Curriculum

BS Session: 2022-2023

(BS Session: 2020-2021, 2021-2022)

Four-Year Integrated
Bachelor of Science (Honours)
Degree in Disaster Science and Climate Resilience

January 2023

Department of Disaster Science and Climate Resilience
Faculty of Earth and Environmental Sciences
University of Dhaka

Department of Disaster Science and Climate Resilience (DSCR)
Faculty of Earth and Environmental Sciences
University of Dhaka (DU)
Curriculum for B.S. Honours in DSCR
(Semester-System Course Structure)

1. Introduction to the Department:

On the first day of July 1921 the University of Dhaka opened its doors to students with Sir P.J. Hartog as the first Vice-Chancellor of the University. The University was set up in a picturesque part of the city known as Ramna on 600 acres of land. At present, the University consists of 13 Faculties, 83 Departments, 13 Institutes, 20 residential halls, 3 hostels, and 56 Research Centres.

Among them is the Department of Disaster Science and Climate Resilience, which was renamed in January, 2022 from Department of Disaster Science and Management that in turn started its journey in 2012. The evolution of the department's name is a reflection of the importance given to climate change studies, along with hazard science and disaster management. The aim is to integrate earth science, social science, and engineering in order to generate multidisciplinary and comprehensive knowledge and skills, to understand and address complex risk and emergency scenarios and eventually create a resilient society. The Department runs with the vision to provide international standard and high quality education, engage in collaboration and has particular focus on basic and applied research.

2. Introduction to the Program:

2.1 Title of the program:

Bachelor of Science in Disaster Science and Climate Resilience

2.2 Duration of the program:

Under the Semester System, the four-year B.S. Honours (integrated) Degree in Disaster Science and Climate Resilience (DSCR) at the University of Dhaka is a program comprised of eight semesters. The duration of the BS Honours program is four years, where each semester consists of six months.

2.3 Eligibility for admission:

Student can apply for admission through KA-Unit admission test as per university rules. Students who have passed the admission test also need to secure minimum 12 out of 30 each in physics, chemistry and math parts to become eligible for the program. In addition with this, a candidate must obtain minimum grade B in physics, A in mathematics and B in chemistry in their HSC or equivalent exam.

2.4 General Objective of the program:

Disasters are no longer seen as the hazardous events created entirely by natural or man-made processes rather as manifestations of unresolved problems of development. Climate change further intensified the risk as the hazards become more frequency and severe. In the current paradigm shift from the response and recovery to the disaster risk management, attention has been given to holistic approaches. The paradigm shift makes sure that the scientific and technological application and innovation are crucial for risk reduction, develop resilience and aware of sustainable development. The advancement of knowledge on scientific and social aspects to resilient crisis management has also evolved as an imperative for sustainable development.

Giving due attention on the paradigm shift, which directs disaster management and climate resilience to evolve as a Discipline, the curriculum of the Bachelor of Science (Hons.) degree has been designed.

3. Structure of the Curriculum:

Grading of the Department according to Higher Education Qualification Levels:

Level	Qualification Grade	Grading Credits
7	Bachelor with Honors/ Bachelor's (4 years)/BS	147

Students are required to attend the entire program equivalent to 147 credit hours in Disaster Science and Climate Resilience (DSCR) Honours program. Out of total courses, theory courses involve 101 credit hours; laboratory, field and project work involve 36 credit hours, and viva vocé includes 8 credit hours.

3.1 Learning and Teaching Activities Hours:

No.	Teaching-Learning Activities	Notional Hours for 1 Credit
1	Lecture, Seminar and Other Theory Course Activities	40
2	Lab	60
3	Fieldwork/Research Project	80

(For Lecture, Seminar and Other theory Course Activities 1 hour face to face learning per week for 14 weeks, For Lab 1.5-hour face to face learning per week for 14 weeks and for Fieldwork/Research Project 2 hours per week for 14 weeks is equivalent to 1 credit)

Each semester shall be of 20 weeks

- 14 weeks for class teaching
- 2 weeks for preparation
- 4 weeks for holding the semester final examination (Including Lab and Viva)

3.2 Total Credit Distribution:

No.	Credit (Theory Course/Lab/Field Work/Research Project	Total Contact Hour (Face to Face Class)	Total Non-contact Hour (Library Work/Self-Study/ Assignments/Report Writing/ Group Study etc.)
1	3 Credit Theory Course	42 Hours	78 Hours
2	2 Credit Theory Course	28 Hours	52 Hours
3	2 Credit Lab Course	42 Hours	78 Hours
4	2 Credit Field Work	7 Days in Field (56 Hours)	104 Hours
5	6 Credit Research Project	168 Hours	312 Hours

The duration of annual DSCR Field Works for two-credit equivalent Field Work courses will range between 05-10 workdays in the field.
The course and credit over eight semesters are illustrated below:

Year	Semester	Number of Courses	Credit
Year One	1st Semester	6	16
	2nd Semester	8	18
Year Two	3rd Semester	8	18
	4th Semester	10	21
Year Three	5th Semester	8	19
	6th Semester	8	19
Year Four	7th Semester	7	18
	8th Semester	7	18
4 Years	8 Semesters	61 Courses	147 Credits

Course and Credit Distribution:

Course/Credit	Theory	Laboratory	Viva	Field and Project	Total
Course	42	12	4	4	62
Credit	103	24	8	12	147

4. Assessment System:

4.1 Evaluation and Grading

Theory courses

Marks Distribution		
Class Assessment	Class attendance	05%
	In-course and/or Assignment	25%
Course Final Examination		70%
Total		100%

Laboratory courses

Marks Distribution		
Class Assessments	Class Attendance	10%
	Continuous Assessment	30%
Lab final Examination		60%
Total		100%

Field Work

Marks Distribution	
Field Assessment	40%
Final Report	60%
Total	100%

Project Work

Marks Distribution	
Research Proposal	10%
Proposal Defense	10%
Written Dissertation	60%
Final Defense	20%
Total	100%

Class Attendance

Five percent of total marks will be awarded for class attendance in theory courses. And, ten percent of total marks will be awarded for class attendance in laboratory courses.

Marks of attendances

Attendance %	**Marks** (Theory)	**Marks** (Laboratory)
90 and above	5	10
85 to 89	4	8
80 to 84	3	6

75 to 79	2	4
60 to 74	1	2
Less than 60	00	00

In course and/or assignments and Continuous assessment

Twenty five percent marks in theoretical course will be added from in-course tests and/or assignments. Assessment may be done by taking class test and/or by giving assignments.

The Class Test(s) for in-course assessment will be taken usually after covering 40% of the course topics and the course teacher will announce the dates of in-course examinations at the beginning of the course. For each semester, the Departmental Academic Committee (AC) may fix an "In-course Examination/Class Test Week" for conducting the tests. The concerned course teacher will be responsible to assess the students of his/her course. There will be 1/2 test for each course to be determined by the course teacher. In theoretical courses assignment will be selected from the course syllabus or from topics related to course syllabus. The assignment may consist of written report or presentation or both.

For laboratory courses, forty percent marks shall be allocated for continuous class assessment where the course teacher will award marks based on student performances in the laboratory classes.

Course Final Examination (Theory and Laboratory Courses)

For appearing in the semester final examination, every student is required to have authorized examination admit card supplied by the Controller of Examination on payment of dues (for each semester).

