industries are included. The strategies are to design efficient fermenters and develop methods for obtaining higher yields of commercial products at low cost with minimum energy consumption. Students will be able to learn the bioprocessing of industrial products e.g. wine, cheese, antibiotics, hormones, vaccines etc.

Course objective:

The overall goals of this course are to

- know cell culture process in a wide variety of techniques for the utilization of human benefits
- gather knowledge and understanding of fermentation technologies for manufacturing commercially important products
- learn the application of biocatalyst in industrial product processing and fermentation technology in combination with molecular genetics and enzyme engineering and metabolic engineering of microorganisms and cells
- inculcate a sound knowledge and technical skills in the area of biotechnology to face the modern challenges in biotechnological industry

- articulate technical and ethical solutions to societal and industrial problems through their imparted technical knowledge and skills

Course Learning Outcome (CLO):

CLO No.	Expected Course Outcomes Upon completion of this course, the students will be able to:
CLO1:	demonstrate the methods of cell culture under various conditions and design and develop medium for cell cultivation for fermentation process
CLO2:	develop immobilized enzymes with higher activity for the manufacturing of commercial products and design methods for degrading industrial wastes, production of biofertilizer and bioinsecticide
CLO3:	assess the changes of the food components during processing and storing, the roles of microorganisms in foods and capable for improvement of food processing and quality of the food products

Course Plan:

Module	Course contents	Credit hrs	CLOs
1	**Animal cell culture:** Animal cell culture technology, requirements for animal cell and tissue culture, culture media, classification, compositions, use of serum in culture media, sterilization of glass ware, equipment and liquids, isolation of animal materials, desegregation of tissue by physical and enzymatic method.	7	1
2	**Fermentation technology:** Definition, industrial fermentation products, microorganisms, prerequisites to practical industrial microbiological processes, criteria for a fermenter design; Batch feed, semi-continuous and continuous feed modes, classification of fermenter, alcohol fermentation, alcoholic contents in some beverages, industrial application of ethyl alcohol, microbial production of antibiotics, L-lysine, microbial insecticides.	8	1

3	**Biodegradation:** Agroindustrial wastes recycling (anaerobic digestion and biogas production, single cell protein production, microbial fertilizer aliphatic and aromatic hydrocarbon transformation.	6	2
4	**Immobilized cells and enzymes:** Immobilized enzymes and cells, processes of immobilization, bioreactor design, applications of immobilized enzymes and cells.	4	2
5	**Food science:** (a) Definition, objective, interdisciplinary approaches. (b) Food engineering; pre and post harvest operation of food materials. (c) Food preservation and processing; preservation by dehydration/drying, low and high temperature, irradiation, preservatives and fermentation.	5	3

Teaching-Learning approach	**Assessment strategy**	**Reinforcement assignment/Tasks**
Lecture followed by discussion Participatory question-answer Text books Lecture notes Online resources Video documentation	Class assessment Assignment quiz presentation written exam Attendance	Feedback Individual discussion Counseling

Learning References:

10. Food Science – Norman N. Potter.
11. Immobilization of enzymes and cells – Gordon F. Bickerstaff.
12. Immobilization of enzymes, antigen, antibody and peptides: Preparation and characterization – H.H. Weetall
13. Pharmaceutical Biotechnology– S.P. Vyan & V.K. Dixit.
14. Culture of animal cells a manual of basic technique and specialized applications- R. Ian Freshney
15. Principles of food preservation – Ganga P. Kharel & Fumio Hashinaga.

Course Code	**: BMB-405**		
Course Title	**: Plant Biotechnology**		
Course Type	**: Core**		
Year/Semester	**: 4th Year**		
Course Teacher	**: Professor Dr. Md. Mominul Hoque and Professor Dr. Md. Anowar Hossain**		
Credit Value:	**: 2**	**Credit hours/week: 2**	**Total credit hours: 30 (minimum)**
Total Marks	**: 50 (Final Exam: 40 and In-course: 10)**		

Course Description:

This course is basically designed for the students to familiarize the hands on training on various techniques of plant tissue culture, plant growth hormones and their uses in commercial plantlets and secondary metabolites production. It also provides the clear idea about the genetic transformation and manipulation of foreign gene techniques used in plant biotechnology. It discusses the specialized topics and advances in field of genetic engineering and their application in crop improvement. This course also gives practical experience and skills on how modern molecular markers could be used to identify the quantitative traits loci (QTL) for the designing of better crops to tackle the climate change effects in Bangladesh.

Course Objective:

The overall goals of this course are to

- aware the students about the basic knowledge of *in vitro* culture of plants, laboratory requirements, techniques and its application in sustainable agriculture
- make basic understanding on germplasm conservation and cryopreservation
- train the students in the basic idea on plant genome, genetic transformation techniques, tools and their applications in plant genetic engineering for crop improvement
- develop practical skills for genetics and breeding using modern molecular tools for crop improvements

Course Learning Outcome (CLO):

CLO No.	Expected Course Outcomes Upon completion of the course, the student should be able to:
CLO1:	describe the history, area and scope, and basic concept of plant tissue culture, types, and their application in sustainable agriculture
CLO2:	use various tools and methodologies for genetic manipulation of pest and disease resistance, crop yield and quality improvement
CLO3:	identify the genes involved in various desired traits (QTL) of crop using modern molecular tools

Course Plan:

Module	Course contents	Credit hrs	CLOs
1	**Introduction to *in vitro* culture:** History and development, aim and objectives, laboratory techniques, culture media, plant growth regulator-class and their use *in-vitro* culture, plant tissue culture, culture types, plant regeneration, somatic embryogenesis, organogenesis, single cell culture methods, cytology of callus.	5	1
2	**Tissue culture techniques and applications:** Haploid production, Androgenesis: anther and microspore culture, protoplast isolation and culture, artificial seeds, cryopreservation and germplasm conservation, application of tissue culture.	5	1
3	**3. Plant genetic transformation:** **a) Plant genomes:** The organization and expression of plant genes; structure of DNA, chromatin and chromosome; gene structure, regulation of eukaryotic gene expression, implication for plant transformation. **b) Techniques for plant transformation:** Agrobacterium mediated gene transfer, Ti-plasmid, process of T-DNA transfer and integration, application, methods of direct gene-transfer such as particle bombardment, microprojectile, electroporation, silicon carbide fiber, PEG etc.	7	2
4	**Binary vector for plant transformation:** Features of plant vectors, promoters and terminators, selectable markers, reporter genes (*gus, gfp, cat, luc, lux*), origin of replication, development of vectors.	3	2
5	**Genetic manipulation of herbicide and pest resistance, quality and yield improvement:** Herbicide composition, and its use, mechanism of action, engineering of herbicide resistance, pest of major crops and its use, GM strategies resistance for insect resistance; e.g. Bt approach. The genetic manipulation of fruit ripening such as softening, modification of flower color and production of golden rice and other high yielding crops.	5	2
6	**Modern technologies for crop improvement:** Induced mutation breeding by physical and chemical mutagens, development of molecular markers and marker assisted selection such as RAPD, RFLP, SSR, SNP etc., next-generation genome editing tools such as CRISPR-Cas9, TALENs etc.	5	3

Teaching-Learning approach	Assessment strategy	Reinforcement assignment/Tasks
Lecture followed by discussion Participatory question-answer Text books Lecture notes Online resources Video documentation	Class assessment Assignment quiz presentation written exam Attendance	Feedback Individual discussion Counseling

Learning References:

1. Adrian Slater, Nigel Scott and Mark Fowler; Plant Biotechnology
2. Anderson, L.A., Plant Cell Culture. Advances in Biochemical Engineering and Biotechnology.
3. Kalyan Kumar Dey, Plant Tissue Culture., 2013
4. S. Narayanaswasmy, Plsnt Cell and Tissue Culture , 2013.
5. Online article will be provided by class teachers

Course Code	**: BMB-406**		
Course Title	**: Pharmaceutical Biochemistry**		
Course Type	**: Core**		
Year/Semester	**: 4th Year**		
Course Teacher	**: Dr. A. K. M. Asaduzzaman and Dr. Subed Chandra Dev Sharma**		
Credit Value:	**: 4**	**Credit hours/week: 4**	**Total credit hours: 60 (minimum)**
Total Marks	**: 100 (Final Exam: 80 and In-course: 20)**		

Course description:

Pharmaceutical Biochemistry relates to the absorption, distribution, metabolism and excretion as well as mechanism of action of drugs with their application. Students taking their course are expected to have some prior knowledge and know how drugs are synthesized and act on living organism to improve pathological condition. Students are also guided to modify the drugs by nanomolecules. The estimation of drugs in laboratory is also discussed.

Course objective:

The overall goals of this course are to

- aware the students about absorption, distribution and metabolism of drugs in the living organisms as well as excretion

- help the students to acquire knowledge with the mechanism of action of biological molecules and different kinds of drugs in cell
- make the students familiar with the treatment of different diseases by specific drugs
- develop skills in students to make modification of drug with nanomolecules
- train the students to estimate drugs in the laboratory

Course Learning Outcome (CLO):

CLO No.	Expected Course Outcomes Upon completion of this course, the students will be able to:
CLO1:	Describe the pharmacokinetics and pharmacodynamics of drugs.
CLO2:	Synthesize, analyzes, identify and interpret biomolecules and drugs.
CLO3:	Modify drugs with nanomolecules having pharmaceutical applications.

Course Plan:

Module	Course contents	Credit hrs	CLOs
1	**Pharmacokinetics:** **a) Absorption of drugs:** Mechanism of absorption; effect of physiological and formulation factors on gastro-intestinal absorption of drugs. **b) Distribution of drugs:** Physical significance of drug concentration in blood, bioavailability, biological half-life. **c) Metabolism of drugs:** General pathways of drug metabolism, sites of drug biotransformation, role of cytochrome P-450 monooxygenases in oxidative biotransformation, oxidative reactions, reductive reactions, hydrolytic reactions, phase II or conjugative reaction, factors affecting drug metabolism.	15	1
2	**Pharmacodynamics:** Mechanism of drug action, drug receptor, their chemical properties, classification of receptors and drug effects, structure activity relationship and conformation of receptor surface, consequence of drug receptor interaction, relation between drug concentration and response, action of drug not mediated by receptors, effect of protein binding on drug deposition and characteristics.	8	1
3	**Histamine and anti-histaminic agents:** Histamine, histamine life cycle, H_1 antagonist, inhibition of histamine release,	7	2

	histamine H_2 receptor antagonist, histamine H_3 receptor ligands.		
4	**Cardiovascular drugs:** Drugs used for the treatment of angina; organic nitrates, calcium channel blocker and β-adrenergic antagonist etc.	5	2
5	**Chemotherapeutic agents:** **a)** Definition, properties, drug resistance, trimethoprim, quinolone, isoniazid. **b) Sulfa drugs:** Synthesis, chemistry, mechanism of action and pharmacological properties. **c) Antibiotics:** Definition, classification, mechanism of action of different antibiotics, chemistry, biosynthesis and their therapeutic uses. **i)** Penicillin and Cephalosporin (1st generation, 2nd generation and 3rd generation, 4^{th} generation), chloramphenicol, tetracycline, streptomycin. **ii)** Antifungal antibiotics such as nystatin, grisefulvin.	10	2
6	**Alkaloids:** Therapeutic properties and uses of some important alkaloids and steroids.	7	2
7	**Nanomolecules:** Definition and classification, applications of Nano-Molecules in biosystems, Nanoscale elements for delivery of materials into cells, peptides coupled nanoparticles, DNA based artificial nanostructure, proteins as components in nanodevice.	8	3

