



**Outcome Based Curriculum for  
Master of Science (M.Sc.) Program  
Session: 2022-2023**



**Department of Geography and Environment**

**Islamic University  
Kushtia-7003, BANGLADESH**

**www.iu.ac.bd**



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***Session: 2022-2023***

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Islamic University

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## OVERVIEW OF THE UNIVERSITY AND DEPARTMENT

(At a glance)

Name of the University

**Islamic University**

Establishment of the University

**November 22, 1979**

Founder Vice Chancellor of the University

**Professor Dr. A. N. M Momtaz Uddin Choudhury**

Current Vice Chancellor of the University

**Professor Dr. Shaikh Abdus Salam**

First Academic Session of the University

**1986-87**

Official Website of the University

**www.iu.ac.bd**

Official Contact Detail of the University

**Tel: +88 071 74904 E-mail: registrar@iu.ac.bd Fax: +880 71 74905**

Name of the Department

**Geography and Environment (GE)**

Founder Chairman of the Department

**Prof. Dr. S. M. Mostafa Kamal**

Current Chairman of the Department

**Md. Inzamul Haque**

Program Offering

**BSc (Hons.), MSc, MPhil, PhD**

First Academic Session of the Department

**2017-18**

Official Website of the Department

**www.ge.iu.ac.bd**

Official Contact Detail of the Department

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<b>Officers-</b>				
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## The Ordinance for the Master of Science (M.Sc.) Programme at Faculty of Sciences, IU

### DEGREE

The name of the degree shall be "Master of Science", in short M.Sc. It is a composite program of learning, examination and evaluation. The Master of Science (M.Sc.) program will consist of Non-thesis Group (Group-A) and Thesis Group (Group-B).

### MEDIUM OF INSTRUCTION

The medium of instruction of the M.Sc. program under this faculty shall be English.

### COURSE IDENTIFICATION SYSTEM

Each course shall be identified by the code name of the department concerned, comprising a maximum of 05 (five) letters, followed by a hyphen and then by four digits. The first one of these four digits will indicate the academic year; the second digit will indicate the semester, and the last two digits will denote the ordinal number of the course in the syllabus. For Example, GE-5101 will denote the 1<sup>st</sup> course of the M.Sc. First semester in the syllabus of the Department of Geography and Environment, while GE-5202 will denote the 2<sup>nd</sup> course of the M.Sc. Second semester in the syllabus of the Department.

### DURATION AND DISTRIBUTION OF SEMESTER ACTIVITIES

The Master of Science (M.Sc.) program in the departments under the faculty shall comprise the Non-thesis Group (Group-A) and/or the Thesis Group (Group-B).

- a) The study of the Non-thesis Group (Group-A) shall extend over a period of one academic year consisting of two (02) consecutive semesters, and a student shall have to complete the program within two (02) consecutive academic years (*i.e.*, 04 consecutive semesters) from the date of his/her first admission to the M.Sc. program.
- b) The study of the Thesis Group (Group-B) shall extend over a period of one and a half academic years consisting of three (03) consecutive semesters, and a student shall have to complete the program within two and half (2.5) consecutive academic years (*i.e.*, 05 consecutive semesters) from the date of his/her first admission to the M.Sc. program.
- c) The activities of each semester consisting of six consecutive academic calendar months shall be distributed as follows:
  - i) Classes : 13 (thirteen) active weeks
  - ii) Preparatory Leave : 02 (two) weeks
  - iii) Semester Final Examination : 04 (four) weeks
  - iv) Vacation : Only the usual University vacation will be applicable
  - v) Result publication : Within 30 (thirty) days from the last exam date

### CREDIT REQUIREMENT AND DURATION OF STUDY

- a) For theoretical courses 13 (Thirteen) class-hour of 60 minutes each is defined as one credit.
- b) For practical or lab courses 26 (Twenty six) lab hours work defined as one credit.
- c) Based on course content and weightage, individual courses may have different credit hours.
- d) The total credits required to be earned or fulfilled for obtaining a Master of Science (M.Sc.) degree from "Non-thesis Group (Group-A)" will be 42 credits.
- e) The total credits required to be earned or fulfilled for obtaining a Master of Science (M.Sc.) degree from "Thesis group (Group-B)" will be 57 credits.
- f) The distribution of credits among courses of the Master of Science (M.Sc.) program shall designed in the course curricula by the committee of courses of the respective Departments keeping the total 42 credits for "Group-A" and 57 credits for "Group-B" intact and must be approved by the Academic Council through the Faculty.

#### Assignment of Credit:

- a) Credit for each Theoretical Course = 2.0 to 4.0
- b) Credit for each Practical Course = 1.0 to 3.0
- c) Credit for Industrial Tour/ Field work/In-plant Training = 1.0 to 6.0
- d) Credit for Project /Internship Dissertation = 6.0 (Maximum)

e) Credit for Research/Thesis works:	
Dissertation/Thesis	= 10.0
Thesis defence/presentation	= 6.0
Overall performance evaluation by the thesis supervisor	= 2.0
	-----
	Total = 18.0
f) Credit for Course Work (Thesis related Theoretical Course)	= 3.0
g) Credit for <i>viva-voce</i> (if any)	= 1.0 (Maximum)

**NB:** The step of credit increment should not be less than 0.5

### DISTRIBUTION OF MARKS:

a) <b>For Theoretical Courses:</b>	
i) Class attendance	:10%
ii) Quiz/presentation/ <i>Viva-Voce</i>	: 05%
iii) In-course/tutorial exam/assignment	: 15%
iv) Semester end final examination	: 70%
b) <b>For Practical/Laboratory Courses:</b>	
i) Laboratory performance during lab hours	: 05%
ii) Lab attendance	: 10 %
iii) Lab notebook on experiment	: 05%
iv) <i>Viva-voce</i> on experiments during practical examinations	: 10%
v) Semester-end final Practical Examinations	: 70%
c) <b>For Industrial Tour/Field work /In-plant Training Courses:</b>	
i) Report of the Industrial Tour/Field work /In-plant Training	: 50%
ii) Overall performance in the Tour/Field work /Training	: 30%
iii) <i>Viva-voce</i> /Quiz/Presentation	: 20%
d) <b>For Thesis/Project /Internship Courses:</b>	
i) Dissertation of the Project/ Internship work	: 56%
ii) Presentation of the Project/ Internship work	: 33%
iii) Overall performance evaluation by the supervisor	: 11%

### REQUIREMENTS TO SIT FOR SEMESTER FINAL EXAMINATION

- Students having 75% or more attendance on average is eligible to appear in the semester final examination.
- Students having average 60-74% attendance will be allowed to sit for the examination with fine.
- Students having average attendance below 60% will not be allowed to sit for the semester final examination but may seek re-admission in the program.

### 15. GRADING SYSTEM

#### a) Grades and Grade Points:

Marks	Letter Grade	Grade Point	Interpretation
80% and above	A+ (A plus)	4.00	Outstanding
75% to less than 80%	A (A regular)	3.75	Excellent
70% to less than 75%	A- (A minus)	3.50	Very Good
65% to less than 70%	B+ (B plus)	3.25	Good
60% to less than 65%	B (B regular)	3.00	Satisfactory
55% to less than 60%	B- (B minus)	2.75	Below Satisfactory
50% to less than 55%	C+ (C plus)	2.50	Average
45% to less than 50%	C (C regular)	2.25	Below Average
40% to less than 45%	D	2.00	Poor

less than 40%	F	0.00	Fail
	I		Incomplete

- (b) In the case of the theory courses only "D" and higher grades will be counted as credits earned By a student.
- (c) In the case of the Industrial Tour, Field work, In-plant Training, Project, Internship, Practical and *Viva-Voce* courses grades lower than C+ will not be counted as credits earned by a student.
- (d) Absence from the examination will be considered as **Incomplete**.
- (e) The calculations of the Grade Point Average (GPA), the Accumulated Grade Point Average (AGPA), and the Cumulative Grade Point Average (CGPA) shall be done according to the rules followed by the public universities in the country, as demonstrated in the Appendix-I.

### PROMOTION SYSTEM

- a) The promotion from the 1<sup>st</sup> semester to the 2<sup>nd</sup> semester for both non-thesis-group (Group-A) and thesis-group (Group-B) students of the M.Sc. program shall be automatic.
- b) For promotion from 2<sup>nd</sup> semester to 3<sup>rd</sup> semester a thesis-group (Group-B) student shall be required to earn a minimum AGPA of 2.25 (Letter Grade-C), taking into consideration the entire published retake grades (if any).
- c) The result of any semester final examination must be published/informed before the start of the next semester final examination.

### RETAKE AND/OR IMPROVEMENT OF EXAMINATION

- a. If a student obtains "F" grade in a theoretical/practical course or has incomplete a theoretical/practical course, he/she must apply for the Retake Examination (Compulsory Retake or CR) to the Controller of Examinations through the Chairman of the Department within 15 days of publication of the results at the end of the 2<sup>nd</sup> semester (for both non-thesis and thesis groups) and at the end of the 3<sup>rd</sup> semester (for thesis group only). And subject to the approval of the Authority, the respective M.Sc. Examination Committee shall conduct the CR examination. The applicant shall have to pay the required fee for each course he/she retakes.
- b. After the publication of the final results at the end of the final semester (i.e., the 2<sup>nd</sup> Semester for the Group-A, and the 3<sup>rd</sup> Semester for the Group-B), a student shall be allowed to apply within 15 days to the Controller of Examinations through the Chairman of the Department for Improvement Examinations of only those theoretical courses in which he/she has obtained GP of 2.75 (Letter Grade B-) or less. And subject to the approval of the Authority, the respective M.Sc. examination committee shall conduct the improvement examinations. The applicant shall have to pay the required fee for each course he/she takes.
- c. A student shall not be allowed to improve the scores of the Internal Evaluation part of any theoretical or practical course.
- d. A student shall not have the opportunity to improve his/her grade in any course if he/she has got CGPA of 3.25 (Letter Grade B+) or more as the result of the final examinations of the final semester.
- e. A student shall have the opportunity to Retake/Improvement Examinations only once.
- f. For practical courses, the students shall have only the opportunity for Compulsory Retake, but not the Improvement Examinations.
- g. If a student fails to improve his grade in a course, his/her previous grade will be retained.
- h. Students shall not be allowed to retake/improve the scores of viva-voce/presentations, industrial tour, fieldwork, in-plant training, project, internship, and thesis.
- i. A physically sick student may apply to the authority through the Chairman of the department and the head of the Medical Centre for the approval of sitting for the examination in a different seat in the respective examination hall.

### DROP OUT

- a. After having re-admission for the 2<sup>nd</sup> time, if a student fails to earn minimum required GPA for promotion, shall be dropped out from the program.
- b. If a student fails to earn required total credits within two (02) academic years (Group-A)/ within two and half academic years (for Group-B) since his/her first admission to M.Sc. program from any of the

departments under this faculty, he/she shall be dropped out from the program and shall no more be allowed to continue his/her studentship.

- c. If it seems that it is not possible for a student to complete the program within two (02) academic years (Group-A)/ within two and half academic years (Group-B) from any of the departments under this faculty, he/she shall be dropped out from the program.

#### **AWARD OF THE MASTER OF SCIENCE (M.Sc.) DEGREE**

- a) A student of the non-thesis group (Group-A) must complete a total of 42 credits, and a student of the thesis group (Group-B) must complete a total of 57 credits offered by the departments under this faculty.
- b) A student carrying "F" grade/ Incomplete in any course shall not be awarded the degree.
- c) A student shall earn a minimum Cumulative Grade Point Average (CGPA) of 2.25 (Letter grade C) in the program.
- d) The final result (CGPA) must be published with two digits after the decimal point.

#### **ADOPTION OF UNFAIR MEANS**

- a. If a student adopts unfair means in any semester (1<sup>st</sup> semester/ 2<sup>nd</sup> semester) final examination or any other examination of M.Sc., he/she shall be penalized in accordance with the Islamic University rules.
- b. If any student adopts unfair means in any examination, invigilator (s) shall report his/her nature of unfair means to the Chief-invigilator and Chairman of the examination committee. The Chairman of the respective examination committee with recommendation from the Chairman of the Department will take necessary action for onward transmission to the disciplinary committee of the university for such student.