Eligibility of Sitting for the Final Exam

- Student having 75% or more attendance on average (collegiate) are eligible to appear in the final examination.
- Student having 60-74% attendance are considered to be non-collegiate and will be eligible to sit for the final examination on payment on fine tk. 1,000/= (One thousand).
- Student having attendance less than 60% will not be allowed to sit for the final examination but may seek readmission in the program.
- Student must have at least 30% attendance for readmission.

Preparatory Leave (PL)

All academics activities (classes, class assessment etc) will have to be completed before 15 days of semester final exam for smooth functioning of the exam (exam registration, submitting class assessment, and preparation of students for exam). AC can reduce the time only in special circumstances.

Duration of Exam

The duration of theoretical course final examinations will be as follows:

Credit	**Duration of Examination**
3 credit course	3 hours

2 credit course	2.5 hours

The duration of laboratory examinations will be 4 hours. The duration of Viva Voce will be 10-30 minutes.

Evaluation of Examination Script

In the final examination, each theory course will be evaluated by two teachers of the department or outside (who may be either from DU or outside DU). In a single teacher course, the semester final test scripts must be evaluated by two teachers, one of whom must be the course teacher, and another, a suitable second examiner who may be either from DU or outside DU.

Evaluation by Third Examiner

In the semester final examination if the difference of final exam marks in any course is more than 20% (out of 70), the script will be evaluated by a third examiner. The final marks will be average of the third examiner's marks and one of the two examiner's marks which has the least difference.

Evaluation of Laboratory Courses

Evaluation of laboratory courses will be done by the course teacher/teachers. No option for second or third examination is allowed in laboratory courses.

Evaluation of Field Works

For field works evaluation will be done the field work coordinator/coordinators. Field Report will be evaluated by field trip coordinator/coordinators.

Research Project and Project Supervisor Selection

In order to develop skilled personnel in problem identification, methodologies, scientific interpretation, producing a standard report; individual student shall carry out a supervised study independently on a specified topic. A project will be developed by each student with the guidance from his/her supervisor/co-supervisor which is to be approved by the Academic Committee of the department. Students shall contact with the faculty of their field of interest for the selection of supervisor and/or co-supervisor. The Academic Committee shall approve the final list of supervisors. On completion of the Project, each student shall defend and submit written Project Report on the work undertaken. Upon the decision of Academic Committee project may also be completed by group work as well with field visit. Students may also carry out internship at an organization/NGO/Agency or Industry upon the approval of the academic committee.

Evaluation of Research Project

The written proposal, proposal defense, and the final defense will be evaluated by the Examination Committee. The written Project Report shall be evaluated by the Project Supervisor or Co-supervisor and an assigned Expert (assigned by the academic committee). Marks distribution has been shown above.

Viva voce

Viva shall be evaluated by the Examination Committee of the semester at the end of the semester final exam.

Grading Scale and Grades

At the time of evaluation all marks will be entered in numerical form. Only at the time of submitting the final grade sheet and while finalizing the results in the tabulation sheet, grades will be entered in both numerical and letter grade form.

Marks can be given in fraction up to two decimals. If the total marks of a course are in fraction. They should be raised to the higher whole number. GPA and CGPA can be in fraction up to two decimals. The second decimal will be raised to the next higher number if the third decimal number is 5 or above.

Transcript issued to the students will include Letter Grades, Grade Point (GP), Grade Points Average (GPA), and Cumulative Grade Point Average (CGPA). Transcript will not include numerical grades. Numerical Grades, Letter Grades, and Grade Point Averages (GPA), and Cumulative Grade Point Average (CGPA) will be given according to the following scale:

Numerical Marks	Letter Grades	Grade Points
80 above	A+	4.00
75 -79	A	3.75
70 – 74	A-	3.5
65 -69	B+	3.25
60 – 64	B	3.00
55 -59	B-	2.75
50 – 54	C+	2.50
45 -49	C	2.25
40 – 44	D	2.00
Less than 40	F	0.00
Incomplete (does not take an exam)	I	0.00
Withdrawn (does not attend any class and take any exam)	W	0.00

Calculation of GPA and CGPA

GPA (Grade Points Average) will be calculated by multiplying the course credits by the GP (Grade Points) obtained in the courses and dividing the total by total credits. CGPA of more than one semester will be calculated by adding the GPA of the semesters concerned multiplied by the semester credits and dividing the results by the total credits of the semesters.

$$\text{GPA of One Semester} = \frac{Credits\ of\ Course\ A \times GP\ obtain\ in\ Course\ A + \cdots + Credits\ of\ Course\ Z \times GP\ obtain\ in\ Course\ Z}{Total\ Credits\ of Courses\ of\ the\ semester}$$

CGPA of Year One

$$= \frac{Total\ GP\ of\ 1st\ Semester + Total\ GP\ of\ 2nd\ Semester}{Total\ Credits\ of\ 1st\ and\ 2nd\ semester}$$

CGPA of eight Semesters

$$= \frac{Total\ GP\ of\ 1st\ Semester + \cdots + Total\ GP\ of\ 8th\ Semester}{Total\ Credits\ (145)}$$

Sample Question Types and Marks Distribution and Duration of Exams

Final Exam

- There will be no Multiple Choice Questions (MCQs) in final exam.
- Five questions will have to answer from seven questions in question papers. The total mark of each question will be 14.
- Last questions may be short notes (four short notes to answer from seven topics) each short notes is worth 3.5 mark.
- All theoretical courses' final exams will be held in 70 marks. The duration of the exam will be 3 for 3 credit course and 2.5 hours for 2 credit course.
- Question setter will set seven questions.
- Class assessment marks will be 30 in all theoretical courses.

Midterm Exam

Course teacher will decide about question type and duration etc. Question can be either objective type or descriptive.

Laboratory Exam

All final laboratory exams will be in 60 marks. There may be written parts in laboratory exam based on course curriculum. Number of questions will be selected based on course curriculum. In laboratory courses 40 marks will be added from class assessments.

Viva voce

All viva voce will be in 100 marks. Viva marks will be given by averaging the viva board member's marks.

5. Promotion

Promotion will be year wise. Minimum CGPA (Cumulative Grade Point Average) 2.00 is needed only for promoting from second semester to third semester. Minimum CGPA 2.25 is needed for promoting from fourth to fifth semester, and minimum CGPA 2.50 is needed for

promoting from sixth to seventh semester. **For final degree a student must have to secure minimum CGPA 2.50.**

Promotion from first to second semester, third to fourth semester, fifth to sixth semester and seventh to eighth semesters will be automatic for those students having sixty percent attendance.

The minimum CGPA of a student, as mentioned above, is calculated taking into consideration the grade points obtained in courses of all previous class years. Besides, a student failing to clear up university or departmental dues shall not be promoted to the next class year.

6. Final Degree

For BS Honours degree a student need to complete 140 credit hours without F grade in any course, has to secure minimum CGPA 2.50 and complete the program **within six consecutive academic years** including the year of first admission into the program.

7. Retaking of Examinations and Improvement of Grades

Improvement of grade/grades is applicable only for the students who get promoted.

A student securing GPA C+ (2.50) or lower in any course may improve his/her grades by retaking the examination/examinations of the course/courses only once in the following session. In this case, marks of the initial class assessment will be added to the improved (if) final exam marks for final grading.

Retaking or improvements are not allowed in laboratory and field works based courses.