Teaching-Learning approach	**Assessment strategy**	**Reinforcement assignment/Tasks**
Lecture followed by discussion Participatory question-answer Text books Lecture notes Online resources Video documentation	Class assessment Assignment quiz presentation written exam Attendance	Feedback Individual discussion Counseling

Learning References:

1. Lippincott's Illustrated Review: Pharmacology, By Richard A. Harvey and Pamela C. Champe

2. Examinations and Board Review: Pharmacology, By Bertram G. Katzung and Anthony J. Trevor

3. The Pharmacological Basis of Therapeutics, By Goodman and Gilman.

4. Textbook of organic, Medicinal and Pharmaceutical Chemistry, By Wilson and Gisvolds

Course Code	**: BMB-407**		
Course Title	**: Immunology-II**		
Course Type	**: Core**		
Year/Semester	**: 4th Year**		
Course Teacher	**: Professor Dr. Farjana Nikkon** **Dr. Kazi Abdus Salam**		
Credit Value:	**: 4**	**Credit hours/week: 4**	**Total credit hours: 60 (minimum)**
Total Marks	**: 100 (Final Exam: 80 and In-course: 20)**		

Course Description:

The immune system governs defense against pathogens and is of great importance for the development of many communicable and non-communicable diseases. This course includes a detailed description of the effector mechanisms of innate, cellular and humoral immunity against antigens. Students are expected to learn how immune system is regulated, make a relation between function and regulation of the different molecules of the immune system. Course also focuses on the major immunological methods used in research and clinical purposes. Students will gain some fundamental knowledge about the vaccines and monoclonal antibody production. Furthermore, students should be aware that the science of immunology has already been successfully translated into clinical medicine.

Course objective:

The overall goals of this course are to:

- gain in-depth knowledge of relevant different effector mechanisms of the immune system, its regulation and immunological tolerance
- learn about the production of monoclonal antibodies and its therapeutic applications
- learn about the vaccines, their types and clinical applications
- gain knowledge on the science of immunology that has already been successfully translated into clinical medicine
- learn about major immunological methods used in research and clinical purposes

Course Learning Outcomes (CLOs):

CLO No.	**Expected Course Outcomes** Upon completion of this course, the students will be able to:
CLO1	understand the role of cytokines in immunity and immune cell activation; and be able to identify and characterize cytokines of particular immune importance
CLO2	explain the effector mechanisms, regulation of immune responses and immunological tolerance
CLO3	describe the method for production of monoclonal antibodies, their applications, principles of governing vaccination and to understand the immunological methods used in research and diagnosis purposes

Course Plan:

Module	Course contents	Credit hrs	CLOs
1	**Cytokines:** General and functional categories of cytokines, cytokines receptors, role of cytokines in innate and adaptive immunity; development and functions of T_H1 and T_H2 subsets of T cells.	8	1
2	**Effector mechanism of innate immunity:** Recognition of microbes by neutrophils and macrophages, recruitment of leukocytes to sites of infection, phagocytosis of microbes, effector functions of activated macrophages, recognition of infected cells by NK cells and effector functions of NK cells.	8	2
3	**Effector mechanism of cell-mediated immunity:** T-cell mediated macrophage activation, induction of CMI, migration of activated T cells and other leukocytes to site of antigen, activation of macrophages and their functions, cytolytic T lymphocytes and mechanisms of cytolytic T lymphocyte-mediated cytolysis.	8	2
4	**Effector mechanisms of humoral immunity:** Complement system, classical and alternative pathways of complement activation, late steps of complement activation, receptors for complement proteins, regulation of complement activation, function of complements.	8	2
5	**Regulation of immune response:** Regulation of immune response by lymphocytes, antigen and antibody molecules.	7	2
6	**Monoclonal antibody production:** Definition of monoclonal and polyclonal antibody, method for the production of monoclonal antibody, importance of monoclonal antibody.	3	3
7	**Immunological tolerance:** General features and mechanism of immunological tolerance, central and peripheral tolerance of B and T cells, tolerance induction by foreign protein antigens, importance of tolerance.	5	2
8	**Vaccines:** Definition, objectives, types and their description, adjuvants used in vaccine development, preparation of medically important vaccines (HIV and Hepatitis B vaccines).	5	3

9	**Immunological techniques:** Precipitation reaction and techniques, agglutination and techniques, immunodiffusion, radioimmunoassay (RIA), enzyme-linked immunosorbent assay (direct and indirect), some important ELISA techniques used in the diagnosis of diseases (TSH, HIV/AIDS and Hepatitis B), immunofluorescence techniques and complement fixation assay, immunoprecipiation.	8	3

Teaching-Learning approach	**Assessment strategy**	**Reinforcement assignment/Tasks**
Lecture followed by discussion Participatory question-answer Text books Lecture notes Online resources Video documentation	Class assessment Assignment quiz presentation written exam Attendance	Feedback Individual discussion Counseling

Learning References:

1. Cellular and Molecular Immunology – A. K. Abbas, A. H. Licistman, J. S. Pober
2. Roitt's Essential Immunology – Ivan Roitt
3. Immunology – Roitt and Brostoff
4. Understanding Immunology- Peter Wood
5. Medical Immunology – Daniel P. Stites, Abba I. Terr, Tristram G.
6. Molecular Biology of Cell – Bruce Alberts, D. Bray, J. Lewis, M. Raff, K. Roberts, J. D. Watson
7. Microbiology Concepts Application M.J. Pelczer, E.C. Chan, Noel R. Krieg

Course Code	**: BMB-408**		
Course Title	**: Oncology-I**		
Course Type	**: Core**		
Year/Semester	**: 4th Year**		
Course Teacher	**: Professor Dr. Jahan Ara Khanam and Dr. Md. Abdur Rakib**		
Credit Value:	**: 4**	**Credit hours/week: 2**	**Total credit hours: 60 (minimum)**
Total Marks	**: 100 (Final Exam: 80 and In-course: 20)**		

Course Description:

Oncology is the branch of science dealing with the physical, chemical, biological, genetic and molecular properties of tumors, including study of their origin, kinetics of tumor growth diagnosis, treatment, prevention and management of cancer. This course explain molecular Mechanism of cell proliferation and cell death and malignant cells spread, explain the types of gene mutations possible and how these mutations can contribute to cancer formation, describe an oncogene and why it is important in cancer development, describe the function of tumor suppressor gene, learn how cancer cells escape cell death, and explain current approaches in cancer treatment. This course also discusses the induction of cancer by physical, chemical agents, ionizing, UV-, γ-radiation, and environmental hazard. It also reflects the scientific focus on retrovirus and DNA virus. Different techniques for assessment of cell kinetics, different factors responsible for cancer initiation and the role of immune system in the progression and prevention of cancer will be discussed. The goal of studying cancer is to develop safe and effective methods to prevent, detect, diagnose, treat, and, ultimately, cure the different types of cancer. Better understanding these diseases, the more progress will make toward diminishing the cancer.

Course objectives:

The overall goals of this course are to:

- make students familiar with characteristics, symptoms and remedies of different types of cancer
- aware the students about different chemical, physical, viral and hormonal factors that possess important role in intiation, progression and spread of cancer.
- understand the interaction between cells of the immune system with tumour cells which is important for the development of new therapies for cancer treatment

Course Learning Outcomes (CLOs):

CLO No.	Expected Course Outcomes Upon completion of this course, the students will be able to:
CLO1	explain about organ base cancer; conduct epidemiological study; detect the fine morphology of cancer cell using microscope, count the number of cells at different stages of cancer instrumentally and measure the staging of cancer
CLO2	identify the chemical carcinogens in the laboratory, analyze the carcinogenic effect of chemicals, ionizing, viral and environmental hazard on living system
CLO3	explain molecular Mechanism of cell proliferation and cell death and malignant cells spread, explain the types of gene mutations possible and how these mutations can contribute to cancer formation, describe an oncogene and why it is important in cancer development, describe the function of tumor

	suppressor gene, learn how cancer cells escape cell death, explain current approaches in cancer treatment and to know the immunology of tumors

Course Plan:

Module	Course contents	Credit hrs	CLOs
1	**Introduction and overview of cancer: a)** Characteristics of normal and cancer cell, benign and malignant tumors, nomenclature of tumors, differentiation and anaplasia, Characteristics of different types of cancer (lymphoma, leukemia, Hodgkin's disease, non-Hodgkins lymphoma, bone cancer, skin cancer, breast cancer, colon cancer, lung cancer, liver cancer and brain cancer) **b) Biology of tumor cell growth:** Introduction, nature of tumor growth, growth rate and doubling time, assessment of cell kinetics (tritiated thymidine and autoradiography and flow cytometry techniques	12	1
2	**Molecular Biology of Cancer:** **a) Cell proliferation and cell death:** Mechanism of cell cycle regulation, mammalian cell cycle regulation, cyclin, cyclin dependent protein kinases, inhibition of cyclin dependent kinases, inhibitors of cell cycle progression, cell cycle and cancer, regulation of E2F transcription factors, cell cycle check points, apoptosis (programmed cell death), p53 gene in apoptosis, BCL-2 in apoptosis. **b) Tumor progression and metastasis:** Tumor progression, clonal evolution, and molecular genetics of tumor progression, pathogenesis of metastasis. **c) Oncogenes:** Oncogenes, protooncogenes, and tumor suppressor genes and hereditary cance, identification of oncogenes, bioassay for oncogenes in tissue culture systems, functions of oncogenes and tumor suppressor genes (signal transduction, extracellular growth factor, receptor tyorosine kinases, Ras, Fos, Jun and API, CMYC, REL, RB gene p53, ATM) **d) Genetic basis of cancer:** Chromosome nomenclature and methodology, terminology and types of chromosome abberation in cancer, chromosome in solid tumor, the mechanism of genetic respectability, relation between cancer incidence and age, cellular and genetic basis of cancer, types of genetic risk factors for cancer, cytogenetics of hematological malignancies, cytogenetics of solid tumors, heritable cancer (retinoblastoma and Knudsons hypothesis, the retinoblastoma gene, colon carcinoma, breast	30	3

	carcinoma).		
3	**Etiology of cancer:** **a) Chemical factors:** The nature of chemical carcinogens (chemistry and metabolism), biological process in chemical carcinogenesis (multistep model in carcinogenesis), DNA adducts, and repair, identification of carcinogens. **b) Physical factors:** Ionizing radiations, ultraviolet radiation carcinogenesis, asbestos, hypothermia and erythrome, AbIgne, electric and magnetic field. **c) Viruses:** DNA tumor viruses (SV40 virus, human adenovirus, human papilloma virus, Epstein Bar virus, Hepatitis B virus) and Kaposis sarcoma. **d)Viral diseases:** Infectivity, mode of gene expression and virus assembly, representative member of each class, herpes virus, papovirus, hepatitis virus, picorna virus, vascular somatitis virus, rabies virus, recovirus, and retrovirus, AIDS	12	2, 3
4	**Cancer Epigenetics:** Cancer epigenomic, epigenomic carcinogens, the roles of epigenetics in cancer (DNA methylation, chromatin remodeling, histone modification, and non-coding RNAs in cancer), Epigenetic drugs (epidrugs) in cancer.	6	3

Teaching-Learning approach	**Assessment strategy**	**Reinforcement assignment/Tasks**
Lecture followed by discussion Participatory question-answer Text books Lecture notes Online resources Video documentation	Class assessment Assignment quiz presentation written exam Attendance	Feedback Individual discussion Counseling

Learning References:

1. The Basic Science of Oncology. Ian F. Tannock; Richand p Hill.
2. Oxford Text Book of Oncology vol.1 & voll.11; Peckham, Pinedo, and Veronest.
3. Cancer, Principles and Practice of Oncologys. Vincent T. Devita, Jr. Samuel Hellman, Steven A. Rosenberg.
4. The molecular Biology of Cancer Busch.
5. Biochemistry of Human Cancer Bodansky.
6. Robbins Pathologic Basis of Disease. Romzi S, Cotran MD, Vinay K, Stanley L. Robbins.
7. Microbiology 2nd Edition, Lensing N. Prescott, John P. Harley, Donald A. Klein.