#### **READMISSION**

- a) If a student fails to get promotion from 1<sup>st</sup> semester to 2<sup>nd</sup> semester (for Group-A and Group-B)/2<sup>nd</sup> semester to 3<sup>rd</sup> semester (for Group-B) or fails to appear at the above examinations due to shortage of required percentage of attendance or fails to deposit the examination fees or is expelled from the university for any reason, in that case he/she shall have to get himself/herself readmitted for only once in the successive academic year.
- b) A student having readmission has to take all the courses of that semester he has been readmitted.

#### **DEAN'S AWARD**

In recognition of excellent academic performance, students may be given Dean's Merit Award for top scorer (CGPA) from every batch among the students of Group-A & B of each department after completion of the M.Sc. degree as per following criteria-

- a) An awardee must not have appeared in any improvement exam during his/her study record.
- b) An awardee must be top scorer among the students of Group-A & B of M.Sc. and have CGPA 3.75 or above.
- c) However, the number of awardees of each department will not exceed one. In the case of equal CGPA the final semester GPA will be considered to break the tie.

Curriculum for M.Sc. (Masters) Program  
(Session: 2022-23)

**PART-A**

**Program Overview**

Degree	Master of Science (M.Sc.) in Geography and Environment
Duration of the Degree	1 year Master's by Coursework-General Group (Group A)
	1.5 years Master's Mixed Mode-Thesis Group (Group B)
Program Offering Entity (POE)/Discipline	Department of Geography and Environment
Faculty	Faculty of Sciences
Awarding Institution	Islamic University
Location	Kushtia, Bangladesh
Bangladesh National Qualifications Framework (BNQF) Code	0532
Mode of Study	Full Time
Medium of Study	English
Applicable Session	2021-22 and onwards

**Vision of the University**

- To create a new generation of people who will be equipped with academic excellence, professional expertise, and encored with moral height.
- To extend the scope and increase opportunities for higher education and research in every branch of human knowledge and ensure the quality of all along.

**Mission of the University**

The mission of establishing Islamic University is “to provide instruction in technology and other fields of Islamic Studies and comparative jurisprudence and such other branches of learning at the graduate and post-graduate level as the University may think fit and make provision for research including Post-Doctorate research and training for the advancement and dissemination of knowledge” (The Islamic University Act,1980).

**Quality Policy**

To provide services of the highest quality both curricular and co-curricular; so that our graduates can integrate their skills and serve the different education sector, industry, and society equally well at a global level.

**Vision of the Department**

The department of Geography and Environment endeavors to generate world-class graduates in Geography and Environment by providing state-of-art knowledge and skills who will be able to contribute for the sustainable development of society and the environment.

**Mission of the Department**

<b>M1</b>	To provide quality education for producing competent graduates in Geography and Environment to contribute to different sectors including natural and human environment, agriculture, and industry.
<b>M2</b>	To encourage creative leadership, academic expertise, and effective teamwork.
<b>M3</b>	To achieve personal academics, successful professionals, and influential researchers for a time-demanding and technology-centered geo-world by use of modern technology at secondary and tertiary levels, independent thought, collegial exchange of ideas, and high ethical standards.

<b>M4</b>	To provide adequate laboratory facilities, instrumental supports for effective fieldworks, collaborative research environment, and promoting Human Resource Development (HRD) to face the future challenges at national, regional, and global contexts.
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### **Graduate Attributes (Knowledge Profile)**

This program will provide students with an opportunity to develop the Graduate Attribute(s) specified below:

#### **Attribute 1: Deep discipline knowledge and intellectual breadth**

Graduates have comprehensive knowledge and understanding of their subject area, the ability to engage with different traditions of thought, and the ability to apply their knowledge in practice including in multi-disciplinary or multi-professional contexts.

#### **Attribute 2: Creative and critical thinking, and problem solving**

Graduates are effective problem-solvers, able to apply critical, creative, and evidence-based thinking to conceive innovative responses to future challenges.

#### **Attribute 3: Teamwork and communication skills**

Graduates convey ideas and information effectively to a range of audiences for a variety of purposes and contribute in a positive and collaborative manner to achieving common goals.

#### **Attribute 4: Professionalism and leadership readiness**

Graduates engage in professional behaviour and have the potential to be entrepreneurial and take leadership roles in their chosen occupations or careers and communities.

#### **Attribute 5: Intercultural and ethical competency**

Graduates are responsible and effective global citizens whose personal values and practices are consistent with their roles as responsible members of society.

#### **Attribute 6: Self-awareness and emotional intelligence**

Graduates are self-aware and reflective; they are flexible and resilient and have the capacity to accept and give constructive feedback; they act with integrity and take responsibility for their actions.

### **Program Educational Objectives (PEO)**

<b>PEO1</b>	Providing students with a coherent understanding of the field of geo-environment and its key challenges.
<b>PEO2</b>	Supporting students with existing knowledge about man, environment, time and space to combine and create new knowledge.
<b>PEO3</b>	Equipping students with the technical knowledge and practical skills required to work as a professional geographer and environmentalist.
<b>PEO4</b>	To acquaint moral and ethical values aspects of geo ethics inculcating a value system among students.
<b>PEO5</b>	To enable entrepreneurship abilities contributing to self and national development.

### Program Learning Outcome (PLO)

PLO	Learning outcome domains	Description
1	Fundamental Skill	Demonstrate a systematic understanding of advanced knowledge and skills which may be at the forefront of geo-environmental study.
2		Analyse, synthesize, and integrate knowledge and information with the context of multidisciplinary as well as interdisciplinary areas in Geography and Environment.
3		Apply knowledge and develop practical skills including experimental design, data generation, data analysis and data presentation for addressing the critical problems in geosciences.
4		Synthesize complex information, concepts, theories and problems in environment as a basis for research.
5	Social Skill	Demonstrate advanced knowledge of cultural, governmental, and environmental issues at a regional and international level, in relation to issues within Bangladesh and actively participating in and advocating for changes/solutions for the betterment of the nation.
6	Thinking Skill	Be independent and individually responsible for work, professional practice, systems, processes and decision-making on complex problematic matters or issues within the geographical space.
7		Appraise geo-environmental problems in providing solutions critically, creatively and innovatively;
8	Personal Skill	Communicate and demonstrate adequate interpersonal skills with time management.
9		Demonstrate self-advancement through continuous academic and/or professional development.
10		Ability to inculcate an attitude of enquiry towards developing innovative ability and enhancing entrepreneurship skills.

### Mapping Mission of the Program with PEOs

Mission Statements	PEO1	PEO2	PEO3	PEO4	PEO5
M1	*	*			
M2			*	*	*
M3		*	*		
M4	*		*		*

### Mapping PLOs with PEOs

Mission Statements	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
PEO1	*				*		*			
PEO2	*	*		*			*			
PEO3			*			*		*	*	
PEO4						*			*	
PEO5					*					*

### Mapping of Courses with the PLOs

Courses	Credit	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
GE- 5101	4.0	*	*	*	*	*	*	*			*
GE- 5102	4.0	*	*	*	*		*	*			*
GE- 5103	4.0	*	*	*	*		*	*	*		*
GE- 5104	4.0	*		*	*	*	*	*		*	*
GE- 5105	4.0	*	*	*		*	*			*	
GE- 5106	4.0	*	*		*	*	*	*		*	*
GE- 5107	4.0	*		*	*	*	*	*		*	
GE- 5108	1.5			*	*	*	*	*			*
GE- 5109	1.5			*	*		*	*		*	
GE- 5201	3.0	*	*	*	*		*	*		*	
GE- 5202	3.0	*		*	*	*		*		*	*
GE- 5203	3.0	*	*	*	*	*	*				*
GE- 5204	3.0	*	*		*	*	*	*		*	
GE- 5205	3.0	*	*	*	*	*		*	*	*	
GE- 5206	3.0	*	*	*	*	*		*		*	*
GE- 5207	3.0	*	*		*		*	*	*	*	*
GE- 5208	1.5	*	*	*	*	*	*	*	*	*	*
GE- 5209	1.5	*	*	*	*	*	*	*	*	*	*
GE- 5210	1.0		*	*	*	*	*	*		*	*
GE- 5211	6.0	*	*	*	*	*	*	*		*	*
GE- 5212	1.0	*		*		*	*			*	*

## Summary of the Courses

### (For General Group- A)

#### First Semester

Course	Credit	Marks
4 Theory Courses	4.00×4=16.00	100×4=400
2 Practical Courses	1.50×2=3.00	100×2=200
<b>Total:</b>	<b>19.00</b>	<b>600</b>

#### Second Semester

Course	Credit	Marks
4 Theory Courses	3.00×4=12.00	100×4=400
2 Practical Courses	1.50×2=3.00	100×2=200
1 Project/Internship	6.00×1=6.00	100×1=100
1 Field Work	1.00×1.00=1.00	100×1=100
<i>Viva-Voce</i>	1.00×1=1.00	100×1=100
<b>Total:</b>	<b>23.00</b>	<b>900</b>

### (For Thesis Group-B)

#### First Semester

Course	Credit	Marks
4 Theory Courses	4.00×4=16.00	100×4=400
2 Practical Courses	1.50×2=3.00	100×2=200
<b>Total:</b>	<b>19.00</b>	<b>600</b>

#### Second Semester

Course	Credit	Marks
4 Theory Courses	3.00×4=12.00	100×4=400
2 Practical Courses	1.50×2=3.00	100×3=300
1 Field Work	1.00×1=1.00	100×1=100
<i>Viva-Voce</i>	1.00×1=1.00	100×1=100
<b>Total:</b>	<b>17.00</b>	<b>800</b>

#### Third Semester

Course	Credit	Marks
Thesis related theory course	3.00×1=3.00	100×1=100
Thesis:	18.00×1=18.00	300
(a) Dissertation	10.00×1=10.00	100
(b) Overall Performance Evaluation by the Thesis Supervisor	2.00×1=2.00	100
(c) Thesis defense (with dissertation Presentation)	6.00×1=6.00	100
<b>Total:</b>	<b>21.00</b>	<b>400</b>

## Summary of the Courses

### M. sc. First Semester

Sl. No.	Course code	Course	Credit	Marks				
				CIE			SEE	Total Marks
				Incourse/Tutorial/Assignment (15)	Class Attendance (10)	Presentation/Quiz (5)		
1	GE-5101	Environmental Issues & Sustainable Development	4.00	15	10	5	70	100
2	GE-5102	Geomicrobiology	4.00	15	10	5	70	100
3	GE-5103	Models in Geography	4.00	15	10	5	70	100
4	GE-5104	Migration & Refugee Management	4.00	15	10	5	70	100
5	GE-5105	Delta Resource Planning & Management	4.00	15	10	5	70	100
6	GE-5106	Global Food Security and Nutrition	4.00	15	10	5	70	100
7	GE-5107	Paleo Geomorphology and Climatology	4.00	15	10	5	70	100
8	GE-5108	Techniques in Human Geography Lab	1.5	05 (Lab Notebook)	10+5=15 (Attendance +Performance)	10 Viva on Experiment	70	100
9	GE-5109	Advanced Geospatial Analysis Lab	1.5	05 (Lab Notebook)	10+5=15 (Attendance +Performance)	10 Viva on Experiment	70	100