A student with F grade in any course/courses will be allowed to improve the grade/grades by retaking the final examination/examinations of the concerned course/courses for the ***second time.***

In case of improvements (with no F grade), generally there is no scope for improvements in the 7^{th} and 8^{th} Semester. Upon meeting the all the criteria above, a student can sit for Improvement Examinations until the date of the publication for the result of 8^{th} Semester.

If a student has CGPA 2.50 in year four (7^{th} and 8^{th} semesters combined) but having F Grade in any semester, his/her result will be graded as incomplete (I). To get the degree the student shall have the opportunity to improve his/her grade by retaking the courses.

In all cases class assessment marks will be retained.

In addition to the usual fees, a fine will be imposed for each course to be retaken as per the university rules or the decision of the academic committee of the department.

For improvement exams, there will be no additional flexibility of rescheduling in case of overlapping schedules with his/her regular exams.

The same rules will be applicable in the case of any student having an F grade due to being absent in any course/courses.

8. Readmission

A student failing to get the requisite grade points for promotion to the next year may seek re-admission with the following two batches.

If a student is not eligible to appear at the examination owing to inadequate attendance, he/she must seek readmission to study with the following batches.

For re-admission, a student should apply within one month after the publication of result of the concerned year. On re-admission, grades obtained earlier by a student in the class year of re-admission shall be cancelled and the student shall have to retake all the courses and examinations.

A student may take readmission only two times. If required a student may take readmission twice to the same class and thus remain in the same class for three years, but the degree must be completed within twelve semesters, i. e. six years.

In case of W in any course, he/she must go for readmission to continue in a class. The AC of the department must be convinced of the genuineness of his/her absence.

9. Drop out

A student failing to get a minimum CGPA required for readmission two times in a row to the particular semester of the same year will be dropped out of the program.
If a student getting F in any course fails to improve his/her grade even after retaking the examination twice will not be given any further chance for improvement and will be dropped out from the program.

10. Class Representatives

Each batch will have two class representatives (one male and one female) to maintain liaison with the course coordinator and the course teachers regarding their progress and problems. Student advisor/advisors will select class representatives. Class representatives can continue whole academic period to serve the class or in every semester new representative can be selected from the class.

11. Course Teacher

Course teacher shall be finalized before the beginning of a semester by AC. The AC can make necessary change in course teacher if necessary (going on leave, illness etc.). More than one teacher can take one course if deemed necessary by the AC.
Besides taking scheduled classes the course teacher may arrange field visit if necessary for the courses.

The course teacher shall submit class assessment marks (attendance, mid-terms, presentation, and assignment), two copies to the chairman of the examination committee, and one copy to the controller of the examination at least fifteen days before semester final exam.
The course teacher and second examiner will submit two copies of mark-sheets (final exam) to the chairman of the examination committee, and one copy to the controller of the examination.

12. Semester Coordinator

The AC of the department will also select a semester coordinator for each semester, who may be a member of the examination committee, for smooth functioning of the program. AC can change semester coordinator if necessary.

The semester coordinator will prepare routines, arrange and monitor classes and attendances, ensure smooth functioning of the academic work, and help the chairman in getting questions from the question setters, holding examination, preparing exam routines, and publishing examination results.

Ensure submission of all class assessments of a particular semester fifteen days before the semester final exam. The semester coordinator will arrange posting of relevant notices on notice board.
In case of the semester coordinator falling sick, going on leave, or is unwilling to continue, the academic committee will nominate a substitute.

13. Field Trip and Coordinator/Coordinators

For field trip courses field trip coordinator/coordinators shall be finalized at the beginning of the semester by AC. The coordinator will fix location and timeframe of the fields. All arrangements of field visits shall be carried out by the supervision of Field trip coordinator.

14. Examination Committee

The Academic committee of the department shall form an Examination Committee for each semester. The committee will include the Chairman and three members, including one external who may be from DU or outside DU.

The selected course coordinator by the AC of the department may be a member of the examination committee, for smooth functioning of the program.

Chairman of the Examination Committee

He/she will be responsible for getting questions from the course teachers, moderating and printing the questions, holding of examinations, and publication of results. If the chairman desires, he/she may request the course coordinator to collect questions from the course teachers.

The chairman of examination committee will take necessary initiatives (formulating exam routines, issuing letter for seeking class assessment marks from course teachers, seeking

question papers from examiners etc) of semester final examination at least one month before the starting of final examination.

15. Tabulation and Tabulator of the Examination Results

Two teachers of the department from the Examination Committee will be appointed as tabulators. The chairman of the examination committee and the course coordinator will select the tabulators who should be preferably member of examination committee.

The course teacher and second examiner will submit two copies of mark-sheets (final exam) to the chairman of the examination committee, and one copy to the controller of the examination.

The course teacher will submit class assessment marks (attendance, mid-terms, presentation, and assignment), two copies to the chairman of the examination committee, and one copy to the controller of the examination at least fifteen days before semester final exam.

The two tabulators will enter the class assessment marks and semester final marks (average of first and second examiner) in to tabulation sheets and process the examination results.

In the semester final examination if the difference of final exam marks in any course is more than 20% (out of 70), the script will be evaluated by a third examiner. The final marks obtained will be average of the third examiner's marks and the nearest examiner's marks.

The tabulator will help the controller office to prepare three copies of computerized tabulation sheets. The controller's office will send one copy to the chairman of the department for preservation.

The controller's office will publish the examination results at the end of semester and issue the transcripts.

16. Credit Transfer

Credit transfer from any other programs or institutions is allowed for the B.S. Honours degree

17. Plagiarism and Referencing

Plagiarism is use of intellectual material produced by another parson without acknowledging its source. Common examples are copying, paraphrasing (published, unpublished or web based) from others without acknowledging the authors.

Plagiarism is a serious academic offence and violation of academic and student conduct rules. It is regarded as stealing of intellectual properties. **It is punishable with failing grades or possibly more severe action.**

Referencing is the process of acknowledgement of the sources (words and ideas of another author) used in easy, assignment, dissertation or anything else.

18. Dean's Award

Students who have obtained CGPA 3.75 without having any improvement, no F grade, no academic loss and readmission, no disciplinary action throughout eight semesters and having at least 90% attendance "Dean's Award" shall be presented to him/her.

19. Semester Break

After completing all examination of Semester final (theory, laboratory, and viva, presentation etc) a semester, semester break will start. The duration of semester break 7-15 days. The AC will change (duration, time etc), if necessary. After semester break academic activities of next semester (classes) will start. In the semester break the department will take necessary steps to start next semester and prepare results of the semester final exam.

20. Other General Regulations

Any matter is not covered in the above guidelines; existing rules for integrated Honours Course of University of Dhaka will be applicable.