8. Medical Microbiology Mins; Playfair, Roitt, Wakelin, Williams.

Course Code	**: BMB-409**		
Course Title	**: Neurochemistry**		
Course Type	**: Core**		
Year/Semester	**: 4th Year**		
Course Teacher	**: Professor Dr. Md. Zahangir Alam Saud and Dr. Md. Ismail Hossain**		
Credit Value:	**: 2**	**Credit hours/week: 2**	**Total credit hours: 30 (minimum)**
Total Marks	**: 50 (Final Exam: 40 and In-course: 10)**		

Course Description:

Neurobiochemistry deals with the cells of the nervous system and the organization of these cells into functional circuits that process information and mediate behavior. It is a large and fast moving branch of biology. One of the most challenging and interesting problems in biology is understanding the brain: how we think, feel, recall, and learn. This course will focus on the structure and function of the mammalian nervous system and the propagation of nerve impulses and transfer of information between nerve cells, the effect of drugs on this process, and the development of nerve cells into the brain and spinal cord. The tropics and contents will cover the neurochemical bases of brain diseases and the systems which control motivation, emotion, learning and memory.

Course objectives

The overall goals of this course are to

- provide a systematic introduction to the mammalian nervous system, emphasizing the structural and functional organization of the human brain
- explore the ionic basis of nerve potentials, the physiology of synapses, sense organs and effectors, and the integrative action of the nervous system
- expose the students to the field of neuroscience

Course Learning Outcome (CLO):

CLO No.	**Expected Course Outcomes** Upon completion of the course, the student should be able to:
CLO1:	describe how neurons are connected in neuronal circuits that control our behavior and analyze the influence of transmitters on the functions of human body
CLO2:	describe the functions of the nervous system such as the regulation of movement, motivation, pain, emotions and memory
CLO3:	describe neurological disorders such as Parkinson's disease, addiction, schizophrenia, depression and also introduce the current neurobiological techniques, such as brain histology, electrophysiology, behavioral analyses

Course Plan:

Module	Course contents	Credit hrs	CLOs
1	**Brain as a specialized tissue:** Structural, chemical and metabolic peculiarities; difference between growing and adult brain.	2	1
2	**Nervous System and its organization:** Nerve cells and their classification, Nervous system, Overall structure of human nervous system, organizing principle of neural system.	3	1
3	**Synapse:** Structure, function, their types- chemical synapse and electrical synapse, Signal transmission at chemical synapses	3	1,
4	**Nerve impulse and its conduction:** Action potential, its ionic basis, sodium channel, Myelin composition and maturation, Mechanism of conduction along myelinated and unmyelinated nerve fibres, comparison of conduction velocity along myelinated fibres.	5	2, 3
5	**Neurotransmission:** Neurotransmitters, properties of neurotransmitter, their metabolism, molecular mechanism of neurotransmitter secretion, calcium channel and the role of calcium in transmitter secretion, post synaptic receptors their modulation with agonists and antagonists, neuropeptides.	5	2, 3
6	**Brain growth and development:** Species, structural and cell type differences, neurogenesis and gliogenesis, neuronal death and nervous system development.	3	1,2,3
7	**Metabolism of the developing brain:** Energy metabolism, changes during development, susceptibility of developing and adult brain to energy supply.	4	2,3
8	**Brain development during malnutrition:** Effect on cell proliferation, myelination and synaptogenesis.	2	2,3

9	**Brain diseases:** Parkinson's disease, Epilepsy, Alzheimer's disease, Huntington's disease.	3	2,3

Teaching-Learning approach	**Assessment strategy**	**Reinforcement assignment/Tasks**
Lecture followed by discussion Participatory question-answer Text books Lecture notes Online resources Video documentation	Class assessment Assignment quiz presentation written exam Attendance	Feedback Individual discussion Counseling

Learning References:

1. Principles of Neural Sciences by Eric R. Kendel, James H. Shwartz
2. Neuroscience by Dale Purves, George J. Augustine
3. Text Book of Medical Physiology. By Guyton and Hall
4. Human Physiology. By C.C. Chatterjee, Vol. A and 2.
5. Human Physiology. By Chakrabarti, Ghosh and Sahana.
6. Review of Medical Physiology. By William F. Ganong.
7. Brain and its development: By Harun K.M. Yusup

Course Code	**: BMB-410**		
Course Title	**: Enzyme Technology**		
Course Type	**: Core**		
Year/Semester	**: 4th Year**		
Course Teacher	**: Not assigned yet**		
Credit Value	**: 2**	**Credit hours/week: 2**	**Total credit hours: 30 (minimum)**
Total Marks	**: 50 (Final Exam: 40 and In-course: 10)**		

Course Description:

Enzyme technology deals with the technological applications of enzyme. This course will provide the students with current knowledge on how enzymes from different source can be efficiently and economically utilized to produce valuable products. Optimized application and recycling through immobilization and kinetic study will ensure proper use of enzymes. Insights into new application of enzymes will also be provided.

Course objective:

The overall goals of this course are to:

- provide students a deeper insight intothe use of enzymes in industries and medicine
- make the students understand the function and kinetics of immobilized enzymes for its economic use in various purposes
- enable student to perform immobilization of enzymes
- develop skills in students to innovate alternative use of enzyme

Course Learning Outcome (CLO):

CLO No.	**Expected Course Outcomes** Upon completion of the course, the student should be able to:
CLO1:	explain the concept and applications of enzyme to produce food, detergents and medicine
CLO2:	immobilize enzyme with favorable kinetics for efficient and economic use
CLO3:	engineer enzymes for innovative applications, propose new application in biosensor tools to benefit human life and to distinguish commercial, ethical, legal and socio-cultural impacts on the advanced application of enzyme in food, medicine and Industry

Course Plan:

Module	**Course contents**	**Credit hrs**	**CLOs**
1	**The large-scale use of enzymes in solution**: Applications of proteases in food, leather and wool industries; its use in starch hydrolysis, production of glucose syrup, production of syrups containing maltose, Enzymes in the sucrose industry, Glucose from cellulose; The use of lactases in the dairy industry, Enzymes in the fruit juice, wine, brewing and distilling industries, Glucose oxidase and catalase in the food industry; Medical applications of enzymes	5	1
2	**The preparation and kinetics of immobilised enzymes**: The economic argument for immobilisation, Methods of immobilisation, Kinetics of immobilised enzymes, Effect of solute partition and solute diffusion on the kinetics of immobilised enzymes, Analysis of diffusion effects in porous supports.	6	2
3	**Application of Immobilized enzymes:** Enzyme reactors,	5	2

	Membrane reactors, Continuous flow reactors, Packed bed reactors, Continuous flow stirred tank reactors, Fluidized bed reactors, Immobilized-enzyme processes, High - fructose corn syrups (HFCS), Use of immobilized raffinase, lactase, invertase; Production of amino acids, antibiotics; Preparation of acrylamide		
4	**Biosensors:** The use of enzymes in analysis, Definition of biosensors? Calorimetric biosensors, Potentiometric biosensors, Amperometric biosensors, Optical biosensors, Piezo-electric biosensors, Immunosensors.	5	3
5	**Recent advances in enzyme technology**: Enzymatic reactions in biphasic liquid systems; The stabilization of enzymes in biphasic aqueous-organic systems, Equilibria in biphasic aqueous-organic systems, Enzyme kinetics in biphasic aqueous-organic systems, Use of aqueous 2-phase systems, Practical examples of the use of enzymes 'in reverse' Glycosidases used in synthetic reactions, Interesterification of lipids.	6	3
6	Future prospects for enzyme technology: Whither enzyme technology? Use of 'unnatural' substrates, Enzyme engineering, Artificial enzymes, Coenzyme-regenerating systems.	3	3

Teaching-Learning approach	**Assessment strategy**	**Reinforcement assignment/Tasks**
Lecture followed by discussion Participatory question-answer Text books Lecture notes Online resources Video documentation	Class assessment Assignment quiz presentation written exam Attendance	Feedback Individual discussion Counseling

Learning References:

1. Principles of Enzyme Technology, MY Khan, Farha khan, 2015.
2. Enzyme Technology Martin F. Chaplin, C. Bucke, 1990
3. Immobilization of enzymes and cells, Jose M. Guisan
4. Enzymatic reaction mechanisms, Christopher Walsh

Course Code	**: BMB-411**		
Course Title	**: Laboratory Work**		
Course Type	**: Core (Practical)**		
Year/Semester	**: 4th Year**		
Course Teacher	**: Assigned Course Teachers**		
Credit Value:	**: 8**	**Credit hours/week: 6**	**Total credit hours: 120 (minimum)**
Total Marks	**: 200 (Final Exam: 140 and Class assessment: 60)**		

Course Description:

Graduates preparing their career as a biochemist need to be skilled in analyzing and interpreting biochemical problems. This course has been designed to provide the students of 4th year with hand on training in various analytical and instrumental operations to get them skilled in solving different biochemical, clinical, and immunological problems. This course actually contains some laboratory works related to theoretical knowledge given to them through the courses designed for 4th year.