***N.B.: Any four Theoretical Courses Subject to the Approval of the Academic Committee for both Group A and B***

## M. Sc. Second Semester

Sl. No.	Course code	Course	Credit	Marks				
				CIE			SEE	Total Marks
				Incourse/Tutorial/Assignment (15)	Class Attendance (10)	Presentation/Quiz (5)		
1	<b>Course No.</b>	<b>Course Title</b>	<b>Credit</b>	15	10	5	70	100
2	GE-5201	Flood and River Management	3.00	15	10	5	70	100
3	GE-5202	Occupational Health and Safety	3.00	15	10	5	70	100
4	GE-5203	Biodiversity and Conservation	3.00	15	10	5	70	100
5	GE-5204	Climate Change Simulation and Forecasting	3.00	15	10	5	70	100
6	GE-5205	Environmental Biotechnology	3.00	15	10	5	70	100
7	GE-5206	Geoinformatics in Disaster Management	3.00	15	10	5	70	100
8	GE-5207	Urban Environmental Management	3.00	15	10	5	70	100
9	GE-5208	Techniques in Physical Geography Lab	1.50	05 (Lab Notebook)	10+5=15 (Attendance +Performance)	Viva on Experiment =10	70	100
10	GE-5209	Laboratory Analysis of Environmental Components	1.50	05 (Lab Notebook)	10+5=15 (Attendance +Performance)	Viva on Experiment =10	100	100
11	GE-5210	Fieldwork on Micro Region Survey	1	50 (Field Report)	30 (Overall FW Performance)	20 Viva/Quiz/Presentation	100	100
12	GE-5211	Research Project/Internship (General Group)	6.00	33 Project Defense	11 Overall Evaluation	56 Project Report		100
13	GE-5212	Viva-Voce	1	Nil	Nil	Nil	100	100

**N.B.:** (Any Four Theoretical Courses Subject to the Approval of the Academic Committee for both Group A and B, GE-5211 Course is Compulsory Only for Group-A)

## M. Sc. Third Semester

(Only for Thesis Group-B)

Sl. No.	Course code	Course	Credit	Marks				
				CIE			SEE	Total Marks
				Incourse/Tutorial/Assignment (15)	Class Attendance (10)	Presentation/Quiz (5)		
1	GE-5301	Theories and Methods for Master's Thesis	3.0	15	10	5	70	100
2	GE-5302 (Thesis)	Dissertation	10.0	-	-	-		100
		Overall Performance Evaluation by the Thesis Supervisor	2.0	-	-	-		100
		Thesis defense (with dissertation Presentation)	6.0	-	-	-		100

**Abbreviation:** \*CIE= Continuous Internal Evaluation, \*SEE= Semester End Examination,

### M.Sc. First Semester (detail course outline)

<b>Course Code:</b> GE-5101	<b>Course Title:</b> Environmental Issues and Sustainable Development	<b>Course Type:</b> Core Course	<b>Total Marks:</b> 100
<b>Level:</b> MSc. 1 <sup>st</sup> Semester		<b>Contact Hours:</b> 52	<b>Credit:</b> 4

#### Course Rationale:

This course has been designed to enrich the students with up-to-date knowledge about the contemporary environmental issues of Bangladesh. Thus, it will help them to develop skills to contribute to ensuring the sustainable development of Bangladesh.

#### Course Objectives:

1. To introduce the students to current environmental problems/issues in the context of Bangladesh.
2. To familiarize the students with the concept of sustainable development
3. To make the students capable of understanding the relationship between environmental change and sustainable development in Bangladesh

**Course Learning Outcomes (CLOs):** After Successful completion of the course the students will be able to

1. Understand the basic concept of environmental problems and sustainable development.
2. Gather knowledge about various environmental problems in the context of Bangladesh.
3. Relate environmental change and sustainable development in the context of Bangladesh.
4. Outline the impacts of different environmental problems.
5. Evaluate environmental situation of Bangladesh.

#### Mapping of CLOs with PLOs

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	*				*					
CLO2			*				*			
CLO3			*	*	*					
CLO4		*				*				*
CLO5					*		*			

#### Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

Content	CLO	Teaching-Learning Strategies	Assessment Strategies
<b>Environmental issues:</b> Definition, classification.	1	Lecture PPT, Video, Demonstration, Group discussion, Q/A, Discussion	Class Test, Quiz, Assignment, Presentation, Final Examination
<b>Current environmental problems/issues in Bangladesh:</b> Water pollution, Air pollution, Deforestation, Soil erosion and degradation, Drought, Depletion of biodiversity, Natural hazards and disaster, Climate change, Flood, Salinity, Coastal degradation, Sea-level rise, Severe overpopulation.	2,5		
<b>Sustainable Development:</b> Concept, historical perspective, UN SDGs.			
<b>Relationship between environmental change and sustainable development:</b> Environmental change and Sustainable Development in Bangladesh.	3		
<b>The Impact Syndromes:</b> i) Effects of Natural Environment. ii) Environmental Degradation. iii) Effects on Biological Environment. iv) Effects on Flora and Fauna. v) Lessening of Bio-Diversity. vi) Deforestation, Desertification, etc. vii) Structural Intervention of Man on Environment. viii) Dams, Polders, Embankment, etc.	4		

<b>Environmental Situation of Bangladesh including Discussion on National Conservation Study on Bangladesh.</b>	3		
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### Books Recommended:

1. Sarvajayakesavalu, S., & Chareonsudjai, P. (Eds.). (2021). *Environmental Issues and Sustainable Development*.
2. Kumar, N. (2020). *Environmental Concerns and Sustainable Development*. V. Shukla (Ed.). Springer Singapore.

<b>Course Code:</b> <b>GE-5102</b>	<b>Course Title:</b> <b>Geomicrobiology</b>	<b>Course Type:</b> <b>Core Course</b>	<b>Total Marks:</b> <b>100</b>
<b>Level: MSc. 1<sup>st</sup> Semester</b>		<b>Contact Hours: 52</b>	<b>Credit: 4</b>

### Course Rationale:

This course has been designed to enrich the students with up-to-date knowledge about Geomicrobiology. Thus, it will help them to develop concepts of Microbial Formation and Degradation of Carbonates.

### Course Objectives:

The course aims to introduce the main groups of microorganisms that are important in biogeochemical element cycles, and how they influence the dissolution degradation of minerals and rocks and the precipitation and formation of new mineral deposits.

**Course Learning Outcomes (CLOs):** After Successful completion of the course the students will be able to

1. Give an overview of the most important microbial metabolisms in biogeochemical cycles.
2. Give an overview of methods for the detection and identification of microorganisms in geological material.
3. Explain how the microbial processes mediate the dissolution of minerals/rocks, and formation of new, secondary minerals
4. Evaluate which biogeochemical processes that are most important in different environments.

### Mapping of CLOs with PLOs

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	*	*		*						
CLO2		*		*			*			
CLO3		*	*				*			
CLO4						*				*

### Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

Content	CLO	Teaching-Learning Strategies	Assessment Strategies
<b>Introduction:</b> Definition, Scope and Subject matter; The universal Tree of life; Overview of the Bacteria, Archaea and Eukarya; The Origin of Life and Its Early History	1	Lecture PPT, Video, Demonstration, Group discussion, Q/A, Discussion	Class Test, Quiz, Assignment, Presentation, Final Examination
<b>Microbial Habitat:</b> Lithosphere; Hydrosphere; Microbial Energy Generation:	4		
<b>Geomicrobial Processes:</b> Physiological and Biogeochemical overview	3,4		
<b>Methods in Geomicrobiology:</b> Detection and Isolation of geomicrobially active organisms; In situ study of geomicrobial activity; Laboratory reconstruction; Quantitative study; Enzymatic and Nonenzymatic geomicrobial activity; Reaction products and geomicrobial transformation	4		
<b>Microbial Formation and Degradation of Carbonates:</b> Distribution; Deposition; Biological carbonate formation and biodegradation; Carbon cycle	1		
<b>Minerals and Geomicrobial Interactions:</b> Silicon; Bauxite; Phosphorus; Nitrogen, Mercury; Antimony; Iron; Manganese;	3		

Chromium, Molybdenum, Vanadium, Uranium, and Polonium; Sulfur; Selenium and Tellurium			
<b>Geomicrobiology of Fossil Fuels:</b> Methane; Peat; Coal; Petroleum	2		

### Books Recommended:

1. Ehrlich, Henry Lutz. 2001. Geomicrobiology. Marcel Dekker Inc.
2. M.T. Madigan; J.M. Martinko; J. Parker. 2017. Brock Biology of Microorganisms. 15th edition, Prentice Hall.
3. T. Fenchel; G. M. King; T. H. Blackburn. 2000. Bacterial Biogeochemistry: the ecophysiology of mineral cycling. Academic Press.
4. E. A. Paul; F. E. Clark. 2000. Soil Microbiology and Biochemistry. Academic Press.
5. F. J. Stevenson; M. A. Cole. 1999. Cycles of Soils: Carbon, Nitrogen, Phosphorus, Sulfur, Micronutrients, 2nd Edition. Wiley.
6. W. Stumm; J. J. Morgan. 1996. Aquatic Chemistry. Chemical equilibria and rates in natural waters. Wiley.
7. J. F. Banfield, J. Cervini-Silva, and K. M. Nealson, 2005. Molecular Geomicrobiology.

<b>Course Code:</b> <b>GE-5103</b>	<b>Course Title:</b> <b>Models in Geography</b>	<b>Course Type:</b> <b>Core Course</b>	<b>Total Marks:</b> <b>100</b>
<b>Level: MSc. 1<sup>st</sup> Semester</b>		<b>Contact Hours: 52</b>	<b>Credit: 4</b>

### Course Rationale:

This course intends to provide a deep discussion on models in geography which is central to solving real-world issues critically.

### Course Objectives:

The course aims to provide an in-depth understanding of modeling geographic phenomena.

**Course Learning Outcomes (CLOs):** After Successful completion of the course the students will be able to-

1. Identify and characterize a model and understand the spatial process-based model
2. Translate a physical, environmental, and/or spatial process into mathematical language
3. Grasp all steps of a modeling process, from the statement of a question to the validation of results
4. Develop a spatial capability for solving a real-world problem

### Mapping of CLOs with PLOs

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	*	*		*						
CLO2			*	*			*			
CLO3			*			*				
CLO4							*	*		*

### Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

Content	CLO	Teaching-Learning Strategies	Assessment Strategies
1. <b>Introduction:</b> Model and Modeling definition; Modeling process; Type, Significance, Properties, and Utilities of Modeling in Geography	1	Lecture PPT, Video, Demonstration, Group discussion, Q/A, Discussion	Class Test, Quiz, Assignment, Presentation, Final Examination
2. <b>Core Concepts: Aerial differentiation;</b> Spatial and Locational analysis; The geographic continuum; Quantitative revolution.	2		
3. <b>Geographical Data:</b> Nature; Type; Processing and Visualization	2		
4. <b>System Analysis:</b> Models of systems; System analysis and GST Theory; system structure; Geographical Systems	3		
5. <b>Models in Physical Geography:</b> Uniformitarians, Isostasy model, Continental Drift theory, Cavern Formation Theory	3		
6. <b>Regional Growth, Planning, and Development Models and Theories:</b> Myrdals's cumulative causation, Fiedman's	3,4		

Core-Periphery Model, Rostow's Model, Limits to growth-Forrester Meadows Model, Haggerstrand's Diffusion model, the Planning process of McKaye			
7. <b>Locational Models:</b> Agricultural Location Theories and models (e.g. Von thunen, Sinclar, O. Jonasson, Hoover, Garrison and Marble); Weber's Industrial Location Model, Central Place Models; Theories of Growth Pole and Centres (e.g. Perroux, Boudeville, Hirschman); Trade Theories-Theory of Absolute Advantage, Classical Trade Theory of Comparative Cost, Heckscher-Ohlin Trade Theory.	3,4		
8. Population Models: Demographic Transition Model, Malthusian Theories, Marxian analysis of Population, Ackerman's population region theory, Migration models of Ravenstein and Zelinsky	3,4		
9. Urban Morphological Models: Models of E.W. Burgess (Concentric Zone Model), Homer Hoyt (Sector Model), C.D. Harris and E.L Ullman (Multiple Nuclei Model), James Vance Jr (Urban Realms Model), Chauncey D. Harris (Galactic City Model); Latin American model by Ernst Griffin and Larry Ford, South Eastern Asia Model by T.G. McGee, Sub-Saharan Africa model by H.J. DeBlij	3,4		
10. Geopolitical Models: Models of Richard Hartshorne (Boundary model), Friedrich Ratzel (Organic State Model), Halford Mackinder (Hartland Model), Nicholas Spykman (Rimland model), Alfred Mahan (Sea Power Doctrine), Wallerstein (World Systems model)	3,4		

#### Books Recommended:

1. M. Husain (2016) *Models in Geography, Rawat, India.*
2. Theories and Models in Geography. K.Siddhartha

<b>Course Code:</b> GE-5104	<b>Course Title:</b> Migration and Refugee Management	<b>Course Type:</b> Core Course	<b>Total Marks:</b> 100
<b>Level: MSc. 1<sup>st</sup> Semester</b>		<b>Contact Hours: 52</b>	<b>Credit: 4</b>

#### Course Rationale:

The course introduces the concept of migration and refugee management including migration theories, data and statistics, types, and migration policies regarding national and global perspective. It also offers population redistribution, gender and poverty issues in migration, internal displacement. Moreover, this course provides wider understanding about migration and refugee management in connection with geographical variations.