Course Structure: B.S. (Honours) in Disaster Science and Climate Resilience

Course ID	1st Semester	Credit	Course ID	2nd Semester	Credit
DSCRHT 101	Introduction to Earth System and Disaster	3	DSCRHT 107	Applied Earth Sciences	3
DSCRHT 102	Basics of Climatology and Meteorology	3	DSCRHT 108	Atmospheric Physics	2
DSCRHT 103	Introduction to Environment and Ecosystem	3	DSCRHT 109	Introduction to Hydrology and Water Resources	3
DSCRHT 104	Applied Calculus	3	DSCRHT 110	Society and Disaster	2
DSCRHL 105	Surveying and Mapping Lab.	2	DSCRHT 111	Applied Linear Algebra	2
DSCRHV 106	Viva Vocé	2	DSCRHT 112	Basic Statistics and Probability	2
			DSCRHL 113	Earth Materials Lab	2
			DSCRHF 114	Field Work	2
Total Credit		**16**	**Total Credit**		**18**

Course ID	3rd Semester	Credit	Course ID	4th Semester	Credit
DSCRHT 201	Applied Differential Equation	3	DSCRHT 209	Seismology and Geodesy	3
DSCRHT 202	Geological and Hydro-meteorological Hazards	2	DSCRHT 210	Numerical Analysis and Sampling Techniques	2
DSCRHT 203	Climatic Hazards and Climate Change	2	DSCRHT 211	Bangladesh Studies and Climate Resilience Approach	2
DSCRHT 204	Anthropogenic Hazards	2	DSCRHT 212	Principles of Remote Sensing	2
DSCRHT 205	Climate Resilience and Public Health	3	DSCRHT 213	Geographic Information System and Database Management	2
DSCRHT 206	Built Environment	2	DSCRHL 214	Remote Sensing Lab.	2
DSCRHT 207	Introduction to Computer Programming	2	DSCRHL 215	GIS Lab.	2
DSCRHL 208	Environmental Pollution Lab	2	DSCRHL 216	Disaster Statistics Lab	2
			DSCRHF 217	Field Work	2
			DSCRHV 218	Viva Vocé	2
Total Credit		**18**	**Total Credit**		**21**

Course ID	5th Semester	Credit	Course ID	6th Semester	Credit
DSCRHT 301	Mitigation, Prevention and Preparedness	2	DSCRHT 309	Climate Resilience and Development: Economic Concept	3
DSCRHT 302	Vulnerability and Risk Assessment	3	DSCRHT 310	Seismic Risk Reduction Approach	3
DSCRHT 303	Community Based Risk Assessment and Planning	2	DSCRHT 311	Hydro-meteorological Risk Reduction Approach	3
DSCRHT 304	Geophysical Application: Principal and Practices	3	DSCRHT 312	Population, Migration and Shelter Management	2
DSCRHT 305	Geotechnical Application: Principal and Practices	3	DSCRHT 313	Inequalities and Disasters	2
DSCRHT 306	Urban and Regional Planning: Risk Mitigation Concept	2	DSCRHL 314	Hazard Analysis and Risk Reduction Lab	2
DSCRHL 307	Geotechnical and Engineering Geophysics Lab	2	DSCRHF 315	Field Work	2
DSCRHL 308	Risk Sensitive Landuse Planning Lab	2	DSCRHV 316	Viva Vocé	2
Total Credit		**19**	**Total Credit**		**19**

Course ID	7th Semester	Credit	Course ID	8th Semester	Credit
DSCRHT 401	Crisis Planning, Response and Recovery	3	DSCRHT 408	Damage, Loss and Need Assessment	2
DSCRHT 402	Disaster and Climate Resilience: Institutions and Instruments	2	DSCRHT 409	Disaster in Agriculture and Food Security	2
DSCRHT 403	Climate Risk Modelling and Resilience	3	DSCRHT 410	Mainstreaming Disaster Management and Climate Resilience	2
DSCRHT 404	Research Methodology and Knowledge Management	3	DSCRHT 411	Project Planning, Monitoring and Evaluation	2
DSCRHT 405	Prediction and Early Warning	3	DSCRHL 412	Damage, Loss and Need Assessment	2
DSCRHL 406	Numerical Simulation and Machine Learning Lab	2	DSCRHP 413	Research project	6
DSCRHL 407	Geo-informatics and MIS in Disaster and Climate Change	2	DSCRHV 414	Viva Vocé	2
Total Credit		**18**	**Total Credit**		**18**

[Note: Of the DSCR Majors, each Theory course is denoted by four-letter code DSCRHT (i.e., DSCR Honours Theory), Laboratory/Lab course by the DSCRHL (i.e., DSCR Honours Lab), Field Works course by the DSCRHF (i.e., DSCR Honours Field), Project work by the DSCRHP (i.e., DSCR Honours Project) and viva vocé by the DSCRHV (i.e., DSCR Honours Viva vocé) followed by a three-digit number.]

Detailed Contents of the Courses

Course Number and Title: DSCRHT 101 Introduction to Earth System and Disaster
Credit: 03
Introduction to the Course:
Disasters are no longer considered isolated events but are now addressed as complex phenomena with multidisciplinary dimensions. Over the years, the frequency and intensity of disasters have increased multifold. With the growing population, more and more infrastructures are being developed; creating more elements at risk and, sometimes, creating new risks as well. To understand the risks of disasters, it is essential to understand the earth system and the processes governing the planet. The earth and its components can act as a source of hazards as well as the elements at risk. This course offers the concept and framework of modern scientific approach for studying disasters, its key components and terminologies, and its integrated relationship with the earth system.
Specific Objectives:
A student is expected to learn the multidisciplinary approach to the concept of modern disaster management, its evolution, its key components and subcomponents. The course aims at portraying the different aspects of disasters an how these are integrated with the earth system. The course also allows the earth materials to be studied from both hazard source as well as elements exposed to hazards. It also emphasizes the content in Bangladesh perspective.
Number of Classes: 28
Course Contents:
Topics

Topic 1: Earth System: Origin of the earth and the solar system; spheres of the earth system; interior of the earth.
Topic 2: Earth Materials: Definitions, types and physical properties of rocks and minerals.
Topic 3: Earth's Surface Processes: Weathering, erosion, denudation, and deposition.
Topic 4: Natural Agents: Glacier, running water and wind.
Topic 5: Geomorphology: Fluvial, glacial, aeolian and coastal processes and their major geomorphic features

In-Course-1

Topic 6: Global Tectonics: Isostasy, continental drift, seafloor spreading, and plate tectonics.
Topic 7: Geological Structure and Succession: Folds, faults, discontinuities, geological time scale.
Topic 8: Relation of earth science with disaster.

In-Course-2

Topic 9: Disaster: Definitions of terminologies; a four-phase approach of disaster management, paradigm shift, disaster trends.
Topic 10: Hazards: Natural hazards (geological, meteorological, hydro-meteorological, biological, and climatic hazards); technological and man-made hazards; hazard identification and hazard profiling.
Topic 11: Risk: Components of risk (likelihood, consequence, and trends); risk evaluation; risk acceptability, and alternatives; disaster risk reduction and disaster risk management.
Topic 12: Vulnerability: Physical profile; social profile; environmental profile; economic profile; risk factors influencing vulnerability; risk perceptions.
Topic 13: Fundamental approach of disaster management in Bangladesh.

Learning Outcomes
By the end of the course students will be able to learn:

- The earth system, earth materials and the earth processes

- The fundamentals of geology, geomorphology, plate tectonics and their application in disaster science
- The multidisciplinary approach to understanding disasters and its trends
- The disaster management cycle and its components
- The fundamental components e.g. risk, hazard, vulnerability, exposure, capacity, resilience etc. and their subcomponents
- Paradigm shift and the evolution of disaster management
- Disaster management in the context of Bangladesh
- Scope of earth science in understanding disasters

Instructional Strategies:

Visual aids like Multimedia alongside whiteboard writings will be used to present lectures. All the materials will be provided. Teaching methods will be: lectures, group discussion, exercises, case studies, assignments and presentations. The techniques of experiential learning like role play, question and answer sessions, practical research and report writing will be used to increase participation. In addition, problem solving and hands on learning is encouraged.