Course Objectives:

The overall goals of this course are to:

- train the students how to analyze and assay different biomolecules (e.g. starch, glycogen, fatty acids, phospholipids, protein etc) and pharmaceuticals
- develop in student the skill of analyzing clinically important biological samples (such as serum enzymes, creatinine, sugar, bilirubin, cholesterol, albumin, globulin, hematological samples etc) and interpreting the data
- develop in students skills of using different chromatographic and electrophoretic techniques for future research and development purposes
- build in students the capability of isolating and analyzing DNA, RNA and using them in biotechnology purpose

***Course Learning Outcomes* (CLOs):**

CLO No.	**Expected Course Outcomes** Upon completion of this course, the students will be able to:
CLO1	analyze and assay different biomolecules (e.g.starch, glycogen, fatty acids, phospholipids, protein etc) and pharmaceuticals

CLO2	analyze clinically important biological samples (such as serum enzymes, creatinine, sugar, bilirubin, cholesterol, albumin, globulin, hematological samples etc) and interpreting the obtained data
CLO3	apply different chromatographic, electrophoretic techniques and molecular tools in practical and real life situations

Course Plan:

Module	Course contents	No. of classes (1 class = 3 credit hrs)	CLOs
1	**B. General Biochemistry** 1. Estimation of carbohydrates by anthrone method. 2. Isolation and assay of glycogen from liver and skeletal muscle. 3. Micro Kjeldahls method of protein estimation. 4. Determination of total fatty acids in a lipid extract. 5. Determination of brain phospholipids.	5	1
2	**B. Clinical Biochemistry** 1. Assay of serum SGOT and SGPT activity in mice. 2. Estimation of bilirubin from supplied sample. 3. Isolation and determination of cholesterol content of biological samples. 4. Assay of serum alkaline phosphatase activity. 5. Assay of muscle lactate dehydrogenase activity. 6. Assay of urease activity.	7	1,2
3	**C. Biochemical Techniques** 1. TLC of fruit juice and amino acids. 2. SDS-PAGE of rat liver protein. 3. Gel filtration chromatography for separation of known protein and purification of deamidase/protease from germinating seeds. 4. Identification of albumin, globulin and fibrinogen by paper chromatography. 5. Ion exchange chromatography of known proteins and checking for separation by gel electrophoresis.	6	2,3
4	**D. Pharmaceutical Estimation** 1. Estimation of streptomycin. 2. Estimation of ampicilin. 3. The estimation of acetoaminophen and salicylate in serum. 4. Estimation of serum vitamin-A.	5	1,2

	5. Determination of antibacterial activity of plant extracts.		
5	**E. Haematology** 1. Determination of ESR. 2. Total and differential white cell counts. 3. Separation of blood leucocytes. 4. ELISA for detection of HBsAg. 5. Assay of human serum immunoglobulins.	5	1,2
6	**F. Molecular Biology and Environmental Biochemistry** 1. Isolation of plasmid DNA. 2. Isolation of DNA from plant tissue. 3. Isolation of bacteriophage. 4. Isolation of microbes from natural habitats. 5. Estimation of DNA, RNA and Oligonucleotides. 6. Agarose-gel electrophoresis of nucleic acids. 7. PCR/Restriction digestion of genomic DNA. 8. Determination of bacterial drug resistance by disc diffusion method. 9. Determination of dissolved oxygen (DO), and biological and chemical oxygen demand (BOD, COD) of different water samples. 10. Determination of bacterial load from different environmental samples.	12	2,3

Teaching-Learning approach	**Assessment strategy**	**Reinforcement assignment/Tasks**
Lecture followed by discussion Text books Lecture notes Group discussion Online resources Demonstration for different Laboratory techniques Power-point demonstration	Lab assessment Presentation Viva voce Written exam Practical Exam	Feedback Individual discussion Counseling

Learning References:

Textbook of Biophysics: west.

Physical biochemistry: Bull.

Introduction to electrochemistry: Glasstone.

Text book of physical chemistry: Glasstone

Dutlines of physical: Glasstone

Applied physiology: Right.

Human physiology: Chattarjee.

Trace elements in Human and animal nutrition: Underwood.

The vitamins: Sebrell and Harris.

Chemistry and physiology of the vitamins:

Physical chemistry: Daniels and Alberty.

A source book of atomic energy: Glasstone.

Introduction to radiochemistry: Friendlander and Kennedy.

Quantitative chemical analysis: Vogel

A text book of practical organic chemistry: Vogel

Organic chemistry: Fieser and Fieser.

Ionic organic reaction: Alexander.

Hand book of organic analysis: Clarke.

Principle of organic chemistry: English and Cassidy.

Organic chemistry: Gram and Hammond.

Hohici's Yeast, mold and actinomydets : Skinner and others.

Bacterial chemistry and physiology: Porter,

General bacteriology: Searls.

Introduction to bacteria: Clifton.

Soil microbiology: Waksman,

Text book of physiology and biochemistry: Bell and other:

Rosenberg.

The biochemistry of B-vitamins by Williams

Human nutrition and dietetics: Davidson and Passmore.

Newer methods of nutritional biochemistry: Albanese.

proteins and amino acids in nutrition: Albanese,

The proteins: Fox.

Vitamins and coenzymes L. Wegner and Folker.

General biochemistry: Fruton and Simmods.

Dynamic aspects of biochemistry: Baldwin.

Practical physiological chemistry: Hawk, Oserand Summenson.

Principles of biochemistry: Whits, Hankler and Smith.

Enzymes: Summer and Meback.

Text book of biochemistry: West and Tood.

Metabolic pathways: Greenberg.

Biochemical reaction mechanism: Ingram

Advances in carbohydrate chemistry: Pigman.

The nucleic acids: Chargoff and Davidson

The carbohydrates, chemistry, biochemistry and physiology: Picman.

Course Code	**: BMB-412**
Course Title	**: Viva-voce**
Course Type	**: Core**
Year/Semester	**: 4th Year**
Course Teacher	**: Assigned Examination Committee**
Credit Value:	**: 2**
Total Marks	**: 50**

Course Description:

Viva Voce is a Latin expression that was used in Catholic seminary education to refer to oral exams (it literally means, "living voice"). Oral exams are used not as a substitute, but as a complement to written exams. They are a way to ask what is not feasible through the written format. Ostensibly, the rationale is that teachers can use the oral format to probe, challenge, and critically assess what a student really knew about a particular topic.

Course objective:

Viva voce will be conducted towards the end of the each semester in the form of oral questions-answers and discussions with the expert academic body (the exam committee) which covering the complete syllabus. This course aims at evaluating the basic understanding of the taught courses.

Course Learning Outcomes (CLOs):

CLO No.	Expected Course Outcomes Upon completion of this course, the students will be able to:
CLO1	Demonstrate verbally the depth of understanding, thinking and problem solving ability
CLO2	Interact with courage and spontaneity beyond nervousness in face to face interview.
CLO3	Present their concepts systematically in oral form and exhibit preparedness for future job interview.

Assessment Strategies:

Students will have to appear the interview board (the examiners panel) and the panel will judge them based on their understanding the courses that they had attended and grade them in marks.

Course Code	**: BMB-413**
Course Title	**: Project work /In-plant training**
Course Type	**: Core**

Year/Semester	**: 4th Year**
Credit Value:	**: 2**
Total Marks	**: 50**

Course Description:

In-plant training helps learners to master the latest techniques, skills, methodologies and to build a strong foundation for their career growth. In a nutshell, it can be said that it helps in boosting career of students.

Course objective:

The overall goals of this course are to:

- provide students comprehensive learning platform where they can enhance their employability skills
- enhance students' knowledge in one particular technology
- Develop self-confidence of students and helps in finding their own proficiency
- provide learners hands on practice within a real job situation

Course Learning Outcomes (CLOs):

CLO No.	Expected Course Outcomes Upon completion of this course, the students will be able to:
CLO1	gain practical experience in the relevant field
CLO2	apply general and specific biochemical and molecular biological procedures in the industry
CLO3	communicate effectively in the working group and apply experience to solve the problems in the industry

Assessment Strategies:

The students shall have to submit a report on their in-plant training received and these reports will be evaluated. In addition, they have to present their training experience gathered during the training period in a seminar and the assigned examination committee will evaluate their presentation performance.

8. Co-curricular and Extracurricular activities

In addition to academic activities, the department also engages the students and staffs with regular activities other than the curricular one. The co-curricular activities include the arrangement of debates and workshops at least once a year to develop and increase the student's leadership and communication skills. The debates and workshops are arranged on current topics related to health and diseases. The students are also taken to industrial visit once within his 4-year undergraduate program. A study tour is also arranged for the students of postgraduate (M.Sc.) program.

The department arranges for extra-curricular activities like indoor games, fresher's welcoming and farewell for outgoing students, annual picnic etc. All these indoor and outdoor activities are performed by participation of students along with teaching and non-teaching staffs of the department. It provides a scope for the students to interact with the teaching and non-teaching staffs to build up a close relation among the participants. In addition, the department provides all kinds of logistic supports for the students to participate in the inter-department sports competition, such as cricket, football, volleyball tournaments arranged by the university.Moreover, there are gymnastic facilities provided by the university forbody build up and to maintain sound health of the students. For the purpose, the university set up a gymnasium and a swimming pole within the campus. In addition to a stadium, there are several other play grounds, basket ground within the campus to facilitate all sorts of physical activities.

9. Academic Calendar for the program

The program runs as a course system in which the program for bachelor degree is divided into four academic years. According to the Faculty Ordinance, each academic year is from July to June. But practically, admission procedure being very lengthy, the session begins in nextJanuary and ends in December. The academic calendar is decided by the academic committee of the department before the session begins. Sometimes due to unavoidable situations the date of examination is shifted to later dates according to the decision taken by the Academic committee.

10. Students Facilities

10.1. ICT Center:

Computer Center was established in July 1985 in the First Science Building with terminal based Alpha Micro1000E, in order to accelerate research facilities in the university. It has been developed gradually during the last two decades and upgraded PCs were added to enhance computation efficiency. Now it is under a plan to establish highly efficient computation cluster to increase computation speed. E-mail connection was established through dial-up modem in 1997. It was an off line system and operated two or three times a day during the office hour.

Looking for a better solution, the university authority then decided to install the Optical Network System. At present the total length of Optical Fiber Network is about 10 kilometers. Then internet facility was provided in 2001. Now it is under consideration to renovate and extend single mode Optical Network instead of existing multi-mode system to adapt fast growing communication and information technologies.

Internal optical network was connected to the Submarine Optical Super Highway Network on August 2009 with a bandwidth of 32 Mbps. Moreover the present administration has taken further steps to enhance bandwidth to 60 Mbps to meet the growing demand of the users. Now our bandwidth has been enhanced to 64 Mbps from 23 Feb 2011. Now internet facilities are open to students. The students can enjoy internet facilities through Wi-Fi at class room and even outside the class buildings.

4.2. Residential Halls

The University provides the students with residential facilities. There are a total of 17 residential halls within the campus among which 11 for male students and 6 for female students. In addition, there are two more student dormitories for postgraduate students (MPhil and PhD) one of them is for foreign students alone. There are 4-seated, 3-seated, 2-seated and single-seated rooms which are allocated to students based on the seniority and academic performance of the students. The students are attached to one of the residential halls during his/her first admission to the university. The students are distributed to different halls centrally by the academic unit of the university.

10.3. University Medical Center

The department of Biochemistry and Molecular Biology as a POE does not have any medical facility. The university has a central health care system (Medical Center) to provide primary health care to the students. Rajshahi University Medical Centre is situated at the center point of the University. Students and all the family members of the teachers and other employees receive treatment and medical advices here. University Medical Centre has its own clinical diagnostic system including X-ray, Pathology and Biochemistry, ECG, Nebulization and ambulance services. There are some specialist units such as Medicine, Orthopedics, Eye, Skin, Oro-dental and Pediatrics. Out-door facilities are provided in two shifts, morning and evening. In the morning shift patients are received from 8-15 am to 12-00 noon and in the evening shift from 2-30 pm to 5-30 pm. In the night shift and holydays only emergency patients can receive their treatments. Students enjoy all the facilities free ofcost. Teachers and all others employees enjoy all the facilities on payment except consultation.

All the family planning facilities are also available here. A Govt. family planning office is serving here. Vaccination for the children is also available here once a month arranged by the City Corporation.