#### Course Objectives:

1. To understand the concept, theories and models of migration and refuge and key characteristics.
2. To analysis the migration and refuges related data and statistics.
3. To evaluate the trends, causes and consequences of the national and international migration.
4. To investigates the policies of international in and out migration.
5. To assess the advantages and disadvantages of migration.
6. To understand the refuges problems with special references of Bangladesh.

**Course Learning Outcomes (CLOs):** After Successful completion of the course the students will be able to-

1. Able to state the concept, theories and models of migration and refugees, and key characteristics.
2. Able to understand determinants, causes and consequences of migrations, and internal displacement.
3. Able to explain the types and trend of global migration and refugees.
4. Able to analyses migration data and statistics.
5. Able to assess population distribution, migration policies, environmental migration and refugee problems.

#### Mapping of CLOs with PLOs

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
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CLO1	*			*						
CLO2			*		*					
CLO3	*						*		*	
CLO4				*		*				
CLO5							*		*	*

### Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

Content	CLO	Teaching-Learning Strategies	Assessment Strategies
1. <b>Migration:</b> concept and definition, scope of migration studies, classification, typologies and selectivity of migration.	1,3	Lecture PPT, Video, Demonstration, Group discussion, Q/A, Discussion	Class Test, Quiz, Assignment, Presentation, Final Examination
2. <b>Data and Statistics:</b> sources of data, nature of migration data and migration estimation procedure.	4		
3. <b>Theoretical Aspects of Migration Studies:</b> Ravenstein's Law. Lee's hypothesis and Stouffer's intervening opportunity model. Mabusgunj system approach and Zelinisky's mobility Hypotheses.	1		
4. <b>Internal Migration:</b> determinants, types, causes and consequences.	3		
5. <b>International Migration:</b> types, causes and consequences, selecting migration and overseas migration from Bangladesh.			
6. <b>Migration Policies:</b> definitions, aims, objectives, historical background, migration policies in developed and developing countries, gender and poverty issues in migration.	5		
7. <b>Population Redistribution:</b> internal and international redistribution of population, refugee and labour migration. Problems of urbanization. Internal displacement problems.	5		
8. <b>Environmental migration and Refuge Problems:</b> mitigation, adaptation and management.	5		
9. <b>Refuges problem in Bangladesh:</b> Socio-economic and environmental perspectives.	5		

#### Books Recommended:

1. Castles, S. and Miller, M. (2003), *The Age of Migration*, (3<sup>rd</sup> edn.), New York: Guilford Press.
2. Connell, John et al. (1976), *Migration from Rural Areas: The Evidence from Village Studies*, Delhi: Oxford University Press.
3. ESCAP (1987), International Labour Migration Remittances between the Developing ESCAP Countries and the Middle East: Trends, Issues and Policies, *Development Papers*, 6.
4. Foresight (2011), *Migration and Global Environmental Change: Future Challenges and Opportunities*, Final Project Report, London: Government Office for Science.
5. ILO (2002), *Making the Best of Globalization: Migrant Worker Remittances and Micro-Finance*.
6. Kosinski, L.A. and Prothero, R.M eds. (1974), *People on the Move: Studies on Internal Migration*, London: Methuen and Co. Ltd.
7. Krishnan, P. and Rowe, G. (1978), "internal Migration in Bangladesh". *Rural Demography*, 5 (1-2)
8. Siddiqui, Tasneem eds. (2005), *Migration and Development: Pro-poor Policy Choices*, Dhaka: University Press Ltd.
9. Wickramasekera, P. (2002), *Asian labour Migration: Issues and challenges in an Era of Globalization*. International Migration Paper No. 57, International Migration Programme, Geneva: ILO.

<b>Course Code:</b> GE-5105	<b>Course Title: Delta Resource Planning and Management</b>	<b>Course Type:</b> Core Course	<b>Total Marks:</b> 100
<b>Level: MSc. 1<sup>st</sup> Semester</b>		<b>Contact Hours: 52</b>	<b>Credit: 4</b>

### Course Rationale:

The course introduces the Overview of the Delta Plan, Its Need and Significance, Salient features, Strategies, Cost and Financing, Governance, Projects, Bengal Delta, Delta opportunities and Challenges: Ecosystem maintenance, Natural hazard risks, climate change, Socioeconomic Characteristics of Bengal Delta, Water Resource Management, Sustainable Land Use and Spatial Planning.

### Course Objectives:

1. Develop an understanding of the over-delta land, need, and significance strategy.
2. Develop an understanding of Evolution, Formation, Process, Ecology, Climate, and Delta Management.
3. Critically assess theoretical and conceptual issues relating to Ecosystem maintenance, Natural hazard risks, climate change, environment, and ecological issues.
4. Analyze the relationship between food and nutrition and society, environment, and political and economic factors.

**Course Learning Outcomes (CLOs):** After Successful completion of the course the students will be able to

1. Understand Delta Plan, Need and Significance, Salient features, Strategies, Cost and Financing, Governance, and Projects.
2. Analyze the relationship between the Bengal delta and others.
3. Translate generic concepts of delta opportunities and challenges and socioeconomic characteristics of the Bengal delta.
4. Critically assess theoretical and conceptual issues relating to transboundary water management urban water management (UWM).

### Mapping of CLOs with PLOs

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	*		*							
CLO2		*				*				
CLO3			*			*			*	
CLO4					*	*			*	

### Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

Content	CLO	Teaching-Learning Strategies	Assessment Strategies
1. <b>Introduction to BDP:</b> Overview of Delta Plan, Need and Significance, Salient features, Strategies, Cost and Financing, Governance, Projects.	1,2	Lecture PPT, Video, Demonstration, Group discussion, Q/A, Discussion	Class Test, Quiz, Assignment, Presentation, Final Examination
2. <b>Bengal Delta:</b> Evolution, Formation, Process, Ecology, Climate, Delta Management	1,2		
3. <b>Delta opportunities and Challenges:</b> Ecosystem maintenance, Natural hazard risks, climate change, environment and ecological issues	2,3		
4. <b>Socioeconomic Characteristics of Bengal Delta:</b> Local history, Current status, Disaster vulnerability and adaptation	3,4		
5. <b>Water Resource Management:</b> Management strategies for Fresh water, Barind and drought prone zone, Coastal zone, Rivers and estuaries, Haor and flashflood zone, Urban area, CTG Hill tracts. Flood Risk management strategies; Blue economy and hydro-energy	1,2,4		
6. <b>Transboundary Water Management:</b> Geographical setting of Water resource, Geopolitics of water,	2,4		

Transboundary water issues and management, Present and future issues and challenges, Regional water cooperation,			
7. <b>Sustainable Land Use and Spatial Planning:</b> Land resource of Bangladesh; Aspects and importance of integrated spatial planning; Constraint and challenges of Land resources; Land management structure; Strategies; Urban governance.	4		
8. <b>Agriculture, Food Security and Nutrition:</b> Agriculture and food security scenario of BD; Climate change, Agriculture Food security, Nutrition and Livelihood; Opportunities and challenges in Agriculture; Adaptation and mitigation measures; Sustainability, agriculture and food security; Agriculture and rural livelihoods	3,4		
9. <b>IWT and Bangladesh Delta:</b> IWT- Context, Economics, Current status, Governance and institutional structure; Climate change and river morphology; Navigability management.	2,4		
10. <b>Urban Water Management (UWM):</b> Component and approaches; Urban water scenario in Bangladesh; Urban water supply; Urban sanitation and wastewater management, SWM, Storm-water and urban drainage management; UWM- Challenges, institutional reform, UWM and SDGs	4		

### Books Recommended:

1. Bangladesh Delta Plan 2100 Bangladesh in the 21st Century (Abridged Version)

<b>Course Code:</b> GE-5106	<b>Course Title:</b> Global Food Security and Nutrition	<b>Course Type:</b> Core Course	<b>Total Marks:</b> 100
<b>Level:</b> MSc. 1 <sup>st</sup> Semester		<b>Contact Hours:</b> 52	<b>Credit:</b> 4

### Course Rationale:

This course will cover the food and nutrition security in global perspective covering the accessibility, availability, utilization and stability of food and its effect on nutrition status among various segment of population including the political, economic, social factors and their impact on food and nutrition security.

### Course Objectives: The course aims to:

1. Develop an understanding of food and nutrition security internationally.
2. Critically assess theoretical and conceptual issues relating to the emerging risks both to food and nutrition security.
3. Analyze the relationship between food and nutrition and society, environment, political and economic factors.

**Course Learning Outcomes (CLOs):** After Successful completion of the course the students will be able to-

1. Understand food security and agricultural issues in Australia and internationally.
2. Analyse the relationship between food and agricultural activities and society and the environment.
3. Translate generic concepts and methods into reviews of contemporary, real-world food production, exchange and policy using a variety of methods of conceptualization and critical analysis.
4. Critically assess theoretical and conceptual issues relating to the emerging risks both to food and agricultural systems.

### Mapping of CLOs with PLOs

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	*				*	*				
CLO2		*					*			

CLO3				*			*			*
CLO4				*	*				*	

### Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

Content	CLO	Teaching-Learning Strategies	Assessment Strategies
<b>Introduction:</b> Definition; Key dimensions; Food security and vulnerability, hunger, malnutrition and poverty; Food security analysis; Key global and regional players in food and nutrition security; Global Food Security Strategy	1,2	Lecture PPT, Video, Demonstration, Group discussion, Q/A, Discussion	Class Test, Quiz, Assignment, Presentation, Final Examination
<b>'Food Sovereignty' and Socio-Political Stability:</b> 'Food security', how the term has evolved over the 20th century and green revolution; liberalization of food markets and international trading's impact on food sovereignty and socio-political stability, with special attention to developing countries.	3		
<b>Agriculture, International Trade, and Food Markets:</b> Impact of the Land grabbing and Financial Crisis on Food Security;	3,4		
Technological Changes and Food Security: green revolution, food safety and advanced irrigation techniques to food and nutrition security strategies	3		
<b>Risk and Food Security:</b> Climate change and potential impact; Environmental and demographic change;	3		
<b>Policy, Governance and Standards:</b> Featuring the contrast between developed and non-developed countries; Global differences; Challenges.	3		
<b>Nutrition for Human Health:</b> Nutrition and communicable, non-communicable diseases; Role of women, principles of food safety and prevention of food borne illness and its impact on food security	3		
<b>Food Security, Nutrition and Sustainable Development:</b> Global food security, nutrition, development, and agricultural policies; The role of modern and alternative technologies as a means to contributing to the alleviation of hunger and food insecurity; Human right to food and adequate nutrition;	1,4		

#### Books Recommended:

1. The State of Food Security and Nutrition in the World 2020; FAO, IFAD, UNICEF, WFP, WHO; ISBN 978-92-5-132901-6; 2020
2. Encyclopedia of Food Security and Sustainability by Pasquale Ferranti, 2019
3. Global Food Security: What Matters? by Zhou Zhang-Yue, ISBN: 9781138222748- 2019
4. Food Security Policy, Evaluation and Impact Assessment by Sheryl L. Hendriks (Editor) ISBN: 135101981- 2019
5. Ensuring Global Food Safety: Exploring Global Harmonization by Oliva Dsouza (Editor) ISBN: 1774072904-2019

<b>Course Code:</b> GE-5107	<b>Course Title:</b> Paleo Geomorphology and Climatology	<b>Course Type:</b> Core Course	<b>Total Marks:</b> 100
<b>Level: MSc. 1<sup>st</sup> Semester</b>		<b>Contact Hours: 52</b>	<b>Credit: 4</b>

**Course Rationale:** This course is designed to provide fundamental concepts of Paleo Geomorphology and Climatology.

#### Course Objectives

1. Conceptualize general knowledge of Paleo Geomorphology and Climatology.
2. Acquire knowledge of the different disciplines of Paleo Geomorphology and Climatology.
3. Acquaint with Palaeo-geomorphology and Palaeoclimatology of Bangladesh.