Assessment:

Formative (30%): Incourse Examination/Assignment /Presentation
Summative (70%): Course Final Examination

References:

1. Leet L.D. et al (1982) Physical Geology. Prentice-Hall. USA.
2. Turbuck E.J., Lutgens F. K. and Tasa D.S. (2013) An Introduction to Physical Geology. 13th Edition. Prentice Hall. US.
3. Plummer C., Carlson D. and Hammersley L. 2014. Physical Geology. 15th Edition. McGraw Hill. US.
4. Berry L.G. and Mason B. (1968) Elements of Mineralogy. Greenwood Press. US.
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8. Khan F.L. (1991) Geology of Bangladesh. The University Press Limited. Dhaka. Bangladesh.
9. Reimann K-U (1993) Geology of Bangladesh. Gebruder Borntraeger Verlagsbuchhandlung, Science Publishers, Berlin
10. Philip Kearey et al (2009) Global Tectonics, Wiley-Blackwell Publication
11. Coppola D.P. (2007) Introduction to International Disaster Management. Elsevier. UK.
12. Cees Westen et al (2011) Multi-hazard Risk Assessment. Public Works
13. Paul B.K. (2011) Environmental Hazards and Disasters: Contexts, Perspectives and Management. Wiley-Blackwell. US.
14. Pinkowski J. (2008) Disaster Management Handbook. CRC Press. US.
15. Smith K. and Petley D.N. (2009) Environmental Hazards: Assessing Risk and Reducing Disaster. Routledge. New York.
16. United Nations International Strategy for Disaster Reduction (UNISDR) (2004) Living with Risk: A Global Review of Disaster Reduction Initiatives. Geneva: United Nations.
17. Wisner B. (2004) At Risk: Natural Hazards, People's Vulnerability and Disasters. Routledge. US.

Course Number and Title: DSCRHT 102 Basics of Climatology and Meteorology
Credit: 03
Introduction to the Course:
Basics of Climatology and Meteorology is an introductory course for learning various physical process that determine climate and weather. In this course, students will learn the basic concept of atmospheric sciences, learn to classify world into different climatic region. Introduction to different climatic extremes and Bangladesh perspectives of climate and weather will also include in this course.
Specific Objectives:
To understand the basic concepts of different atmospheric processes and long term climatic processes. This will also help understand the basic of climate change phenomenon.
Number of Classes: 28
Course Contents:
Topics

Topic 1: Climatology and Meteorology: Basic concepts of climatology and meteorology.

Topic 2: Earth and Its Atmosphere: Earth as a system; overview of Earth's atmosphere; vertical structure of the atmosphere.

Topic 3: Energy: Warming and Cooling of Earth and the Atmosphere: Energy, temperature, and heat; heat transfer in the atmosphere; incoming solar energy; radiation, absorption, emission, and equilibrium; annual and daily energy balances.

Topic 4: Seasonal and Daily Temperatures: The physical controls of temperature; Why earth has seasons; local seasonal variations; daily temperature variation; the geographic controls of temperature; air temperature data; air temperature and human comfort; measuring air temperature.

Topic 5: Atmospheric Humidity: Circulation of water in the atmosphere; the many phases of water; evaporation, condensation, and saturation; humidity.

In-course-1

Topic 6: Condensation: Dew, fog, and clouds: - the formation of dew and frost; condensation nuclei; haze; fog; clouds.

Topic 7: Stability and Cloud Development: Atmospheric stability; determining stability; cloud development.

Topic 8: Precipitation: Precipitation processes; precipitation types; measuring precipitation.

Topic 9: Air Pressure and Winds: Atmospheric pressure; surface and upper-level charts; newton's laws of motion and forces; forces that influence the horizontal winds, winds and vertical air motions.

Topic 10: Winds at Different Scales-Small and Local: Scales of motion; microscale winds interacting with the environment; local wind systems; large-scale thermal circulations; determining wind direction and speed.

Topic 11: Wind, Global Systems and Air Fronts: General circulation of the atmosphere; jet streams; atmosphere-ocean interactions; Air masses; fronts.

Topic 12: Middle-Latitude Cyclones: Polar-front theory; where do middle-latitude cyclones tend to form? vertical structure of deep dynamic lows; upper-level waves and middle-latitude cyclones; the necessary ingredients for a developing middlelatitude cyclone; vorticity, divergence, and developing middle latitude cyclones.

In-course-2

Topic 13: Weather Forecasting: Acquisition of weather information; weather forecasting tools, weather forecasting methods; weather forecasting using surface charts.

Topic 14: Thunderstorms and Tornadoes: Thunderstorms; tornadoes; tornado formation; severe weather and doppler radar; waterspouts.

Topic 15: Hurricanes: Tropical Weather; Anatomy of a hurricane; hurricane formation and

dissipation; naming hurricanes and tropical storms; devastating winds, flooding, and the storm surge; hurricane watches, warnings, and forecasts; modifying hurricanes.

Topic 16: Earth's Changing Climate: Reconstructing past climates; prehistoric climates; climate during the past 1000 years; temperature trends from measurements; possible causes of climate change; current and future climate change.

Topic 17: Global Climate: A world with many climates; climatic classification; the global pattern of climate.

Topic 18: Air Pollution: A brief history of air pollution; types and sources of air pollutants; air pollution: trends and patterns; factors that affect air pollution; air pollution and the urban environment; acid deposition.

Topic 19: Light, Color, and Atmospheric Optics: White and colors; white clouds and scattered light-nonselective scattering; blue skies and hazy days-Rayleigh and Mie scattering; red suns and blue moons-effects of Rayleigh and Mie scattering; refraction, twinkling, and twilight; mirage: seeing is not believing; the green flash; halos, sundogs, and sun pillars; rainbows; coronas, glories.

Topic 20: Basic concepts of climate resilience.

Learning Outcomes:

- Atmospheric structure and how atmospheric parameter vary with time and space.
- Learn global circulation of wind and temperature and how it contributes on local and global weather and climate.
- How atmospheric observation and measurements is done
- Weather and climate of Bangladesh and how it varies over time and space
- Able to classify world into climatic region

Instructional Strategies:

Visual aids like Multimedia alongside whiteboard writings will be used to present lectures. All the materials will be provided. Teaching methods will be: lectures, group discussion, exercises, case studies, assignments and presentations. The techniques of experiential learning like role play, question and answer sessions, practical research and report writing will be used to increase participation. In addition, problem solving and hands on field learning is encouraged.