10.4. Library Facility

Rajshahi University Central Library is situated at the heart of the university behind the Vice Chancellor’s building. It is a three-storied building superbly designed for library purposes. It

looks beautiful from outside and provides quiet and comfortable inside environment for the library users. The ground floor of the building is used for storage and lending, the nicely designed well-ventilated first floor for reading rooms and the second floor for cataloguing, automation and administrative activities.

It is one of the oldest and largest libraries of Bangladesh and, since its inception, it has been providing library support to students, teachers, researchers and general readers for more than six decades. This library has a collection of more than 3,50,000 books, 40,000 journal volumes and periodicals. These books and journals cover all areas of knowledge and information and reflect the nature of a general university with equal emphasis on humanities, social sciences, business administration, sciences and applied sciences. The library has also a huge archive of newspapers and other 'ephemeral' publications. The library keeps open for readers Saturday - Thursday from 8.00 AM to 8.00 PM and on Friday 3.00 PM to 8.00 PM.

The Central Library also provides the students e-resources such as e-journals and e-books. It also provides audio-visual system to practice for spoken and written foreign languages, especially English. There is a University Repository system which provides the readers with university research titles, full thesis and other administrative documents. There is a digital archive which contains rare collections, news clips and special collections.

In addition to the central library, each department has its own Seminar Library that reserves multiple copies of reference text books for the students and teaching staff's reading and short time issuance. The seminar library also provides magazines, journals, thesis and periodicals.

10.5. Transport

Although students are provided with their residential support within campus, yet the university provides the students with transport facilities. There are 22 buses which run 5 times a day to and from the campus to bring the students from around the campus. In addition, there are 2/3 ambulances at the medical center to provide transportation service to the critical patients from campus to medical center or to the government hospitals as required.

5. Financial grants for the students

Scholarships, Stipends and Free Studentships awarded to students are tenable on conditions of regular attendance, good conduct and satisfactory progress and these may be withdrawn at any time at the discretion of the authority concerned for unsatisfactory attendance or conduct or progress or for any other reason.

Students who abstain from attending classes to join a strike or lend support to it directly or indirectly no longer satisfy the primary requirement of good conduct and will be liable to forfeiture in part or whole of their scholarships, stipends, free studentships and all other financial assistance.

All students holding Scholarships/Stipends/Free Studentships shall attend classes except in cases of illness or any other disability for which leave must be obtained as provided in Section 4 below.

The authority to withdraw any scholarships/stipends/free studentship will be exercised by the Vice-Chancellor in the case of the awards made by the University and the Government and by the Provost of the Hall concerned in the case of awards out of funds placed at the disposal of the Provosts.

2. RENEWAL:

The renewal of Scholarship or Stipend for the second or any subsequent year will depend on the certificate of good conduct, regular attendance and satisfactory progress of the student concerned from the relevant Chairman of the Department. The progress of a Scholarship/Stipend holder will be regarded as satisfactory only when he/she has secured at least second class marks at the Post-Graduate Previous examinations in the case of Post-Graduate final year students. In the case of Honours students, the progress will be regarded as satisfactory only when the student concerned has been promoted to the next higher classes and has, in the opinion of the Chairman of the Department, come into minimum second class standard in his/her performance at Classes, and tutorial/practical examination, if any, during the preceding session.

In the case of renewal of Free Studentship, this requirement may be relaxed by the Vice-Chancellor at his discretion on the recommendation of the relevant Chairman of the Department.

3. REAWARD

When a scholarship or Stipend or Free studentship has not been availed of or withdrawn, it may be reawarded by the Vice-Chancellor or the Provost concerned in the case of awards out of Hall Funds. In such cases the award will be tenable from the date of the vacancy.

4. (a) Absence with leave up to 15 (fifteen) days in a year but ordinarily not exceeding 5 (five) days in a month for reasons other than illness may be granted by the relevant Chairman of the Department and such absence with leave will entail no loss of Scholarship/Stipend/Free studentship. Longer absence with leave other than sick leave will entail loss of scholarship/stipend/free studentship for the whole period, provided that Chairmen of the Departments shall have the authority to grant leave without any loss to the awardees up to one month in exceptional circumstances.

(b) Absence on grounds of illness up to 15 (fifteen) days in a year entails no loss to the award provided he produces a certificate of illness from the Medical Officer of this University or from any other registered Medical Practitioner duly countersigned by the relevant Provosts, if he is a resident student or by the Proctor, if he is a non-resident student and such leave of absence may be granted by the relevant Chairman of the Department. Longer absence of sick leave will entail loss of Scholarship/Stipend/Free studentship for the whole period provided that Chairmen of Departments shall have the authority to sanction leave up to 2 (two) months without any loss to the award and up to further one month on Half-Scholarship/Stipend/Free studentship in exceptional circumstances.

(c) If any student overstays the leave granted, the leave may be cancelled by the relevant Chairman of the Department unless, on sufficient reasons being shown, an extension of leave may be allowed.

(d) Holidays (including vacations) immediately prior to or in continuation of absence, with or without leave, are reckoned as absence with or without leave respectively. The Chairmen of Departments may in exceptional cases grant leave of absence to Scholarship/Stipend/Free studentship holders in combination with vacations or holidays provided Chairmen of Departments are satisfied that the absence in unavoidable. In such cases of absence with leave, holidays and vacations should not be reckoned as absence.
(e) Absence without leave for any period up to 30 (thirty) days at a time will entail loss of Scholarship/Stipend/Free studentship for twice the period of absence. Absence without leave for more than 30 (thirty) days will entail forfeiture of Scholarship/Stipend/Free studentship.
(f) Leave cannot be claimed as a matter of right and will be refused unless sufficient reasons are shown.
(g) Each Chairman of the University Department will maintain in his office full account of leave of all Scholarship/Stipend/Free studentship holders of his Department. He will also send his monthly report regarding conduct, progress and attendance of Scholarship/Stipend/Free studentship holders of his Department as per prescribed approved proforma within three days on the expiry of the month. It is on the basis of these reports that scholarship and stipend money will be disbursed and free studentship allowed.

5. Scholarship/Stipend earned during a month will ordinarily be paid to the Scholarship holders in the following months provided they have paid that fees and provided further that the University Scholarships/Stipends in respect of candidates for B.A., B.Sc. and B.Com. Honours Examinations from January to June and of other examinations from April to June may be adjusted against the fees of holders.
(জাতীয় বিশ্ববিদ্যালয়ের আওতায় স্নাতক পাস ও পূর্বভাগ পরীক্ষা অনুষ্ঠিত হওয়ায় বর্তমানে উপরোক্ত বিধির কার্যকারিতা নাই।)

6. Students shall not be allowed more than one Scholarship or Stipend except with the approval of the Vice-Chancellor in special cases, each individual case being considered on its own merit.
7. A Committee consisting of the following members shall be constituted for the award of Scholarships, Stipends and financial assistance other than those awarded by the Provosts:
(1) Pro-Vice-Chancellor Chairman
(2) The Deans of the Faculties concerned Member
(3) Provosts Member
(4) Two Chairmen of Departments Member
to be appointed by the Vice-Chancellor annually
(5) Registrar Secretary
(উপ-উপাচার্যকে আভ্যন্তরীণ বৃত্তি কমিটির সভাপতি নিয়োগ)
(*সুত্র: সিদ্ধান্তনং ৬, শিক্ষা পরিষদের ১৬৬তম সভা, তারিখ ২৬-৪-৮৮ ও ২-১০-৮৮)
2. Research Fellowships
1. Research Fellowship each of the value of TK. 1000/- a month, ordinarily one for each Department, may be awarded by the Academic Council annually on the recommendation of the Committee for Advanced Studies. This shall be tenable for one year in the first instance and renewable for second year subject to good conduct and the receipt of a satisfactory report from the Chairman of the Department concerned on the work undertaken by the student.

2. Notices inviting applications for Research Fellowships shall be issued by the Registrar. All University Research Fellowships shall be awarded for the first time with effect from the date on which the holders of the fellowships report, through the Chairman of the Department concerned, that they have taken up their work.

3. The holders of research fellowships shall only be permitted to take up their fellowship from the beginning of a month and to resign them from the end of a month. The year for holders of University Research Fellowship shall be 12 (twelve) months counted from calendar months in which they take up research work.

4. The holder of a Research Fellowship shall be required to give an undertaking that he will devote his whole time to research work. He will not be permitted to prepare himself for any University examinations, other than that for a Doctorate, or for any examination for Government service, or to accept any post during the period in which he has undertaken to pursue research work in the University.

5. The holder of Research Fellowship shall also be required to give a written undertaking that if he relinquishes it voluntarily or fails to fulfil the above conditions before the completion of the year for which it was awarded, he will, if required, refund the emoluments paid to him. No refund of scholarship money may be demanded from those research fellows who have been awarded Overseas Scholarships as they are actually continuing research work.

Provided that research fellowship may be kept in abeyance for a period not exceeding six months including vacations, if the holder is employed in the University or in some educational institution within the territorial jurisdiction of the University and provided further that no refund should be demanded from the holders of research fellowships who have completed at least one year and five months of their research and have drawn the scholarship for the same period.

6. The money saved through the vacating of research fellowships or return of fellowship paid, shall be refunded provided that no award should be made out of the refunded amount till it is sufficient for the award of an additional research fellowship for a period of two years.

7. Applications for research fellowships must contain a full statement of the candidates' academic career and must reach the Registrar through the Chairman of the Department concerned, not later than a date to be fixed by the Vice-Chancellor.

8. Holders of research fellowship shall be attached to or Resident in one of the Halls of Residence of the University.

9. Application for the extension of research fellowships for third year or any portion thereof, may be considered; provided money is available from the unspent balance accumulating in the Research Fellowship Fund.

10. In awarding research fellowship the following conditions shall be taken into account:

(a) Academic qualifications which shall be of a high order.

(b) Evidence of aptitude for research work.

(c) Resources of the University for enabling the candidate to carry on research work in the subjects submitted, such resources are to include the possibility of effective supervision and laboratory and library facilities, etc.

(d) Other conditions being approximately equal, preference shall be given to a candidate from a Department, in which there has not been any fresh award of a research fellowship for the past three years.

11. Applications for research fellowship together with recommendations from the Chairman of the Department, shall first be submitted to the Board of Advanced Studies which shall consider the qualifications of the various candidates and shall make recommendations to the Academic Council for the award of such fellowships as are available.

3. Post-graduate scholarships, stipends and free studentships

(A) SCHOLARSHIPS

REGULATIONS

1. The following Post-Graduate Scholarships are available for award annually:-

(i) 15 (fifteen) General University Post-Graduate Scholarships of Tk. 100/- per month with free-tuition will be awarded to regular Post-Graduate students (excluding those receiving Scholarships from Govt. or any other sources) securing highest marks in their Honours subjects at the B.A., BSS, B.Sc., B.Com., LL.B Honours Examinations of this University.

(ii) 4 (four) University Post-Graduate Scholarships of Tk. 100/- per month with free-tuition will be reserved for regular Post-Graduate Women students graduating with at least Second Class Honours from this University.

(Res. No. 20 of the 110th meeting of the Academic Council as approved under Res. No. 2 of the 175th meeting of the Syndicate held on 23.7.75 and amended vide Res. No. 6. of the 282nd meeting of the Finance Committee approved under Res. No. 2 of the 225th meeting of the Syndicate held on 25.1.84)

(iii) 33 (thirty three) University Post-Graduate Scholarships of Tk. 100/- per month with free-tuition will be awarded to regular Post-Graduate students (excluding those enjoying Scholarships from Govt. or any other sources in the Post-Graduate Final Year Classes) securing 1st and 2nd positions in 1st class at the Post-Graduate Previous Examination in each subject.