**Course Learning Outcomes (CLOs):** After Successful completion of the course the students will be able to-

1. Gather knowledge of the history of Earth's atmosphere and ocean variability on million-year to interannual timescales and understand the forcings behind these climate responses.
2. Learn about physical, chemical and biological paleoclimate archives, the measurements within each archive type that are used to reconstruct past climate change, and the strengths and weaknesses (uncertainties) of each.
3. Learn how to apply common statistical treatments to paleoclimate data.
4. Understand and be able to communicate to both scientists and the general public how paleoclimate information can be used to inform projections of future climate change.

### Mapping of CLOs with PLOs

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	*		*							
CLO2	*		*	*						
CLO3			*		*	*				
CLO4					*		*		*	

### Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

Content	CLO	Teaching-Learning Strategies	Assessment Strategies
1. Palaeo-Geomorphology and Palaeo-climatology: meaning, scope and importance to study.	1,2	Lecture PPT, Video, Demonstration, Group discussion, Q/A, Discussion	Class Test, Quiz, Assignment, Presentation, Final Examination
2. Quaternary Environment: its extents, duration, characteristics and framework.	1		
3. Geomorphological Evidence: Glacial Landform; Periglacial landform, River terraces; dunes; weathering crust	2		
4. Lithological Evidence: Fluvial Deposits: - Facies and Beddings; Palaeosols; Lake, Mire and Bog sediments; Loess sediment; Marine sediments; and Ice-core stratigraphy:	2		
5. Biological Evidence: Pollen analysis; Diatom analysis; Foraminifera Analysis; Plant and Animal Macrofossils	2,3		
6. Chronological Evidence: C14 dating; Uranium series dating; Dendrochronology, varve chronology; Oxygen-isotope;			
7. Climatic changes in the Past: Causes and significance; glacial periods; sea-level changes; human evolution and migration.	3,4		
8. Palaeo-geomorphology and Palaeo-climatology of Bangladesh: Quaternary Lithology. Coastal Stratigraphy; Climate change; Palaeo-monsoon, Quaternary sea-level changes; Palaeo-shorelines; landforms and correlation, human occupancies	5		

### Books Recommended:

1. J.J. Lowe and M.J.C.V. Walker Reconstructing Quaternary Environment 1997
2. N. Robert. The Holocene; An environmental History 1989
3. M.H. Monzur. An Introduction to the Quaternary Geology of Bangladesh 1995.
4. MS Islam Sea-Level Changes of Bangladesh: Last Ten Thousand Years, 2001

<b>Course Code:</b> GE-5108	<b>Course Title:</b> Techniques in Human Geography Lab	<b>Course Type:</b> Lab	<b>Total Marks:</b> 100
<b>Level: MSc. 1<sup>st</sup> Semester</b>		<b>Contact Hours: 39</b>	<b>Credit: 1.5</b>

### Course Rationale:

This course introduces advanced geography students to a number of various techniques used in gathering field data.

### Course Objectives:

To enable students in demonstrating an advanced understanding of central theoretical concepts and research methods commonly used in human geography and assessing their relevance and use in qualitative and quantitative research approaches.

**Course Learning Outcomes (CLOs):** After Successful completion of the course the students will be able to-

1. Conduct case studies and conduct participant observation in familiar and foreign cultural contexts.
2. Conduct fieldwork with special emphasis on interviews, observation, and visual methods can carry out discourse analysis.
3. Code and analyze own data.
4. Assess ethical problems in the research process.

### Mapping of CLOs with PLOs

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1				*			*			
CLO2			*			*				
CLO3			*	*						
CLO4					*					*

### Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

Content	CLO	Teaching-Learning Strategies	Assessment Strategies
Data Coding, analysis and Visualization: Application of SPSS/ STATA spreadsheet in the interpretation of real-world data at local to global level; Introduction with Nvivo, LAT, WARP, MOOD, DOMO.	3	Lecture PPT, Video, Demonstration, Group discussion, Q/A, Discussion	Class Test, Quiz, Assignment, Presentation, Final Examination
Field Exercise to be conducted on the following areas: Population, Environment, Urban and rural planning, Livelihood index, Development index, Environmental index	1,2		
Ethnographic Method	1,2		
Critical interrogation and Ethical issues in FW	4		
Qualitative and Quantitative Field Method	4		

### Books Recommended:

1. Phillips, R. and Johns, J., 2012. *Fieldwork for human geography*. Sage.
2. Clifford, N., Holloway, S., Rice, S.P. and Valentine, G. eds., 2008. *Key concepts in geography*. Sage.
3. Flowerdew, R. and Martin, D. eds., 2005. *Methods in human geography: a guide for students doing a research project*. Pearson Education.
4. Cloke, P., Cook, I., Crang, P., Goodwin, M., Painter, J. and Philo, C., 2004. *Practising human geography*. Sage.
5. Kitchin, R. and Tate, N., 2013. *Conducting research in human geography: theory, methodology and practice*. Routledge.
6. Hay, I., 2000. *Qualitative research methods in human geography*. Oxford.
7. Chang, C.H., Wu, B.S., Seow, T. and Irvine, K. eds., 2018. *Learning geography beyond the traditional classroom*. Springer Singapore.
8. Wilson, H.F. and Darling, J. eds., 2020. *Research Ethics for Human Geography: A Handbook for Students*. Sage.
9. Kusek, W.A. and Wise, N., 2019. *Human geography and professional mobility*. TAYLOR & FRANCIS Limited.

<b>Course Code:</b> GE-5109	<b>Course Title:</b> Advanced Geospatial Analysis Lab	<b>Course Type:</b> Lab	<b>Total Marks:</b> 100
<b>Level: MSc. 1<sup>st</sup> Semester</b>		<b>Contact Hours: 39</b>	<b>Credit: 1.5</b>

### Course Rationale:

This is an advanced course in the applications of geographic information systems and spatial analysis. Students will continue to develop their working expertise of ArcGIS along with other software packages.

### Course Objectives:

1. Develop an appreciation for more advanced forms of spatial analysis such as interpolation, network analysis, and various forms of modelling.
2. Develop an appreciation toward the acquisition of spatial datasets, their accuracies and properties, as well as the complexities of database development, error management, and overall project execution.

**Course Learning Outcomes (CLOs):** After Successful completion of the course the students will be able to

1. Prepare data for geospatial analysis.
2. Determine an appropriate approach to solving a problem using geospatial tools and methods.
3. Managing geoprocessing tools individually and implement a model to run several tools in sequence.
4. Organize the data sets resulting from analysis.
5. Present the results of a geospatial analysis using appropriate terminology and visualizations.

### Mapping of CLOs with PLOs

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1			*							
CLO2			*				*			
CLO3			*			*				
CLO4						*			*	
CLO5				*			*		*	

### Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

Content	CLO	Teaching-Learning Strategies	Assessment Strategies
<b>Introduction to geospatial analysis</b> a. Database joins b. Classifying and displaying data with a variety of statistical methods c. Presenting results as graphs and maps	1,4	Lecture PPT, Video, Demonstration, Group discussion, Q/A, Discussion	Class Test, Quiz, Assignment, Presentation, Final Examination
<b>Using advanced attribute and spatial queries for data exploration</b> a. Using metadata and a data dictionary b. Formulating queries c. Selection by location	1,4		
<b>Using advanced attribute and spatial queries for data exploration:</b> a. Using data dictionaries to interpret attribute tables b. Formulating Boolean queries c. Selection by location d. Buffering e. Implementing a model	3		
<b>Vector data analysis: overlay techniques</b> a. Union b. Intersect c. Converting from coverage format to modern GIS data format	3		
<b>Vector data analysis: creating a site selection model</b> a. Proximity analysis using line and polygon buffering			

<ul style="list-style-type: none"> <li>b. Geospatial data model flow charts</li> <li>c. Creating a model that satisfies multiple location criteria</li> </ul>			
<b>Vector data analysis: network analysis</b> <ul style="list-style-type: none"> <li>a. Building topology</li> <li>b. Network routing</li> <li>c. Modeling of network impedance</li> <li>d. Generating service areas</li> </ul>	3		
<b>Building an automated model</b> <ul style="list-style-type: none"> <li>a. Setting environmental settings prior to running the model</li> <li>b. Setting model parameters in order to later model inputs</li> <li>c. Implementing a multi-step model using automation tools</li> <li>d. Exporting and editing model script</li> </ul>	2		
<b>Raster data analysis: working with topographic data</b> <ul style="list-style-type: none"> <li>a. Using elevation data to create slope, aspect, and hill shade surfaces</li> <li>b. Analyzing an environmental issue using elevation derived data sets</li> <li>c. Reclassifying raster data</li> <li>d. Map algebra</li> <li>e. Viewshed analysis for site selection</li> </ul>	1,4,5		
<b>Raster data analysis: working with hydrographic data</b> <ul style="list-style-type: none"> <li>a. Generating stream flow direction using accumulation surfaces</li> <li>b. Creating watersheds based on topographic data</li> <li>c. Using hydrographic data to analyze a scientific question</li> </ul>	1,4,5		
<b>Raster data analysis: density surfaces</b> <ul style="list-style-type: none"> <li>a. Interpolating density surfaces from point data</li> <li>b. Converting between vector and raster formats</li> </ul>	1,4,5		
<b>Database design and schema implementation</b> <ul style="list-style-type: none"> <li>a. Subtypes</li> <li>b. Default values</li> <li>c. Importing existing database schema</li> </ul>	1,4,5		
<b>Geospatial Intelligence: Foundations of Intelligence Analysis, Data mining, Gathering Geospatial Data from Airborne Sensors, Satellites, and other RS Platforms, Data Fusion, Integration, and geo-visualization.</b>	5		

**Books Recommended:**

1. M. Gimond (2022), *Intro to GIS and Spatial Analysis*.
2. **H. Tenkanen et.at.** Introduction to Python for Geographic Data Analysis.

## M.Sc. Second Semester (detail course outline)

<b>Course Code:</b> GE-5201	<b>Course Title:</b> Flood and River Management	<b>Course Type:</b> Core Course	<b>Total Marks:</b> 100
<b>Level:</b> MSc. 2 <sup>nd</sup> Semester		<b>Contact Hours:</b> 39	<b>Credit:</b> 3

### Course Rationale:

This course is developed to introduce advance level topics of flood and flood relevant issues in regional and global area. The focus points of the course are flood and river management in terms of origin, distribution, spatial variation and policy related issues. The course will be conducted in theoretical mood with special emphasis on management and policy studies in compare with Bangladesh.

### Course Objectives:

1. To teach flood and river management issues, causes and consequences, and policy studies.
2. To evaluate the socio-economic impacts of flood and river on the livelihood.
3. To analysis the complex river system of Bangladesh and flood events.
4. To examine the flood and water related problem, plan, and policies for sustainable development

**Course Learning Outcomes (CLOs):** After Successful completion of the course the students will be able to-

1. Interpolate basic concept of river management and floods.
2. Get acquainted with river induced hazard and disaster.
3. Understand the nature of watershed management and flood.
4. Evaluate sustainable flood and river system management systems.
5. Evaluate the plan, policies relevant to flood, and river management in Bangladesh.