Assessment:

Formative (30%): Incourse Examination/Assignment /Presentation
Summative (70%): Course Final Examination

References:

1. Ahrens, C. D., Jacson, P.L., and Jackson, C.E. J. (2012): Meteorology Today: An Introduction to Weather, Climate, and The Environment, First Edition. Nelson Education. Canada.
2. Allaby M. (2007) Encyclopedia of Weather and Climate. Vol I and II. Facts on File Inc. US.
3. Barry R. G. and Chorley R.J. (1987) Atmosphere, Weather and Climate. Methuen. UK.
4. Byers H.B. (1974) General Meteorology. 4th Edition. McGraw-Hill Co. US.
5. Hartman D.L. (1994) Global Physical Climatology. International Geophysics Series. Volume 56. PP. 412. Academic Press. US.
6. Hidore J.J. and Oliver J.E. (2009) Climatology: An Atmospheric Science. 3rd Edition. Prentice Hall. US.
7. Miller A. and Anthes R.A. (1980) Meteorology. C. E. Merrill Publishing Company. US.
8. Rohli R.V. and Vega A.J. (2007) Climatology. Jones and Bartlett Learning. Wall Street. US.
9. Franklyn W. Gole and Donn. Introduction to Meteorology

Course Number and Title: DSCRHT 103 Introduction to Environment and Ecosystem
Credit: 03

Introduction to the Course:

Knowledge of environment and ecosystem is important to understand the surrounding nature. Mechanism of environment and ecosystem will help to study disaster science scientifically. Studying Environment and Ecosystem involves sustainable development: Renewable energy sources, Soil conservation, high-efficiency irrigation, organic agriculture, Pollution reduction, Habitat and species protection, Recycling, Fighting global climate change.

Specific Objectives:

This course will prepare students to understand the principles of geography, four spheres of the environment, and their interaction with different biogeochemical cycles to gain greater depth of knowledge on environment. Make them familiarize with earth system and how to deal with major biogeochemical cycles, hydrologic cycle, atmospheric elements and factors, ecological components, ecosystem diversity, different kinds of pollution and pollutants etc

Number of Classes: 28

Course Contents:

Topics

Topic 1: Environment: definition of environment; components of environment: biotic and abiotic; four spheres of earth: lithosphere/geosphere, hydrosphere, atmosphere, and biosphere

Topic 2: Fundamental of Geography: basic concepts in geography (themes in geography, world physical and human regions); modes of explanation in geography

Topic 3: Soil Formation: soil forming factors, soil forming process; soil profile characteristics of different soils; physical, chemical, and biological properties of soils

In-Course-1

Topic 4: Ecosystem: definition of ecology and ecosystem; component of ecosystem; food chain and food web; energy pyramid; trophic level; Autotrophs, Heterotrophs, Herbivores, Carnivores, Decomposers, etc

Topic 5: Biomes: definition of biomes; types and distribution of biomes (terrestrial, aquatic)

Topic 6: Biodiversity: definition; types (species diversity; genetic diversity; ecosystem diversity; functional diversity); conservation of biodiversity (in-situ, ex-situ).

In-Course-2

Topic 7: Major Biogeochemical Cycles: Laws of thermodynamics, oxygen cycle; carbon cycle; nitrogen cycle; phosphorus cycle.

Topic 8: Pollution and Pollutants: Definition; types of pollution and pollutants (air, water, soil, noise, and thermal pollution); point source pollution, non-point source pollution

Learning Outcomes

By the end of the course students will be able to learn:

- Explain environment and its major components and their interactions.
- Understand basic concepts of geography.
- Understand soil forming processes and its relation to ecosystem.
- Understand different realms and their components with different zones with specific characteristics
- Explain ecosystem and their components and how it works.
- Understand biodiversity and biochemical cycles.
- Evaluate various kinds of pollution, its causes and remedy technologies

Instructional Strategies:

Visual aids like Multimedia alongside whiteboard writings will be used to present lectures. All the materials will be provided. Teaching methods will be: lectures, group discussion, exercises, case studies, assignments and presentations. The techniques of experiential learning like role play, question and answer sessions, practical research and report writing will be used to increase participation. In addition, problem solving and hands on learning is encouraged.

Assessment:

Formative (30%): Incourse Examination/Assignment /Presentation
Summative (70%): Course Final Examination

References:

1. Botkin D. B. and Keller E. A. (2000) Environmental Science: Earth as a Living Planet. 3rd Edition. Wiley-Blackwell. US.
2. Enger E. and Smith B. (2008) Environmental Science: A Study of Interrelationship. McGraw Hill. US.
3. Keller E.A. (1985) Environmental Geology. CBS Pub and Distributor. India.
4. Merritts D. et al (1998) Environmental Geology: An Earth System Science Approach. W. H. Freeman and Company. US.
5. Miller G.T. and Spoolman S. (2012) Environmental Science. 14th Edition. Cengage Learning. India.
6. Park C. C. (2001) The Environment: Principles and Application. Routledge. US.
7. Pickering K.T. and Owen L.A. (1997) An Introduction to Global Environmental Issues. Routledge. US.
8. Ruth F. Weiner (2003) Environmental Engineering. Elsevier PublicationBradshaw M., White G.W. and Chacko E. (2004) Contemporary World Regional Geography, 2nd Edition. McGraw Hill. US.
9. Bradshaw M.J. et al. (1978). The Earth's Changing Surface. Wiley-Blackwell. US.
10. Brady N.C. and Weil R.C. 2008. The Nature of Properties of Soils. 14th Edition. Pearson. US

Course Number and Title: DSCRHT 104 Applied Calculus

Credit: 03

Introduction to the Course:

This course is intending to develop basic concepts and skills on differential and integral calculus and its application for solving technical problems, particularly in disaster and climate sciences.

Specific Objectives:

To develop skill of using calculus to solve technical problems in disaster and climate sciences.

Number of Classes: 28

Course Contents:

Topics

Topic 1: Functions and Their Graphs: Polynomial and rational functions; logarithmic and exponential functions; trigonometric functions and their inverses; hyperbolic functions and their inverses; combination of such functions.

Topic 2: Limits of Functions: Definition; basic limit theorems (without proofs); limit at infinity and infinite limits; continuous functions; properties of continuous functions on closed and boundary intervals (no proofs required).

Topic 3: Differentiation: Tangent lines and rates of change; definition of derivative; one-sided derivatives; rules of differentiation (with applications); linear approximations and differentials; successive differentiation; Leibnitz theorem; Rolle's theorem: Lagrange's mean value theorems; extrema of functions; problems involving maxima

and minima.

In-Course-1

Topic 4: Integrals: Antiderivatives and indefinite integrals; techniques of integration; definite integration using antiderivatives.

Topic 5: Definite integrals a limit of a sum; the fundamental theorem of calculus; integration by reduction.

Topic 6: Application of Integration: Plane areas; solids of revolution. volumes by cylindrical shells; volumes by cross-sections. Arc length and surface of revolution.

In-Course-2

Topic 7: Applications of calculus in disaster and climate-related problem solving.

Learning Outcomes:

By the end of the course students will be able to learn:

- Basic concept of calculus
- Able to solve basic differential equations
- Use derivatives to analyses and creating graphs for algebraic and transcendental functions
- Able to apply integration to determine volumes, areas and averages etc.
- Developed skill to solve technical problems using calculus

Instructional Strategies:

Visual aids like multimedia alongside whiteboard writings will be used to give lectures. Teaching methods will be lectures, group discussions, exercises, case studies, assignments, and presentations. The techniques of experiential learning like role-playing, question and answer sessions will be used to increase participation. In addition, problem-solving and hands-on field learning example is encouraged.

Assessment:

Formative (30%): Incourse Examination/Assignment /Presentation
Summative (70%): Course Final Examination

References:

1. Anton H. et al. (1988) Calculus with Analytic Geometry. Wiley-Blackwell. US.
2. Bers L. and Karal F. (1976) Calculus. Holt, Rinehart and Winston. US.
3. Lang S. (1998) A First Course in Calculus. 5th Edition. Springer. Netherlands.
4. Swokowski E.W. (1992) Calculus with Analytic Geometry. Wadsworth Publishing Co Inc. California. US.