These Scholarships will be awarded to the best students in the Faculty of Arts, Science, Commerce, Social Science, Life and Earth Science and Law. These Scholarships will be awarded for one year at the first instance and may be renewed on satisfactory progress and good conduct of the scholars.

After award of the above Scholarships the Academic Council may also award Scholarships of such value to the deserving students, if any, on the recommendation of the Scholarship Committee. The Scholarship Committee may, if necessary, convert the Scholarships into stipends of lower value or into suitable lump grants within the limit of the total value of the Scholarships converted.

(এই ধারায় বিজনেস স্টাডিজ, চারুকলা কৃষি ও প্রকৌশল অনুষদের বিভাগগুলি অন্তর্ভুক্ত হবে।)

(B) STIPENDS

REGULATIONS

2. (a) 72 (Seventy two) Post-Graduate Stipends of Tk. 60/- each per month will be annually awarded to Final year students in the Faculty of Arts, Science, Commerce, Social Science, Life and Earth Science and Law securing at least Second Class in Hounours Examination of this University.

(b) 42 (forty two) Post-Graduate Stipends of Tk. 60/- each per month tenable for two years will be annually awarded to students of Previous year securing at least Second Division in the Degree Pass Examinations.
These Stipends will be awarded for one year in the first instance and may be renewed on satisfactory progress and good conduct of the scholars.
(c) In the award of Stipends, merit and poverty shall be the guiding factors. At least one stipend of each category shall be reserved for each Department.
After award of the above Stipends the Academic Council may award Stipends of such value to the deserving students, if any, on the recommendation of the Scholarship Committee.
The Scholarship Committee may, if necessary, convert the stipends into stipends of lower value or into suitable lump grants within the limit of the total value of the Stipends converted.

(C) FREE STUDENTSHIP
3. Free studentships will be annually awarded to 10% (fractions of a number being raised to the next whole number) of the total number of students in each class of each Department on the consideration of poverty and on the recommendation of the relevant Chairman of the Department. In case of students of the Master's previous year class, free studentships will be awarded for one year in the first instance and may be renewed for another session on satisfactory progress and conduct of the scholars.

4. Undergraduate scholarship and free studentship
(a) **Scholarships**
(Res. No. 6 of the 64th meeting of the Academic Council held on 10.11.65 as approved under Res. No. 2 of the 93rd meeting of the Syndicate held on 29.12.65 and amended vide Res. No. 6 of the 282nd meeting of the Finance Committee held on 22.1.84 as approved under Res. No. 2 of the 225th meeting of the Syndicate held on 25.1.84)
1. The following Scholarships are available for Honours students in this University:
(i) 63 (Sixty three) Scholarships of Tk. 70/- per month with free-tuition tenable for three years will be annually awarded to 1st year Honours students in the Faculties of Arts, Science, Commerce, Social Science, Life and earth Science and for four years for the Faculty of Law on the results of Higher Secondary Certificate Examinations. These Scholarships will be awarded only to the students securing First Division. At least one Scholarship shall be reserved for each Department.
The following provision has been suggested for addition to Sub-Clause (i) of Section 1: Provided that in the event of First Divisioners not available in a Department, the Scholarship may be converted into two Stipends of Tk. 35/- each per month without free-tuition.
(ii) 22 (Twenty two) Scholarships of Tk. 70/- per month with free-tuition tenable for two years for each of the Faculties of Arts, Science, Commerce, Social Science, Life and Earth Science and Law will be annually awarded to the 2nd Year Honours students having shown "EXCEPTIONAL PROGRESS' in the First Year Class on the recommendation of the relevant Faculty.
(iii) 11 (Eleven) Scholarships of Tk. 70/- per month with free-tuition for three years for each of the Faculties of Arts, Science, Commerce, Social Science, Life and Earth Science and four

years for the Faculty of Law will be annually awarded to women students of the First Year Honours Class on the result of Higher Secondary Certificate Examination.

2. All the above Scholarships will be awarded for one year in the first instance and may be renewed on satisfactory progress and good conduct of the scholars.

After award of the above Scholarships the Academic Council may award Scholarships of such value to the deserving students, if any, on the recommendation of the Scholarship Committee.

The Scholarship Committee may, if necessary, convert the Scholarships into stipends or into suitable lump grants within the limit of the total value of the Scholarships converted.

(b) **Stipends**

85 (Eightyfive) Stipends of Tk. 50/- per month will be awarded to the students of First Year Honours Class in the Faculties of Arts, science, Commerce, Social Science, Life and Earth Science and Law. These Stipends will be awarded to students securing at least Second Division in the H.S.C. Examination. At least one stipend shall be reserved for each Department. In case of the Faculties of Arts, Science, Commerce, Social Science, Life and Earth Science, the Scholarships will be tenable for three years while in case of the Faculty of Law the Scholarships will be tenable for four years. In the award of Stipends, merit and poverty shall be the guiding factors. Stipends shall be awarded for a year at the first instance and will be renewed on satisfactory progress and conduct of the scholars.

After award of the above Stipends the Academic Council may award Stipends of such value to the deserving students, if any, on the recommendation of the Scholarship Committee.

The Scholarship Committee may, if necessary, convert the Stipends into stipends of lower value or into suitable lump grants within the limit of the total value of the Stipends converted.

(c) Free studenthsip

Free Studentships will be annually awarded for a period of three years for the Faculties of Arts, Science, Social Science, Life and Earth Science and Commerce and for a period of four years for the Faculty of Law in consideration of poverty and on the recommendation of the Chairman of the relevant Department to the 10% (fractions of a number being raised to the next whole number) of the total number of students in the 1st year Honours Class of each Department. All free studentships will be awarded for one year in the first instance and may be renewed on satisfactory progress and conduct of the scholars.

5. Stipends for sportsmen

(I) 3 (three) Stipends for Sportsmen will be annually awarded to students of the Post-Graduate Previous and Final Year Classes combined for outstanding performance as Sportsmen on the recommendations of the Director of Physical Education.

(In accordance with the Res. of the meeting of the Syndicate held on 1.4.64)

(Res. No. 6 of the 97th meeting of the Academic Council held on 1.5.68 as approved under Res. No. 12 of the 117th meeting of the Syndicate held on 6.5.68.)

AND

(Res. No. 35 of the 93rd meeting of the Academic Council held on 27.7.72 as approved under Res. No. 11 of the 146th meeting of the Syndicate held on 5.8.72)

AND
(Res. No. 6 of the 282nd meeting of the Finance Committee held on 22.1.84 as approved under Res. No. 2 of the 225th meeting of the Syndicate held on 25.1.84.)
A total of 34 (thirty four) stipends for Sportsmen will be annually awarded to students for outstanding performance as Sportsmen on the recommendations of the Director of Physical Education.
FREE STUDENTSHIPS FOR SPORTSMEN
1% Free Studentship on the total enrolment will be awarded to the Sportsmen. These are awarded for one year only.
The value of Stipend is Tk. 50/- per month for Under-Gr5aduate student and Tk. 60/- p.m. for Post-Graduate student.

STIPENDS FOR B.N.C.C. CADETS
(Res. No. 6 of the 97th meeting of the Academic Council held on 1.5.68 as approved under Res. No. 12 of the 117th meeting of the Syndicate held on 6.5.68)
AND
(Res. No. 6 of the 282nd meeting of the Finance Committee held on 22.1.84 as approved under Res. No. 2 of the 225th meeting of the Syndicate held on 25.1.84)
(i) 4 (Four) Stipends will be awarded to the students holding regimental assignments in B.N.C.C. on the recommendation of the Officer Commanding of the B.N.C.C.
6. Free studentship for B.N.C.C. Cadets

ORDINANCE
(ii) 6 (Six) Free Studentships to B.N.C.C. Cadets of the 1st, 2nd, 3rd and 4th year Honours Classes will be annually awarded for outstanding performance as Cadets in the B.N.C.C. on the recommendation of the Officer Commanding of the B.N.C.C.
(iii) 5 (Five) Free Studentships to B.N.C.C. Cadets will be annually awarded to students of the Post-Graduate Previous and Final Year Classes combined for outstanding performance as B.N.C.C. Cadets on the recommendation of the Officer Commanding of the B.N.C.C.
(68th meeting of the Academic Council held on 4/5.5.66 as approved by the Syndicate held on 13.8.66)
(Iv) 9 (Nine) Free-Studentship to B.N.C.C. Cadets will be annually awarded for outstanding performance as B.N.C.C. Cadets on the recommendation of the Officer Commanding of the B.N.C.C.
These are awarded annually and not renewable.
The value of Stipend is Tk. 50/- per month for Under-Graduate student and Tk. 60/- p.m. for Post-Graduate student.

7. Medals and prizes

বিভিন্ন পুরস্কার (স্বর্ণপদক/বৃত্তি/উপবৃত্তি/অনুদান ইত্যাদি) প্রদানের জন্য কতিপয় সাধারণ নীতি-

১। রাজশাহী বিশ্ববিদ্যালয়ের ছাত্র-ছাত্রীদের পুরস্কার (স্বর্ণপদক, বৃত্তি, উপবৃত্তি, এককালীন অনুদান ইত্যাদি) প্রদানের উদ্দেশ্যে দাতাগণ যে টাকা দান করবেন তা যে কোন বাণিজ্যিক ব্যাংকে স্থায়ী আমানত (এফ.ডি.আর) হিসাবে বিনিয়োগ করা হবে এবং উক্ত স্থায়ী আমানতের বাৎসরিক মুনাফা থেকে প্রতি বছর পুরস্কার প্রদান করা হবে।

২। অন্যান্য তহবিলের ন্যায় এই সকল দানের টাকার ব্যাংক একাউন্ট বিশ্ববিদ্যালয় কর্তৃপক্ষ পরিচালনা ('অপারেট') করবেন।

৩। পুরস্কার প্রদানের উদ্দেশ্যে গচ্ছিত টাকার মুনাফা উত্তোলন করার প্রয়োজন পড়লে তা উত্তোলন করে একটি আলাদা সঞ্চয়ী ব্যাংক একাউন্টে জমা রাখতে হবে।

৪। এই সকল দান থেকে প্রাপ্ত মুনাফার ভিত্তিতে বিভিন্ন রকমের পুরস্কার প্রদান পরিচালনার দায়িত্ব একটি স্থায়ী কমিটির হাতে ন্যস্ড় থাকবে। প্রত্যেক দানের অর্থ সুষ্ঠুভাবে পরিচালনার জন্য ভিন্ন ভিন্ন ট্রাস্টি বোর্ড গঠন করা সমীচীন হবে না।

৫। স্থায়ী কমিটির গঠন হবে নিম্নরূপ:

সভাপতি : উপাচার্য বা উপ-উপাচার্য বা কোষাধ্যক্ষ

সদস : ডীন, কলা অনুষদ
ডীন, বিজ্ঞান অনুষদ
ডীন, আইন অনুষদ
ডীন, বিজনেস স্টাডিজ অনুষদ
ডীন, জীব ও ভূ-বিজ্ঞান অনুষদ
ডীন, সামাজিক বিজ্ঞান অনুষদ
ডীন, কৃষি অনুষদ
রেজিস্ট্রার
পরীক্ষা নিয়ন্ত্রক