### Mapping of CLOs with PLOs

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	*	*								
CLO2	*						*			
CLO3				*			*			
CLO4			*			*	*			
CLO5						*	*		*	

### Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

Content	CLO	Teaching-Learning Strategies	Assessment Strategies
<b>Flood and river management:</b> issue, significance, and components.	1	Lecture PPT, Video, Demonstration, Group discussion, Q/A, Discussion	Class Test, Quiz, Assignment, Presentation, Final Examination
<b>Floods:</b> concepts, causes, types and consequences. Physical and topographical features of Bangladesh and flooding.	1		
<b>Human perception and adjustment to flooding</b>	4,5		
<b>Watershed:</b> concept, delineation, and management. Floods: Estimation and control measures.			
<b>Floods and river systems in Bangladesh and its management.</b>	3,4		
<b>Impact of flood control and damage on environment.</b> Urban flooding and drainage.	2		
<b>River management and Bangladesh:</b> River management policies and problems in Bangladesh. Bangladesh Delta Plan 2020	5		

### Books Recommended:

01. Abdul Wazed (1991). "Bangladesher Nadimala (Rivers of Bangladesh, in Bangla)". Dhaka. FH Khan (1991). "Geology of Bangladesh" University Press Limited, Dhaka.
02. H. Brammer (1990). "Floods in Bangladesh: Geographical Background to the 1987 and 1988 Floods". The Geographical Journal. 156 (1): 12–22. doi:10.2307/635431. JSTOR 635431.

03. Haroun er Rashid (1991). "Geography of Bangladesh". University Press Limited, Dhaka.
04. Mohd Shamsul Alam (2012), "Sea Level", in Sirajul Islam; Ahmed A. Jamal (eds.), Banglapedia: National Encyclopedia of Bangladesh (Second ed.), Asiatic Society of Bangladesh.
05. Nishanthi Priyangika (1999), Hundreds of thousands hit by Bangladesh floods, wsws.org, retrieved 27 August 2015 Uddin, Kabir; Matin, Mir A.;
06. Meyer, Franz J. (2019-07-03). "Operational Flood Mapping Using Multi-Temporal Sentinel-1 SAR Images: A Case Study from Bangladesh". Remote Sensing. 11 (13): 1581. Bibcode:2019RemS...11.1581U. doi:10.3390/rs11131581

<b>Course Code:</b> GE-5202	<b>Course Title:</b> Occupational Health and Safety	<b>Course Type:</b> Core Course	<b>Total Marks:</b> 100
<b>Level:</b> MSc. 2 <sup>nd</sup> Semester		<b>Contact Hours:</b> 39	<b>Credit:</b> 3

### Course Rationale:

The course is designed to provide theoretical and practical knowledge on occupational environment, health and safety. After the completion of the course, the student will be able identify occupational health hazards and take measures for probable mitigation and adaptation.

### Course Objectives:

1. To able to demonstrate the complexity of the interaction of the determinants of health, and how the use of evidence-based practice and reflective practice supports an effective approach.
2. Clear understanding of the importance of partnerships, planning and organizing, professional conduct and business awareness via project management and soft skills training.

**Course Learning Outcomes (CLOs):** After Successful completion of the course the students will be able to

- 1: Recognize and evaluate occupational safety and health hazards in the workplace,
- 2: Determine the appropriate hazard controls following the hierarchy of controls.
- 3: Analyze the effects of workplace exposures, injuries and illnesses, fatalities and the methods to prevent incidents using the hierarchy of controls, effective safety and health management systems and task-oriented training.

### Mapping of CLOs with PLOs

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	*			*	*					
CLO2			*				*			
CLO3							*		*	*

### Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

Content	CLO	Teaching Learning Strategies	Assessment Strategy
Introduction: Need for integration of safety, health and environment; Fundamentals of safety; overview of industrial safety management; role of top management and Government in safety management, Legal aspects of safety.	1, 3	Lecture PPT, Video, Group discussion, Q/A, Discussion	Class Test, Quiz, Presentation, Assignment, Final Examination
Steps of industrial safety management: Security Management of Industrial plants; Safe working practices; Personal protective equipment's; Storage and handling of Material and equipment; Safety in transportation and automotive equipment's; Electrical safety; Mechanical Hazards; Chemical Hazards; Building design and Fire protection; Safety in Hazardous area, safety in power plants.	1		
ISO: ISO-14000 and ISO-14001; Scope of OHSAS 18001.	3		
Industrial safety analysis: Introduction, locating and defining injury sources, causes of injury, sources of data, safety analysis techniques, fault tree calculations, risk tolerability.	2		

Implementation and operation: Structure and responsibility, Training, awareness and competence, Consultation and communication, Documentation, Operational control, Emergency preparedness and response, social security inside the industries, Insurance.	2		
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### Books Recommended:

1. Occupational health and safety management systems-Specification, Occupational health and safety assessment series, OHSAS 18001:1999.
2. American national Standard, Quality Management Systems-Requirements” published by American Society for Quality, December, 2000.
3. Asfahl, C. R. and Rieske, D. W. 2010. Industrial Safety and Health Management. Prentice Hall.

<b>Course Code:</b> GE-5203	<b>Course Title:</b> Biodiversity and Conservation	<b>Course Type:</b> Core Course	<b>Total Marks:</b> 100
<b>Level: MSc. 2ndSemester</b>		<b>Contact Hours: 39</b>	<b>Credit: 3</b>

### Course Rationale:

Biodiversity and Conservation is the study of the variety of life forms on Earth and the evolutionary processes that help their preservation. It mainly focuses on the methods and policy dedicated to conserving biodiversity of species and habitats threatened by human activities. Key concerns of this course are approaches to biodiversity protection and conservation, planning and management of protected Areas and the state of biodiversity conservation in Bangladesh.

### Course Objectives:

1. The basics of biodiversity conservation and protection as well as the concept of ecology and ecosystem.
2. The approaches of biodiversity protection and conservation.
3. Planning and management of protected areas.
4. State of biodiversity conservation in Bangladesh.

**Course Learning Outcomes (CLOs):** After Successful completion of the course the students will be able to-

1. Develop fundamental concept biodiversity, ecology, and ecosystem.
2. Understand about planning, protection, and conservation of biodiversity.
3. Learn about the state of biodiversity conservation in Bangladesh and hence help to extend it.

### Mapping of CLOs with PLOs

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	*									
CLO2			*	*	*					
CLO3		*				*				*

### Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

Content	CLO	Teaching-Learning Strategies	Assessment Strategies
<b>Introduction to Biodiversity:</b> Terms, definitions, concept of environment, Evolution of biodiversity conservation, Methods of Biodiversity Assessment., Biodiversity and Space, Distribution of Biodiversity, Threats of Biodiversity, Value of Biodiversity.	1	Lecture PPT, Video, Demonstration, Group discussion, Q/A, Discussion	Class Test, Quiz, Assignment, Presentation, Final Examination
<b>Concept of Ecology and Ecosystem:</b> Flora and Fauna, Food Chain, Nutrient Cycle, Human Ecology and Biodiversity Conservation	1,2		
<b>Approaches to Biodiversity Protection and Conservation:</b> History of Nature Conservation, Emerging Trends in Biodiversity Conservation	2		

<b>Planning and Management of Protected Areas:</b> Spatial Considerations of Conservation, Integrating Conservation and Resource use, Management Issues in Biodiversity Conservation	2		
<b>State of Biodiversity Conservation in Bangladesh:</b> Causes of rapid Biodiversity loss, Consequences of Biodiversity loss, Policy on Conservation of Biodiversity, State of Biodiversity Action Plan	3		

**Books Recommended:**

1. B. Groombridge, M.D. Jenkins (2002) *World Atlas of Biodiversity: Earth's living resources in the 21 century*, University of California Press
2. M. Jeffries (1997) *Biodiversity and Conservation*, Routledge
3. K. R. Miller, S. M. Lanou (1995) *National Biodiversity Planning: Guidelines Based on Early Experiences around the World*, World Resources Institute, United Nations Environmental Program, The World Conservation Union
4. Ministry of Forest and Environment (ND) *National Biodiversity Strategy Action Plan for Bangladesh*, Ministry of Forest and Environment, Government of Bangladesh
5. H. Kabir and S. M. N. Amin (2007) *Tanguar Haor: A Diversified Freshwater Wetland*, Academic Press and Publisher Library, Dhaka
6. R.K. Baydack, H. Canpa, and J. B. Haufler (1999) *Practical Approaches to the Conservation of Biological Diversity*, Island Press, USA.

<b>Course Code:</b> <b>GE-5204</b>	<b>Course Title:</b> <b>Climate Change Simulation and Forecasting</b>	<b>Course Type:</b> <b>Core Course</b>	<b>Total Marks:100</b>
<b>Level: MSc. 2<sup>nd</sup> Semester</b>		<b>Contact Hours: 39</b>	<b>Credit: 3</b>

**Course Rationale:**

This course introduces climate change simulation and forecasting. It Discusses climate change, its effects, simulation, and climate forecasting.

**Course Objectives:**

1. The basics of climate change simulation and climate forecasting.
2. The approaches of climate change simulation and climate forecasting.
3. Models and methods of climate change simulation and climate forecasting.
4. Effect of climate change simulation and Importance of climate forecasting.

**Course Learning Outcomes (CLOs):** After Successful completion of the course the students will be able to

1. Develop fundamental concepts of climate change simulation and climate forecasting.
2. Understand about climate change, the impact of climate change, and conservation of climate.
3. Learn about the state of different methods and models of climate change simulation and climate forecasting.
4. Manage the impact of climate change in context of Bangladesh.

**Mapping of CLOs with PLOs**

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	*			*						
CLO2	*			*		*	*			
CLO3		*		*						
CLO4					*				*	

**Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy**

Content	CLO	Teaching-Learning Strategies	Assessment Strategies
Introduction to climate change simulation and forecasting; types and principles of forecasting;	1		

Approaches to Climate Change Simulation and Forecasting; History of Climate Change Simulation and Forecasting; Emerging trends of Climate Change Simulation and Forecasting.	1,2	Lecture PPT, Video, Demonstration, Group discussion, Q/A, Discussion	Class Test, Quiz, Assignment, Presentation, Final Examination
Concept of climate model; Components of a climate model; Climate models: Nature and applications of climate models; Elements of forecasting; Steps are there in the simulation; Models and simulations to predict changes in the climate; Methods used to study climate change and forecasting.	3		
Global and National Initiatives to Combat Climate Change: The Role of IPCC, International Treaties and Protocols;	2		
Impacts of climate change: Global warming and its causes-emission of enhanced Greenhouse Gases(GHGs) and sources and sinks of these emissions;Past and future climate change-global, regional and sub-regional.Climate Change Impacts-Potential impacts of global, regional and sub-regional climate change.	2		
Climate Change, Health, and Sanitation; Assessment of Impacts of Climate Change on Small Drinking Water and Sanitation System in Bangladesh	4		

### Books Recommended:

- Schumann, G. J., Bates, P. D., Apel, H., & Aronica, G. T. (Eds.). (2018). *Global flood hazard: Applications in modeling, mapping, and forecasting*. John Wiley & Sons.
- Kotamarthi, R., Hayhoe, K., Wuebbles, D., Mearns, L. O., Jacobs, J., & Jurado, J. (2021). *Downscaling techniques for high-resolution climate projections: From global change to local impacts*. Cambridge University Press.
- Von Storch, H., Feser, F., Laprise, R., Stendel, M., & Takayabu, I. (2020). Modeling, Simulating, and Forecasting Regional Climate and Weather. *Frontiers in Environmental Science*, 8, 99.

<b>Course Code:</b> GE-5205	<b>Course Title:</b> Environmental Biotechnology	<b>Course Type:</b> Core Course	<b>Total Marks:</b> 100
<b>Level: MSc. 2<sup>nd</sup> Semester</b>		<b>Contact Hours:39</b>	<b>Credit: 3</b>

### Course Rationale:

Environmental Biotechnology is the study of the concept and scope of environmental biotechnology; its application and the environmental microbial. this course also explains biotechnology and pollution abatement; the role of biotechnology in bioremediation; biotechnology and value addition.