Course Number and Title: DSCRHL 105 Surveying and Mapping Lab

Credit: 02

Introduction to the Course:

Mapping and surveying are some of the important lab techniques to reconnaissance field conditions to design a project. This course introduces surveying methods and techniques. In the field of disaster risk reduction map can aid in different way in all phases of disaster management. This course is designed to teach students about theoretical background of cartography. The student will also learn how to prepare, read, and use maps.

Specific Objectives:

This course enables students to how to carry out different types of survey and mapping techniques. A prime objective is to learn map-making, map reading and map use. This course will also familiarize them with various types of survey equipment, their setups, and the principal of operational procedures.

Contact Hour: 42 Hours

Course Contents:

Topics

Topic 1: Definition of Surveying: Type of survey: (geodetic and plane).

Topic 2: Surveying as the Basis of Large-Scale Maps: The framework of topographical maps;

principles of triangulation; types of triangulations.

Topic 3: Methods of Surveying: *Chain and tape:*- equipment; recording of field data; tie line; principles and uses; open and closed traverse surveying; measuring against obstacles; drawing procedures; advantages and disadvantages of chain and tape survey; *Plane table surveying:*- equipment, method of preparation; open and closed, traverse surveying; advantages and disadvantages of plane table survey; *Prismatic Compass:*- equipment, data recording and plotting; advantages and disadvantages of the survey; *Total Station Survey:* Basics of the machine; setting up the machine; methods of angle measurement; methods of coordinate measurement; principles of operation.

Topic 4: Maps: Definition, history, basic elements of map, aesthetics of map; map projections.

Topic 5: Scale: Definition, types, and use; construction of scale- linear, comparative and diagonal.

Topic 6: Map Reading and Interpretations; Map Reproduction-Enlargement and Reduction at different scales; bearing, azimuth, distance, plotting of location and data.

Topic 7: Map Design and Symbology: Principles of map design; cartographic design; international color scheme; theory; models and perception; typographic map production.

Topic 8: Thematic map: Definition and concept; methods of thematic mapping- choropleth, isopleths, dot, flow, proportional symbol, isothermal and diagrammatic method; cartogram.

Topic 9: Contour maps construction; study of topographic maps, classification of maps and their applications (weather maps, geological maps, etc.).

Topic 10: Determination of dip and strike; plotting structural data on a map; construction of geological cross-sections of representative geological map exercise, interpretation of SOB topographic maps.

Topic 11: Map reading and cross-section (topographic, geologic, and geomorphic).

Learning Outcomes:

Students will be able to learn:

- Learn theory and basic concept of cartography
- Survey with topographical, geologic and geomorphic maps
- Understand the framework of Topographical Maps; Principles of Triangulation; Types of Triangulations.
- Perform methods of surveying such as traversing, chain and tape, plane table, plotting etc.
- Able to perform angle measurement, coordinate measurement and do the cross sections of maps.

Instructional Strategies:

Lecture; Presentation; Hands-on study; online learning, software learning

Assessment:

Formative (40%): Attendance, Laboratory work, Submission of assignment/Lab notebook
Summative (60%): Practical Examination

References:

1. Blyth F.G.H. (1965) Geological Maps and their Interpretation. E. Arnold. UK.
2. Keats J.S. (1973) Cartographic Design and Production. Longman. UK.
3. Monkhouse F.J. and Wilkinson H.R. (1971) Maps and Diagrams. 3rd Edition. Methuen. UK.
4. Robinson A.H. (1953) Elements of Cartography. Wiley-Blackwell. US.
5. Shingh R.L. and Dutt P.K. (1979) Elements of Practical Geography. Students' Friends. India.
6. Punmia B.C. Surveying Volume 1. India
7. Punmia B.C. Surveying Volume 2. India
8. Punmia B.C. Higher Surveying Volume 3. India

9. Basak N. N. Surveying and Levelling (1994). Tata McGraw-Hill. India
10. Aziz M.A. A Textbook of Surveying (1982) 3rd Edition, Bangladesh

Course Number and Title: DSCRHV 106 (Viva vocé)
Credit: 02
Introduction to the Course:
Viva vocé ("living voice"), by tradition, is an oral examination that is carried out not as a substitute, but to complement the written exam. The course is designed to ensure the development of the student's ability to apply, analyze, evaluate and create using the acquired knowledge along with the ability to remember and understand. This course is unique in a sense that it does not have a scheduled class time but the all the courses up to 3rd semester and before constitutes the syllabus. Also, this course is designed to ensure a comprehensive understanding of the subject as a whole with clear a conceptual framework which can help the students explain, evaluate and create the correlations among the individual courses.
Specific Objectives:
This semester mainly focuses on basic disaster and climate sciences. So a student is expected to learn the basic concept of disaster management framework. The main objective of the course is to ensure that student has grasped the fundamentals of disaster science and management as well as the foundation courses on earth sciences, the environment as well as basic calculus, which are essential to for advanced level courses.
Course Contents:
The course contents include all the theory and practical courses taught throughout the first semester.
Learning Outcomes:
- Remember, Understand Fundamentals of disaster science and climate resilience, disaster management framework; Analyze and evaluate based on the framework
- Have a strong grasp on the earth sciences and environmental sciences to better understand the natural disasters
- Learn basic calculus in order to understand the advanced calculation to assess different parameters using calculus

The oral examination process itself can allow a student to grow in the following aspects:
- Develop and demonstrate oral communication ability;
- Provide experience with the communications identified as most challenging in the workplace, i.e., interaction with a superior;
- Help students develop explanatory skills, powers of persuasion, oral poise and self-confidence
- Understand and demonstrate the principles of audience-centered message adaptation;
- Locate, use, and correctly cite appropriate evidence in supporting their claims;
- Demonstrate communication behaviors appropriate for effective comprehensive and supportive listening;

Instructional Strategies:
Questions and Answers; Establishing Rapport; Discussion on topics; Problem solving; Speech on given topics.
Assessment:
The oral exam is to be conducted by the 1st Semester Examination Committee for the respective session. The committee consists of four faculty members led by a chairman. The

members evaluate the performance of a student individually and discretely; the average of which is the number that is awarded to the student and is graded accordingly.

Reference:

Provided in the individual course contents.

Course Number and Title: DSCRHT 107 Applied Earth Sciences

Credit: 03

Introduction to the Course:

Earth materials and the processes interact among themselves to configure the shape of the earth's surface. However, this system is dynamic and the changes often lead to catastrophes or disasters. Different agents drive different processes and, result in diverse configurations and various associated deposits. Each geomorphic feature is associated with different hazards. The earth and its components can act as a source of hazards as well as the elements at risk. This course builds on the basics of earth sciences provided in DSCRHT 101 courses and provides deeper knowledge of topics that are essential to understand disasters and their impacts.

Specific Objectives:

The course aims at studying the earth system as well as earth materials and processes that govern natural disasters. Also, the course allows the earth materials to be studied from both hazard source as well as elements exposed to hazards. Mineralogy, petrology, structural geology, stratigraphy, geomorphology, tectonics, pedology etc. are integrated in this course to ensure a clear understanding of those above mentioned scenarios. The course also offers an extra emphasis on different units that are available in Bangladesh.