সদস্য সচিব: হিসাব পরিচালক

(*উপ-উপাচার্যকে আভ্যন্ড়রীণ বৃত্তি কমিটির সভাপতি নিয়োগ)

সূত্র: সিদ্ধান্ড় নং-৬ শিক্ষা পরিষদের ১৬৬তম সভা তাং ২৬.৪.৮৮ ও ২.১০.৮৮)

৬। এই স্থায়ী কমিটির দায়িত্ব ও কার্যাবলীর মধ্যে থাকবে:

(১) এই নীতিমালা অনুযায়ী যে সকল ছাত্র/ছাত্রী এই সকল পুরস্কার (পদক, বৃত্তি, উপবৃত্তি বা এককালীন অনুদান) পাওয়ার যোগ্য তাদের তালিকা প্রণয়ন করা।

(২) ব্যাংকের মুনাফার হার, জিনিস-পত্রের মূল্য উত্যাদি অবস্থা বিবেচনা করে এবং দাতার ইচ্ছ যতদূর সম্ভব পূরণ করে পুরস্কারের পরিমাণ নির্ধারণ করা।

(৩) মাঝে মাঝে অবস্থা বিশেষে পুরস্কারের পরিমাণ, সংখ্যা ও অন্যান্য আনুষঙ্গিক বিষয়াদি সম্পর্কে পর্যালোচনা (review) করা।

(৪) এই পুরস্কার পদ্ধতি পরিচালনার ও সুষ্ঠু ব্যবস্থাপনার জন্য প্রদত্ত অন্যান্য কার্যাবলী।

৭। এই সকল পুরস্কার (মাসিক বৃত্তি/উপবৃত্তি ছাড়া) বছরে একটি/দুইটি অনুষ্ঠানের মাধ্যমে প্রদানের ব্যবস্থা করা বাঞ্ছনীয়।

৮। এই সকল পুরস্কার প্রদানের ক্ষেত্রে যদি দেখা যায় যে, একাধিক ছাত্র-ছাত্রী সমান যোগ্যতার অধিকারী তাহলে বিশেষ পুরস্কারের অর্থে সঙ্কুলান হলে ঐ ছাত্র-ছাত্রীকে সমপরিমাণ অর্থে পুরস্কার দেয়া যেতে পারে। অর্থে সঙ্কুলান না হলে পূর্ববর্তী পরীক্ষার ফলাফলের ভিত্তিতে যোগ্য ছাত্র-ছাত্রীকে বাছাই করা যেতে পারে।

৯। এই সকল পুরস্কার বিতরণী অনুষ্ঠানে দাতা/দাতার প্রতিনিধিকে উপস্থিত থাকার জন্য আমন্ত্রণ করা হবে। তবে তাঁদের এই অনুষ্ঠানে যোগদানের জন্য বিশ্ববিদ্যালয়ের কোন আর্থিক দায় দায়িত্ব থাকবে না।

(দ্রষ্টব্য:

প্রথম বারের মত নিম্নলিখিত পরীক্ষার ফলাফলের উপর ভিত্তি করে ১৯৮৯ সালের প্রথম দিকে একটি অনুষ্ঠানের মাধ্যমে অগ্রণী ব্যাংকের (সাবেক হাবিব ব্যাংক) স্বর্ণপদক প্রদান করা হয়:

(১) স্নাতক সম্মান পরীক্ষা ১৯৮৫ (আইন ছাড়া সকল বিষয়)

(২) স্নাতক সম্মান আইন পরীক্ষা ১৯৮৬

(৩) বি.এড. পরীক্ষা ১৯৮৮

(৪) এম.বি.বি.এস পরীক্ষা ১৯৮৮ জানুয়ারী

(৫) স্নাতকোত্তর পরীক্ষা ১৯৮৪ (আইন ছাড়া সকল বিষয়)

(৬) স্নাতকোত্তর আইন পরীক্ষা ১৯৮৬

(৭) এম.এড. পরীক্ষা ১৯৮৮

উলেণ্ঢখিত পরীক্ষাগুলির পরবর্তী পরীক্ষার ফল ১৯৮৯ সালের মধ্যে বের হওয়ার কথা। বের হলে তাদেরকেও বছরের (১৯৮৯) শেষ দিকে আরেকটি অনুষ্ঠানের মাধ্যমে এই পদক দেয়া যেতে পারে।)

বিশ্ববিদ্যালয় কর্তৃক প্রদত্ত পদক/পুরস্কার/বৃত্তির তালিকা

ক্রমিক নং	পদক/পুরস্কার/বৃত্তির নাম	দাতার নাম	দেয় টাকার পরিমাণ	পদক/পুরস্কার / বৃত্তির মূল্য ও ধরন	বার্ষিক/ এককালীন	মোট সংখ্যা
১।	অগ্রণী ব্যাংক স্বর্ণপদক	অগ্রণী ব্যাংক	৬,৭৬,৬০৬/-	৫,০০০/-	এককালীন	-
২।	যতীন্দ্র মোহন রায় গণমংগল মেমোরিয়াল পুরস্কার	স্বর্গীয় সুরেশ চন্দ্র দাস গুপ্ত	৩,৫০০/-	৪২৪/-		
৩।	সুরেশ চন্দ্র দাস গুপ্ত মেমোরিয়াল পুরস্কার	মিসেস জ্যোতিষমতি দেবী	২,০০০/-	২৪০/-	পাস কোর্সের জন্য প্রযোজ্য। বর্তমানে চালু নাই	
৪।	ওসমান গণি বৃত্তি	প্রফেসর ডাঃ জুবাইদা খাতুন	৩০,০০০/-	৩,৬০০/-	বার্ষিক	১ জন
৫।	নূরজাহান নেছা পুরস্কার	প্রফেসর ডাঃ জুবাইদা খাতুন	২৫,০০০/-	৩,০০০/-	বার্ষিক	২ জন
৬।	হামিদা হক ফাউন্ডেশন বৃত্তি	প্রফেসর এম.টি. হক	২,০০,০০০/-	২৭,৬০০/-	বার্ষিক	৭ জন
৭।	মোহাম্মদ ইসমাইল মেমোরিয়াল বৃত্তি	ড. মোহাম্মদ আতাউর রহমান	৫০,০০০/-	৭,০০০/-	বার্ষিক	১ জন
৮।	প্রফেসর মোফাসসাল উদ্দিন আহমদ বৃত্তি	মোসাম্মৎ মরিয়ম বেগম	৫০,০০০/-	৬,০০০/-	বার্ষিক	১ জন
৯।	আকবর হোসেন স্কলার পুরস্কার	ইঞ্জিনিয়ার আকবর হোসেন	১০,০০,০০০/-	১৫,০০০/-	বার্ষিক	১ জন
১০।	ইঞ্জিনিয়ার আকবর হোসেন বৃত্তি	ইঞ্জিনিয়ার আকবর হোসেন		১,৮০০/-	বার্ষিক	৪৪ জন
১১।	ডা. এ.কে. খান স্বর্ণপদক	ডা. আবুল খায়ের খান	৫০,০০০/-	স্বর্ণপদক	বার্ষিক	১ জন
১২।	ড. আসাদুজ্জামান স্মৃতি পুরস্কার	মিসেস রেবেকা আসাদ	৫,০০০/-	৫০০/-	এককালীন	১ জন
১৩।	এস.এম. ফাররুখ মাহধহফফুজ মিটুল স্মৃতি পুরস্কার	ডা. সৈয়দ মাহধহফফুজুল হক ও মেশকাত আরা বেগম	১৫,০০০/-	১,২০০/-	এককালীন	১ জন
১৪।	ড. মমতাজ উদ্দিন আহমদ স্বর্ণপদক	প্রফেসর মাসুদা আহমদ	১,৫০,০০০/-	স্বর্ণপদক	বার্ষিক	১ জন
১৫।	ড. মমতাজ উদ্দিন আহমদ বৃত্তি	প্রফেসর মাসুদা আহমদ		৬,০০০/-	বার্ষিক	১ জন
১৬।	রফিক আহমেদ পুরস্কার	প্রফেসর রফিক আহমদ	৫০,০০০/-	২,০০০/-	এককালীন	১ জন
১৭।	সৈয়দা বারেরা মেমোরিয়াল পুস্কার	প্রফেসর রফিক আহমেদ		২,০০০/-	এককালীন	১ জন
১৮।	চিশধহফতি বৃত্তি	শামসুল হক চিশধহফতি	১,১০,০০০/-	৬,০০০/-	বার্ষিক	২ জন
১৯।	সাবিনা ইয়াসমিন, মিতা স্মৃতি বৃত্তি	মোসাম্মাত আখতার বানু	৩৭,৫০০/-	৩,৬০০/-	বার্ষিক	১ জন
২০।	মোসাম্মাত সাজেদা বেগম উপবৃত্তি/এককালীন অনুদান	মোসাম্মাত সাজেদা বেগম	১০,০০০/-	৬০০/-	এককালীন	২ জন
২১।	প্রফেসর এম.আর. সরকার বৃত্তি	মিসেস কে.এ. ফাসিহা খাতুন	২,০০,০০০/-	৪,৮০০/-	বার্ষিক	১ জন
২২।	সালাহ উদ্দিন আহমেদ বৃত্তি	মিসেস কে.এ. ফাসিহা খাতুন		৪,৮০০/-	বার্ষিক	১ জন
২৩।	মিসেস রেহেনা মাহতাব স্কলারশীপ	শাহাবুদ্দীন মাহতাব	৭২,০০০/-	২৪,০০০/-	বার্ষিক	১ জন
২৪।	সালাহ উদ্দীন আহমদ মেরিট স্কলারশীপ	ড. এ.এ.জেড. আহমদ	২,০০,০০০/-	৫,০০০/-	এককালীন	২ জন
২৫।	সাইদা খাতুন মেরিট স্কলারশীপ	ড. এ.এ.জেড. আহমদ		৫,০০০/-	এককালীন	২ জন
২৭।	উর্মী ইসলাম বৃত্তি	প্রফেসর মযহারুল ইসলাম	পেনশেন থেকে	৪,৮০০/-	বার্ষিক	৪ জন
২৮।	প্রফেসর মকবুল হোসেন মেধা পুরস্কার	হাসনা বানু	১,০০,০০০/-	৬,০০০/-	বার্ষিক	১ জন

ক্রমিক নং	পদক/পুরস্কার/বৃত্তির নাম	দাতার নাম	দেয় টাকার পরিমাণ	পদক/পুরস্কার / বৃত্তির মূল্য ও ধরন	বার্ষিক/ এককালীন	মোট সংখ্যা
২৯।	প্রফেসর ফজলুল হালিম চৌধুরী বৃত্তি	মিসেস শামসুন্নাহার চৌধুরী	১,০০,০০০/-	২,৫০০/-	এককালীন	৩ জন
৩০।	আহমেদ হোসেন মেধা বৃত্তি	মিসেস মাহবুবা হোসেন	১,০০,০০০/-	৩,০০০/-	বার্ষিক	২ জন
৩১।	উম্মে সালমা চিশতি বৃত্তি	শামসুল হক চিশতি	১,৩০,০০০/-	৯,৬০০/-	বার্ষিক	২ জন
৩২।	সারোয়ার জাহান স্মৃতি পুরস্কার	মিসেস সালিমা সারোয়ার	৩,০০,০০০/-		এককালীন	১ জন
৩৩।	সারোয়ার জাহান গবেষণা পুরস্কার	মিসেস সালিমা সারোয়ার	১,০০,০০০/-		এককালীন	১ জন