### Course Objectives:

- The basics of environmental biotechnology and microbial systems.
- The approaches of environmental biotechnology.
- Learn about the role of biotechnology in bioremediation.
- Planning and management of bioprocesses in waste treatment.

**Course Learning Outcomes (CLOs):** After Successful completion of the course the students will be able to

- Build fundamental concepts of environmental biotechnology and microbial systems.
- Classify microbes according to energy source and carbon source and evaluate energy outcome of the energy metabolism according to electron acceptor and electron donor usage.
- Define basic concepts in microbial ecology, such as carrying capacity, succession, r- and K-selection, ecological niches- Outline the principles of methods for quantification of organic carbon in wastewater and calculate the theoretical oxygen demand (ThOD) for simple organic compounds.
- Explain the microbial processes and growth requirements undelaying the activated sludge process, nitrification, denitrification, enhanced phosphorus removal, and anaerobic digestion.
- Learn about the planning and management of bioprocesses in waste treatment.

## Mapping of CLOs with PLOs

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	*			*						
CLO2				*			*			
CLO3		*	*							
CLO4					*		*			
CLO5								*	*	

## Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

Content	CLO	Teaching-Learning Strategies	Assessment Strategies
<b>Concept of Environmental Biotechnology:</b> Definition – concept and scope – Application of biotechnology – Role of microbial systems – Principles – Characteristics - Genetically engineered organisms – Merits and demerits – Bio tools for environmental monitoring – Role of biotechnology in environmental protection.	1,3		
<b>Biotechnology and pollution abatement:</b> Biotechnology of wastewater treatment- Bioreactors - Microbial system in wastewater stabilization – Biofilms - immobilization technology in waste water treatment – Microbial metabolism and growth kinetics – oil degradation – bio decolorization – Reed bed technology – Rhizosphere engineering - Biofiltration and Bioindicators.	4,5	Lecture PPT, Video, Demonstration, Group discussion, Q/A, Discussion	Class Test, Quiz, Assignment, Presentation, Final Examination
<b>Role of Biotechnology in Bioremediation:</b> Soil pollution - Bioremediation – Principles - Biodegradation of agro chemicals and other organic compounds – Biotransformation of xenobiotic compound - Role of GEMS in degradation of xenobiotics; Bioscrubbers – Biomining of metals - Biopulping.	3,4		
<b>Biotechnology and value addition:</b> Bio processes in waste treatment - Production of value added products from waste– single Cell Protein (SCP), ethanol, methane and hydrogen, amino acids, vitamins -Enzyme production from wastes– Biodegradable plastics- Environmental implications. Biotechnology of Microbial composting- Biofertilizers, Biopesticides	5		
<b>Environmental Monitoring:</b> Bioindicators –Biomarkers – Biosensors –Biomonitoring –Polluted environment – Short and long-term monitoring of remediated sites	2,5		

### Books Recommended:

1. Chatterji. A.K., 2003. Introduction to Environmental Biotechnology. Prentice Hall of India Pvt. Ltd., New Delhi.
2. Miller Jr. G. T., 2004. Environmental Science. Tenth Edition. Thompson Brooks/Cole. United States.
3. Kumar H.D, 1998. A textbook on biotechnology. II Edition, Affiliated east west press Pvt. Ltd., New Delhi.

<b>Course Code:</b> GE-5206	<b>Course Title:</b> Geoinformatics in Disaster Management	<b>Course Type:</b> Core Course	<b>Total Marks:</b> 100
<b>Level:</b> MSc. 2 <sup>nd</sup> Semester		<b>Contact Hours:</b> 39	<b>Credit:</b> 3

### Course Rationale:

Disaster risk information is spatial in nature and Geographic Information Systems (GIS) play an important role in disaster risk assessment and management. For this, there is a need to create awareness among the disaster management professionals regarding the importance of GIS.

### Course Objectives:

To provide students with concepts and geospatial methodologies for disaster management, risk assessment and satellite based rapid response analysis & mapping in the immediate aftermath of a disaster.

**Course Learning Outcomes (CLOs):** After Successful completion of the course the students will be able to

1. Describe and utilize spatial data, GIS and remote sensing in disaster risk assessment and management.
2. Utilize existing sources of historical disaster information and elements at risk data.
3. Apply GIS/remote sensing in hazard, vulnerability and risk assessment.
4. Employ risk information in emergency preparedness planning.
5. Visualize hazard and risk information.
6. Apply GIS/remote sensing to post-disaster damage assessment.

**Mapping of CLOs with PLOs**

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	*	*								
CLO2				*			*		*	
CLO3			*		*					
CLO4			*		*		*			*
CLO5				*			*			
CLO6					*		*			*

**Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy**

Content	CLO	Teaching-Learning Strategies	Assessment Strategies
<b>Introduction:</b> Major Technological Tools for DM, Acquisition of GIS and Remote Sensing data for disaster management, Data collection techniques, Web Map Services; Web Feature Services; Constituents of Vector and Raster Models, Concept of Spatial Database;	1	Lecture PPT, Video, Demonstration, Group discussion, Q/A, Discussion	Class Test, Quiz, Assignment, Presentation, Final Examination
<b>Informatics and Mapping:</b> Process Modeling; Surface Creation Analysis and Interpolation Techniques; Hazard Mapping, Physical Vulnerability Mapping, Social Vulnerability Mapping and Risk Mapping,	2		
<b>Disaster Risk Assessment:</b> Assessment GIS based Risk Assessment techniques; GIS based Impact Assessment techniques; <b>Post-Disaster Impact and Damage Analysis-</b> The use of satellite image for disaster relief and recovery; Impact analysis and preliminary damage assessment; Building damage assessment; <b>Pre-Disaster Risk Assessment-</b> Hazard assessment, Elements at risk and vulnerability assessment, Types and methods of risk assessment, risk evaluation, cost-benefit analysis	3		
<b>Risk Information for Risk Reduction:</b> Planning; Risk evaluation; Visualization of risk information; Risk information and spatial planning	4		
<b>Emergency Planning Using Spatial and Non-Spatial Data:</b> Information systems management– Spatial and non-spatial data bank creation– Operational emergency management– Vulnerability analysis of infrastructure and settlements– Predisaster and post disaster planning for relief operations– Potential of GIS application in development planning -Disaster management plan – Case studies.	5,6		

**Books Recommended:**

1. Tomaszewski, B. (2020). *Geographic information systems (GIS) for disaster management*. Routledge.
2. Van Oosterom, P., Zlatanova, S., & Fendel, E. (Eds.). (2006). *Geo-information for disaster management*. Springer Science & Business Media.

<b>Course Code:</b> GE-5207	<b>Course Title:</b> Urban Environmental Management	<b>Course Type:</b> Core Course	<b>Total Marks:</b> 100
<b>Level: MSc. 2<sup>nd</sup> Semester</b>		<b>Contact Hours:39</b>	<b>Credit: 3</b>

### Course Rationale:

Urban environmental management is the study of the basic concept of the urban environment, environmental systems, and factors affecting the urban environment. shows interaction between urban development and the urban environment with its problems and environmental injustice in cities, the concept of the sustainable city, the good city, the inclusive city, the unruly cities, neoliberal environment, and urban agriculture. it also discusses the urban environmental problems in Bangladesh.

### Course Objectives:

1. The basics concept of urban environment, environmental systems, and factors affecting the urban environment.
2. The approaches of urban environmental management.
3. Urban planning and management.
4. State of urban environmental problems.

**Course Learning Outcomes (CLOs):** After Successful completion of the course the students will be able to-

1. Understand the basic concept of urban environment, environmental systems, and factors affecting the urban environment.
2. Explain the interaction between urban development and the urban environment with its problems and environmental injustice in cities.
3. Discuss urban environmental management including the complexity of it as well as some theoretical approaches of it.
4. Understand the concept of sustainable city, the good city, the inclusive city, the unruly cities, neoliberal environment, and urban agriculture.
5. Apply urban environmental management in the context of third world and global initiatives of urban environmental management.

### Mapping of CLOs with PLOs

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	*	*								
CLO2		*		*	*					
CLO3		*					*			
CLO4		*			*			*		
CLO5						*			*	*

### Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

Content	CLO	Teaching-Learning Strategies	Assessment Strategies
<b>Introduction to Urban Environment:</b> Definition and concepts of urban environment, urban environmental systems and risks in the urbanizing world, Factors affecting the urban environment. Interaction between urban development and the urban environment, Disproportionate impacts of urban environmental problems, Fighting poverty and environmental injustice in cities. Contrasting Brown, Grey, Blue and Green issues.	1,2	Lecture PPT, Video, Demonstration, Group discussion, Q/A, Discussion	Class Test, Quiz, Assignment, Presentation, Final Examination
<b>Introduction to Urban Environmental Management:</b> Definition and concepts of environmental management, the complexity of urban environmental management. Comparison with other theoretical approaches, such as political ecology, ecological modernization, ecological footprint, urban governance, environmental governance, sustainable development and urban environmental transition.	1,2		
<b>Approaches and Tools in Urban Environmental Management:</b> The institutional setting for urban environmental	3		

management, Constraints and opportunities of urban environmental management in the world, The concept of sustainable city, the good city, the inclusive city, the unruly cities, neoliberal environment, and urban agriculture.			
<b>Urban Environmental Management in the context of Third World:</b> Assessing urban environmental issues and options, providing environmental services and housing, Reducing natural disaster risk in cities, global initiatives of urban environmental management.	5		
<b>Urban environment problems in Bangladesh.</b>	5		
<b>Guiding principles of urban environmental management: Ecological, economic, social and management.</b>	4		

### Books Recommended:

1. Urban Geography – J.H. Johnston.
2. Readings in Urban Geography – H.M. Mayer and C. F. Kohn.
3. Urban Geography – J.H. Johnston.
4. Urban Research Method – J.P. Gibbs.
5. Urban Bangladesh: Geographic Studies ed. – N. Islam and R.M. Ahsan.

<b>Course Code:</b> GE-5208	<b>Course Title:</b> Techniques in Physical Geography Lab	<b>Course Type:</b> Lab	<b>Total Marks:</b> 100
<b>Level: MSc. 2<sup>nd</sup> Semester</b>		<b>Contact Hours:39</b>	<b>Credit: 1.5</b>

### Course Rationale:

This laboratory course provides an introduction to different methods used for conducting researches in physical geography. In the field and lab, students will learn how to recognize landforms, describe and measure Earth surface processes, and collect geological and hydrological samples; in the lab they will learn to analyse their data and interpret their results. Students will also learn different methods for quantifying the the Earth's surface and how to display and analyse these data.

### Course Objectives:

To provide students a better understanding of the discipline of geography and use the techniques of spatial analysis to better understand natural science and human/environmental interactions.

**Course Learning Outcomes (CLOs):** After Successful completion of the course the students will be able to

1. Gain introductory knowledge and experience with state-of-the-art tools, technology, and field methods for capturing and processing various geographical, geological, and hydrological field data
2. Identify common slope, marine, coastal, fluvial, glacial, and periglacial landforms, sediments, and processes in arctic and different physical environments
3. Gain practical experience of microfossil identification to species level.
4. Understand and apply the techniques of studying microclimate and evaluate microclimate of a region.
5. Measure the components, features and fabrics of soils at a microscopic level.
6. Build digital models for geophysical features.

### Mapping of CLOs with PLOs

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1		*	*							
CLO2						*				
CLO3		*		*	*		*			
CLO4	*	*			*			*		
CLO5				*			*		*	
CLO6					*				*	*

## Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

Content	CLO	Teaching-Learning Strategies	Assessment Strategies
<b>Study of methods and techniques in Physical Geography:</b> Topographic, Hydrologic and fluvial geomorphology, Glaciology, Paleoecology	1,2	Lecture PPT, Video Demonstration, Lab Experiment, Single and Group Exercise, Q/A	Class Test, Quiz, Assignment, Presentation, Final Examination
<b>Study of Microclimate</b>	4		
<b>Analysis of Physical Environment:</b> Geo-zoological and Geobotanical observation, identification and Herbarium preparation	4		
<b>Granulometry:</b> Sieve Analysis; Mesh Scale. Optical granulometry; Particle gradation; Pattern recognition and Dynamic light scattering.	5		
<b>Sedimentological Tests:</b> Identification of sand, silt and clay by manual techniques; Studies on the texture, structure, colour, organic matter and composition.	5		
<b>Study of Macro and Micro Fossil</b> (Foraminifera, diatom, plant and animal microfossils)	3		
<b>3D Modeling and Surfer Application:</b> Visualizing Abstract Phenomena, working with google earth Datasets, Measurement- Area, elevation; drawing- Paths and Polygons, Creating Image Overlays; 3D modeling of geophysical features	6		

### Books Recommended:

1. Techniques in Physical Geography - Gouide A, Routledge, London (1990).
2. Micofossil- Braiser, MD., Chapman and Hall, London (1979).
3. Encyclopedia of Quaternary Science (2nd Edition)- Elias, S.A, Elsevier (2013).
4. Paleoecology Past, Present and Future- Bottjer, D.J. (2016).
5. Reconstructing Quaternary Environments (2nd Edition)- Lowe, J.J., Routledge (January 27, 1997)

<b>Course Code:</b> GE-5209	<b>Course Title:</b> Laboratory analysis of Environmental Components	<b>Course Type:</b> Lab	<b>Total Marks:</b> 100
<b>Level:</b> MSc. 2 <sup>nd</sup> Semester		<b>Contact Hours:</b> 39	<b>Credit:</b> 1.5

### Course Rationale:

This course covers the general topics on the analysis of pollutants in environmental matrices including the instrumentations, theory and techniques for their measurements. This course also consists of laboratory experiments.

### Course Objectives:

This course introduces various techniques and methods of analysis of environmental components.

**Course Learning Outcomes (CLOs):** After Successful completion of the course the students will be able to

1. Understand the fundamentals of environmental analysis
2. Know role of sample preparation in environmental analysis
3. Understand theory and techniques for their measurements of pollutants
4. Demonstrate a broad and coherent knowledge and understanding of analytical chemistry and instrumental methods of analysis, including gas chromatography, HPLC chromatography and mass spectrometry
5. Use spectroscopic techniques to determine analyze various pollutants in environment.
6. Draw conclusions from analytical data using appropriate statistical analyses in conventional chemical and mathematical notation after collecting, recording, validating, interpretation of analytical data
7. Apply teamwork skills by working effectively, responsibly, ethically and safely in an individual or team context.

## Mapping of CLOs with PLOs

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO 10
CLO1	*		*							
CLO2			*		*					
CLO3	*					*				
CLO4			*	*					*	
CLO5	*					*		*		
CLO6		*						*	*	
CLO7			*				*			*

## Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

Content	CLO	Teaching-Learning Strategies	Assessment Strategies
1. Introduction to the course: Pollutants in the environment and their sources; general classifications of pollutants and their chemical structures, properties and toxicity; units of measurement; quality control and quality assurance program in environmental analysis; errors in quantitative analysis, precision and accuracy in measurement, statistics in microanalysis, control charts, and detection limit	1,2	Lecture PPT, Video Demonstration, Lab Experiment, Single and Group Exercise, Q/A	Class Test, Quiz, Assignment, Presentation, Final Examination
2. Wet methods: Titrimetric and colorimetric procedures, general discussion, Beers law and spectroscopic methods; analysis of common anions in environmental waters by wet methods; chemical and biochemical oxygen demand.	3,4		
3. Gas chromatography: Principles of chromatography; peaks separation; resolution efficiency of columns; understanding chromatograms and identifying compounds; GC columns and detectors; quantification methods, external and internal standard methods; minimum detection limits	1,4		
4. High performance liquid chromatography: Reversed phase and normal phase liquid chromatography, HPLC instrumentation and detectors; post-column derivatization; ion chromatography	4,6		
5. Atomic spectroscopy: flame and furnace atomic absorption spectroscopy, inductively coupled plasma emission spectroscopy; sample digestion methods	5,6		
6. Sample extraction techniques and removal of interference from sample extracts: purge and trap separation of volatile substances, liquid-liquid extraction, solid phase extraction, ultrasonic extraction, supercritical fluid extraction; sample clean-up methods	4,6		
7. Air Analysis: Air sampling plan, sampling of indoor air, use of adsorbent tubes and canisters, solvent and thermal desorb	7		

### Books Recommended:

1. E. Popek (2018), Sampling and Analysis of Environmental Chemical Pollutants.
2. P. Patnaik(2010), Handbook of Environmental Analysis
3. A. Nigham (2020) , Environmental Analysis Laboratory Handbook
4. J. Jeffrey Peirce(1997) Environmental Pollution and Control

<b>Course Code:</b> GE-5210	<b>Course Title:</b> Field Work on Micro Region Survey	<b>Total Marks: 100</b>
<b>Level: MSc. 2<sup>nd</sup> Semester</b>	<b>Course Type: Field Work</b>	<b>Credit: 1</b>

**Course Rationale:**

The course trains students to prepare for fieldwork in a particular region appropriately.

**Course Objectives:**

To assist students in developing both the practical skills and the professional knowledge required for field research in a specific region.

**Course Learning Outcomes (CLOs):**

1. To work in depth with a specific focus in a micro region.
2. Reflect on various practical skills required to undertake research in different environments, including cross-cultural communication, language competency and budgeting.
3. Identify issues relating to human research ethics and consider how to address them in the context of geographical study.
4. Critically reflect on methodological choices and practices relevant to the regional context

**Mapping of CLOs with PLOs**

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1			*		*	*				*
CLO2		*	*		*	*				*
CLO3		*					*		*	
CLO4				*		*			*	

**Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategies**

Content	CLO	Teaching-Learning Strategies	Assessment Strategies
Socio-Economic context observation	1,2,3	Lecture PPT, Video, Demonstration, Group discussion, Q/A, Discussion, Visit a specific microregion	Presentation, FW Report, Viva
Tourism potentiality assessment	1,3		
Biodiversity identification assessment	1		
Physical environment analysis	1,4		
Land use identification and mapping	1,4		

**Books Recommended:**

1. Hammett, D., Twyman, C. and Graham, M., 2014. *Research and fieldwork in development*. Routledge.
2. Frew, J., 1993. *Advanced geography fieldwork*. Nelson Thornes.

<b>Course Code:</b> GE-5211	<b>Course Title:</b> Research Project/Internship	<b>Total Marks:</b> 100
<b>Level: MSc. 2<sup>nd</sup> Semester</b>		<b>Credit: 6</b>
<i>This course is designed only for the students of non-thesis group and will be designated by the academic committee.</i>		

**Course Rationale:**

This course aims to enable the student to develop deeper knowledge, understanding, capabilities and attitudes in the geo-environmental context. It will offer the opportunity to delve more deeply into and synthesize knowledge acquired in previous studies. This will facilitate quality graduate research experience between students and mentors or professionals to bring students into a community of scholars within their field as well.

**Course Objectives:**

1. To develop the ability to give an independent, systematic, and clear treatment of a certain topic in the field of geographical and environmental sciences.
2. To train the ability to independently identify and analyze relevant problems.
3. To solve a practical problem by a systematic use of an appropriate choice of theory and methodologies.

- To train the ability to independently acquire and handle academic knowledge through independent studies of relevant literature, and to cultivate the ability to evaluate and briefly account for the central elements in a large literature base.

**Course Learning Outcomes (CLOs):** After the successful completion of the course, students will be able to-

- Work in depth with a specific subject area.
- Independently demonstrate their ability to formulate a geography and environmental related topic, select relevant literature, process data, conduct analyses, apply methodologies, make critical assessments, and present answers to questions raised in the problem statement.
- use a holistic view to identify, formulate and deal with complex environmental issues critically, independently, and creatively.
- articulate the relevance of their research to their coursework and professional future, synthesizing their research, academic, and professional interests, and goals.

**Mapping of CLOs with PLOs**

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	*	*				*				
CLO2		*				*	*		*	
CLO3				*			*		*	
CLO4			*		*				*	*

**Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategies**

Content	CLO	Teaching-Learning Strategies	Assessment Strategies
Research topic selection.	1, 2	Students will complete the tasks under the supervision of the selective supervisor of the following exam committee/Institution.	Project dissertation, Final Defense, Overall performance
Literature review	2, 3		
Data collection and Analysis	2, 3		
Project report writing.	3, 4		

<b>Course Code:</b> GE-5212	<b>Course Title:</b> Viva Voce	<b>Total Marks: 100</b>
<b>Level: MSc. 2<sup>nd</sup> Semester</b>		<b>Credit: 1</b>

**Rationale:**

The course aims to enable the students to attend placements and be better performers in their future.

**Objective:**

This viva aims to assess students' understanding based on course objectives covering all the courses of Masters (M.Sc.) 1<sup>st</sup> semester and 2<sup>nd</sup> semester.

**Course Learning Outcomes (CLOs):** After the successful completion of the course, students will be able to-

- Prepare themselves to face interview both in the academic and the service sectors.
- Express themselves confidently with good communication skills.

**Mapping of CLOs with PLOs-**

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	*				*	*			*	
CLO2			*		*	*				*

### M.Sc. Third Semester (detail course outline)

<b>Course Code:</b> GE-5301	<b>Course Title:</b> Research Methods for Master Thesis	<b>Course Type:</b> Core Course	<b>Total Marks:</b> 100
<b>Level: MSc. 3<sup>rd</sup> Semester</b>		<b>Contact Hours: 39</b>	<b>Credit: 3</b>

**Course Rationale:** This course will introduce more complex study designs and higher-level critical appraisal. Several research methods will be explored in depth with consideration of both quantitative, qualitative and mixed methods designs.

**Course Objectives:** To assist the master students in undertaking their own research, enhancing their understanding of disciplinary research, and/or enhancing their ability to disseminate research plans and findings in a range of contexts.

**Course Learning Outcomes (CLOs):** After Successful completion of the course the students will be able to

1. Develop their understanding on core research methods from basic to an advanced level.
2. Evaluate the utility of different research designs to address specific research questions.
3. Apply knowledge of both quantitative and qualitative research methods in the design of geographical research.
4. Synthesize available evidence to reach informed conclusions.
5. Develop skills as an independent learner to support continuing academic development and development as a researcher.

#### Mapping of CLOs with PLOs

CLO/PLO	PLO1	PLO2	PLO3	PLO4	PLO5	PLO6	PLO7	PLO8	PLO9	PLO10
CLO1	*			*						
CLO2				*		*				
CLO3		*				*	*			
CLO4				*	*				*	
CLO5								*	*	*

#### Mapping of Course Learning Outcomes (CLOs) with the Teaching-Learning & Assessment Strategy

Content	CLO	Teaching-Learning Strategies	Assessment Strategies
1. Fundamentals of Research	1	Lecture PPT, Video, Demonstration, Group discussion, Q/A, Discussion	Class Test, Quiz, Assignment, Presentation, Final Examination
2. Population Sampling	1		
3. Research types and variations in geography	3		
4. The Research Report and evaluation	2		
5. Basic Research Designs: Qualitative, Quantitative and Mixed Method research	2		
6. Methods and Tools of research	2		
7. Data Analysis – Quantitative & Qualitative	4,5		
8. Visualization, Presentation and Publication	5		
9. Ethical Consideration and Report Writing	4		

#### Books Recommended-

1. Lochmiller, Chad R. & Lester, Jessica N. (2016). An Introduction to Educational Research: Connecting Methods to Practice, SAGE Publications (ISBN: 9781483319506)
2. Pyrczak, Fred & Tcherni-Buzzeo, Maria (2017). Evaluating Research in Academic Journals: A Practical Guide to Realistic Evaluation (7th Edition), Routledge (ISBN: 9780815365686)
3. Kamil, Michael, and et al(2000) Handbook of Reading Research, Volume III, Lawrence Erlbaum Associates, Mahwah, New Jersey.
4. Wagner, Billy (2006) Using SPSS for Social Statistics and Research Methods, SAGE Publications.
5. Lichtman, Marilyn (2006) Qualitative Research in Education, A User's Guide, SAGE Publications.