(সংশিণ্টষ্ট দপ্তর কর্তৃক প্রদত্ত তালিকা মোতাবেক ক্রমিক এবং অর্থের উৎস উলেণ্টখ করা হলো)

বিভাগ কর্তৃক প্রদত্ত মেধা বৃত্তিসমূহ

১. রফিকুল ইসলাম মেধা বৃত্তি

প্রফেসর মো. রফিকুল ইসলাম এই বিভাগের প্রাক্তন শিক্ষক। তিনি বর্তমানে যুক্তরাষ্ট্রে শিক্ষকতা পেশায় নিয়োজিত আছেন। তিনি প্রাণরসায়ন ও অণুপ্রাণ বিজ্ঞান বিভাগে অধ্যয়নরত তাঁর এলাকার মেধাবী ছাত্র-ছাত্রীদের আর্থিক সহায়তার জন্য ২,০০,০০০/- (দুই লক্ষ) টাকা বিভাগে প্রদান করেছেন। এই টাকা "রফিকুল ইসলাম মেধা বৃত্তি" শিরোনামে FDR করে ব্যাংকে জমা রাখা হয়েছে ও মেধা বৃত্তি দেয়ার বিষয়ে গত ০৬/০২/২০১৫ তারিখে বিভাগীয় একাডেমিক কমিটি সিদ্ধান্ত গ্রহণ করেছে।

২. তানিয়া আক্তার মেধা বৃত্তি

বিভাগের প্রাক্তন ছাত্রী তানিয়া আক্তার ২০০৮ সালে দূরারোগ্য স্কিন ক্যান্সার রোগে আক্রান্ত হয়ে মৃত্যুবরণ করেন। তিনি পরিসংখ্যান বিভাগের অবসরপ্রাপ্ত প্রফেসর মনোয়ার হোসেন এবং প্রফেসর হোসনে আরার কন্যা। তাঁর স্মৃতি ধরে রাখার জন্য তাঁর মা "তানিয়া আক্তার মেধা বৃত্তি" প্রদানের উদ্দেশ্যে ২,০০,০০০/- (দুই লক্ষ) টাকা বিভাগে দান করেছেন। বিগত ০৭/০২/২০১৫ তারিখে বিভাগীয় একাডেমিক কমিটি কর্তৃক এই টাকা "তানিয়া আক্তার মেধা বৃত্তি" শিরোনামে FDR করে ব্যাংকে জমা রাখা হয়েছে ও মেধা বৃত্তি দেয়ার বিষয়ে সিদ্ধান্ত গ্রহণ করা হয়েছে।

ACADEMIC COSTUME: REGULATION

(Res. No. 62, approved by 350th Syndicate, held on 1.8.98)
(At the latest)

1. The academic costume be as follows for the Degree noted below in all cases except those indicated; the gowns shall be of black material and four cornered black cap with tassel, will be worn in all cases:

Chancellor
Gown - Black (Embroidery Ash with Zorry)
Hood - Outside- Black Colour, Inside- Pink Colour
Boarder - Biscuit Colour

Vice-Chancellor
Gown - Black (Embroidery Ash with Zorry)
Hood - Outside- Black Colour, Inside- Bottle Green Colour

Boarder - Ash Colour

প্রো-ভাইস চ্যান্সেলর

গাউন - কাল রং-এর

হুড - বাইরে কাল ভিতরে মেরুন রং-এর

বর্ডার - খুব হালকা কমলা রং-এর

কোষাধ্যক্ষ

গাউন - কাল রং-এর

হুড - বাইরে কাল ভিতরে নীল রং-এর

বর্ডার - খুব হালকা আকাশী রং-এর

সেই সংগে দুইটি ক্যাপ (দুই ব্যক্তিত্বের জন্য) মাননীয় উপাচার্যের ক্যাপের মতই হবে, তবে ক্যাপের টারসেল আলাদা ও হালকা রং-এর হবে।

For Bachelor of Arts and Social Science of Black silk or stuff edged on the inside with a border of white silk;

For Bachelor of Business Administration of black silk or stuff edged on the inside with a border of pink silk;

For Bachelor of Science and Life and Earth Science	-	of black silk or stuff edged on the inside with a border of blue silk;
For Bachelor of Law	-	of black silk or stuff edged on the inside with a border of yellow silk;
For Bachelor of teaching	-	of black silk or edged on the inside with a border of mauve silk;
For Master of Business Administration	-	of black silk or stuff with a lining of blue silk;
For Master of Arts	-	of black silk or stuff with a lining of green silk;
For Master of Science and Life and Earth Science	-	of black silk or stuff with a lining of crimson silk;

মাষ্টার্স অব এম.এস.এস

গাউন- কাল রং-এর

হুড- বাইরে কাল ভিতরে হলুদ রং-এর

বর্ডার- হলুদ রং-এর

এল.এল.এম

গাউন - কাল রং-এর

হুড - বাইরে লাল ভিতরে কমলা রং-এর

বর্ডার - কমলা রং-এর

এম.ফিল (সকল অনুষদের জন্য)

গাউন - গাঢ় হলুদ রং-এর

হুড - বাইরে গাঢ় হলুদ, ভিতরে অফ হোয়াইট রং-এর

বর্ডার - হলুদ রং-এর

2. The Gown and hood for different Doctorate Degree shall be as follows:

Ph.D. (Arts)-
Gown - Scarlet silk;
Hood - Cream silk with two inch green silk border on the outside beneath a one-fourth inch beading of creak silk;

Ph.D. (Science)-
Gown - Scarlet silk.
Hood - Cream silk with two inch deep blue silk border on the outside beneath a one fourth inch beading of cream silk.

পি-এইচ.ডি. (কমার্স)
গাউন - গাঢ় কমলা রং-এর
হুড - ভিতর সাদা, বাইরে লাল রং-এর
বর্ডার - লাল রং-এর
পি-এইচ.ডি. (এম.এস.এস.)
গাউন - গাঢ় কমলা রং-এর
হুড - ভিতর হলুদ, বাইরে লাল রং-এর
বর্ডার - হলুদ রং-এর
D.Litt.-
Gown - Scarlet silk with black silk facings 4 inches wide running down the length on either side.
Hood - Cream silk, lined throughout with crimson silk.
D.Sc.-
Gown - Scarlet silk with black silk facings 4 inches wide running down the length on either side.
Hood - Cream silk, lined throughout with mauve silk.

3. The academic costume for the members of the Syndicate and the Academic Council shall be as follows:-
For members of the Syndicate-
Gown - Black
Sash - Dark crimson silk 4 inches wide with fold fringe 5 inches long.
For members of the Academic Council-
Gown - Black
Sash - Dark green 4 inches wide with silver fringe 5 inches long.
For members of the Senate-
Gown - Black
Sash - Members of the Syndicate, Academic Council and the University Senate, may, at their option, wear the academic costume of their own Universities but they must wear the distinctive Sashes of the University of Rajshahi as prescribed above.

4. Teacher of the University of Rajshahi not holding any University degree, shall wear a black gown with the Master's Hood of the Faculty to which they belong.
5. Gowns and hoods will be hired to graduates at the Convocation ceremony at a sum of Tk. 4/- (Taka four). The money paid for the hire of academic costume for attending the Convocation, shall not be refunded in any case.

6. List of Academic staffs

Chairman: Professor Dr. Tanzima Yeasmin

Sl. No.	Name of staffs	Mobile No.	Photo
Professor			
1.	Dr. M. Shahjahan	01715255567	
2.	Dr. Ranajit Kumar Shaha	01712782680	
3.	Dr. Jahan Ara Khanam	01914254928	
4.	Dr. Md. Habibur Rahman	01714475378	
5.	Dr. Narayan Roy	01715483840	

6.	Dr. Md. Rezaul Karim-2	01755391731	
7.	Dr. Md. Shahidul Haque	01742271897	
8.	Dr. Md. Tofazzal Hossain	01711236318	
9.	Dr. Md. Matiar Rahman	01711947154	
10.	Dr. Tanzima Yeasmin	01556312361	
11.	Dr. Md. Rezaul Karim-3	01718213284	
12.	Dr. Farzana Pervin	01914254931	
13.	Dr. Farzana Nikkon	01711825728	

14.	Dr. Niranjan Kumar Sana	01914254912	
15.	Dr. Md. Khaled Hossain	01726884046	
16.	Dr. Kamal Krishna Biswas	01741070992	
17.	Dr. Md. Belal Uddin	01714549826	
18.	Dr. Md. Zahangir Alam Saud	01711302389	
19.	Dr. Md. Amirul Islam	01712141273	
20.	Dr. Md. Mominul Haque	01733341946	
21.	Dr. Shahanaz Khatun	01712247607	

22.	Dr. Md. Salim Uddin	01758033310	
23.	Dr. Syed Rashel Kabir	01724674615	
24.	Dr. Md. Ashraful Haque	01957776258	
25.	Dr. Md. Masudul Hasan Khan	01740999666	
26.	Dr. Md. Anowar Hossain	01556311310	
27.	Dr. Md. Sohel Hasan	01780471721	
Associate Professor			
28.	Dr. Kazi Abdus Salam	01305343825	

29.	Dr. Md. Shariar Shovon	01779198427	
30.	Dr. Md. Abdur Rakib	01711302971	
31.	Dr. A.K.M. Asaduzzaman	01704649293	
32	Dr. Subed Chandra Dev Sharma	01717729849	
33.	Dr. Md. Rowshanul Habib	01715650193	
34.	Dr. Imtiaj Hasan	01719130033	
35.	Dr. Md. Golam Sarowar Jahan	01640734349	
36.	Dr. Md. Ismail Hossain	01712900209	

37.	Dr. Md. Abdul Aziz	01717675191	
38.	Dr. Md. Farhadul Islam	01712974596	
39.	Md. Nurujjaman	01710356526	
40.	Dr. Md. Shakhawoat Hossain	01303420768	

7. List of Non-Academic Staffs

Officers

	Name	Designation	Mobile Phone
01	S.M. Nurunnabi	Assistant Register	01718843196
02	M. Munsur Ul Islam	Technical Officer	01937969050
03	S.M. Ahsan Alamgir	Data entry supervisor	01713706085

Employee (3rd Grade):

	Name	**Designation**	**Mobile No.**
01	Md. Mahmudul Hassan	Lab. Technician	01712999714
02	Jibon Kumar Sen	Ud Assistant Eqv	01746855691
03	Ashok Kumar Das	Office Pion	01743127570

Employee (4th Grade):

	Name	Designation	Mobile No.
1.	Md. Monimul Islam	Labrotory Attendant	01719022605
2.	Swapon Kumar	Labrotory Attendant	01832667359
3.	Md. Rezaul Karim	Orderly pion	01703379324
4.	Md. Abul Kalam Azad	Seminar Bearer	01712536488
5.	Md. Jamal Uddin	Animal House Cleaner	01774995377
6.	Prodip Jamadar	Sweeper	01759411209
7	Selim Sarma	Sweeper (Temporary)	01709019874