Number of Classes: 28

Course Contents:

Topics

Topic 1: Mineralogy: Physical and chemical properties, classification and occurrence

Topic 2: Petrology: Igneous, sedimentary and metamorphic rocks (occurrence, structure, texture, classification, relation to different hazards)

Topic 3: Major geological structures and their association with different disasters: fold, fault, unconformity, landform controlled by folds, landform controlled by faults, criteria for faulting

In-Course-1

Topic 4: Geological time scale, historical geology and mass extinctions

Topic 5: Geomorphology: factors and agents; Fluvial, Glacial, Aeolian and Coastal processes and their morphology

Topic 6: Stream types and their relation to tectonics and lithology.

In-Course-2

Topic 7: Plate tectonics: concept, classification of plate boundaries and associated hazards, hotspots

Topic 8: Stratigraphy: Principles, classification and their units, stratigraphic contacts, unconformities; vertical and lateral successions; cyclic successions

Topic 9: Geomorphic and tectonic units of Bangladesh. Stratigraphic succession of Bangladesh

Learning Outcomes:

By the end of the course students will be able to learn:

- The earth system, earth materials and the earth processes
- The fundamentals of mineralogy, petrology, structural geology, stratigraphy and their association with disasters

- The ability to identify lithology, and structures which are essential to describe different natural hazards
- The geomorphic processes and agents
- Different landforms that are controlled by major structural nits
- Drainage pattern, Stream types and their relation to the lithology
- Plate tectonics and associated hazards
- The formation of sedimentary rock and its impact on hazard characteristics

Instructional Strategies:
Visual aids like Multimedia alongside whiteboard writings will be used to present lectures. All the materials will be provided. Teaching methods will be: lectures, group discussion, exercises, case studies, assignments and presentations. The techniques of experiential learning like role play, question and answer sessions, practical research and report writing will be used to increase participation. In addition, problem solving and hands on learning is encouraged.

Assessment:
Formative (30%): Incourse Examination/Assignment /Presentation
Summative (70%): Course Final Examination

References:

1. Plummer C., Carlson D. and Hammersley L. 2014. Physical Geology. 15th Edition. McGraw Hill. US.
2. Turbuck E.J., Lutgens F. K. and Tasa D.S. (2013). An Introduction to Physical Geology. 13th Edition. Prentice Hall. US.
3. Berry L.G. and Mason B. (1968) Elements of Mineralogy. Greenwood Press. US.
4. Tyrrell G.W. (1952) The Principles of Petrology: An Introduction to the Science of Rocks. Dutton and Company Inc. New York. Billings M.P. (1972) Structural Geology. 3rd Edition. Prentice Hall. US.
5. Boggs S. (2012) Principles of Sedimentology and Stratigraphy. Prentice Hall. US.
6. Pettijohn F.J. (1975) Sedimentary Rocks. Harper and Row. US.
7. Tyrrell G.W. (1952) The Principles of Petrology: An Introduction to the Science of Rocks. Dutton and Company Inc. New York.
8. Bradshaw M.J. et al. (1978). The Earth's Changing Surface. Wiley-Blackwell. US.
9. Brady N.C. and Weil R.C. 2008.The Nature of Properties of Soils. 14th Edition. Pearson.US.
10. Leet L.D. et al (1982) Physical Geology. Prentice-Hall. USA.
11. Hugget R.J. (2007) Fundamentals of Geomorphology. Routledge Publication
12. Imam B. (2005) Energy Resources of Bangladesh. University Grants Commission. Dhaka. Bangladesh

Course Number and Title: DSCRHT 108 Atmospheric Physics
Credit: 02
Introduction to the Course:
Atmospheric physics is important for weather forecast modeling. This course will help to understand the physical processes in the atmosphere, such as radiation, clouds and sub-grid scale processes, understand the fluid flow equations and chemical models, physical parametrization, etc.

Specific Objectives:
To understand the physical processes in the atmosphere.

Number of Classes: 19

Course Contents:

Topics

Topic 1: Introduction to the atmosphere: atmospheric behavior, mechanisms influencing atmospheric behavior, composition and structure, radiative equilibrium, the global energy budget, the layers of the atmosphere, variation of pressure with height in the atmosphere, spatial and temporal scales of atmospheric processes.

Topic 2: Atmospheric thermodynamics: the ideal gas law, atmospheric composition, hydrostatic balance, entropy and potential temperature, parcel concepts, the available potential energy, moisture in the atmosphere, the saturated adiabatic lapse rate, the tephigram, cloud formation.

Topic 3: Atmospheric radiation: basic physical concepts, the radiative-transfer equation, basic spectroscopy of molecules, transmittance, absorption by atmospheric gases, heating rates, the greenhouse effect.

In-Course-1

Topic 4: Basic fluid dynamics: mass conservation, the material derivative, continuity equation, the equation of state for the atmosphere, the Navier–Stoke's equation, rotating frames of reference, geostrophic and hydrostatic approximations, pressure coordinates and geopotential, the thermodynamic energy equation.

Topic 5: Stratospheric chemistry: thermodynamics of chemical reactions, chemical kinetics, bimolecular reactions, photo-dissociation, stratospheric ozone, the transport of chemicals, the Antarctic ozone hole.

Topic 6: Properties of atmospheric aerosol: the size distribution function, aerosol chemical composition, vertical variation.

In-Course-2

Topic 7: Atmospheric stability and pollution dispersion: atmospheric diffusion theories, dry and wet deposition.

Topic 8: Spectral measurements of atmospheric radiation; polarisation effects; monochromators, detectors and standards; general characterization of spectroradiometers; measurement errors.

Topic 9: Remedial measures: remedial measures against the pollution of atmospheric environment.

Learning Outcomes:

The student will be able to learn:

- Physical processes in the atmosphere
- Thermodynamics and fluid dynamics
- How to measure atmospheric radiation
- Remedial measures

Instructional Strategies:

Visual aids like multimedia alongside whiteboard writings will be used to give lectures. Teaching methods will be lectures, group discussions, exercises, case studies, assignments, and presentations. The techniques of experiential learning like role-playing, question and answer sessions will be used to increase participation. In addition, problem-solving and hands-on field learning example is encouraged.

Assessment:

Formative (30%): Incourse Examination/Assignment /Presentation

Summative (70%): Course Final Examination

References:

1. Holton, J.R. and Hakim, G.J. (2012). Introduction to Dynamic Meteorology, 5th Edition, Academic Press.
2. Hess, L.S. (2012). Introduction to Theoretical Meteorology, Wiley Online Library.

3. Roisin, B.C. and Beckers J.M. (2009). Introduction to Geophysical Fluid Dynamics, Academic Press, 2009.
4. Wallace, J.M. and Hobbs, P.V. (2006). Atmospheric Science: An Introductory Survey (2nd Ed), An Introduction to Boundary Layer Meteorology, R.B. Stull
5. Seinfeld, J.H. and Pandis, S.N. (2016). Atmospheric Chemistry and Physics: From Air Pollution to Climate Change.

Course Number and Title: DSCRHT 109 Introduction to Hydrology and Water Resources

Credit: 03

Introduction to the Course:

Hydrological hazards constitute a large portion of the disasters and often result in massive damage and loss. To better understand the hazards, it is essential to understand different components of the water cycle and the processes the drive them. The course focuses on the fundamentals of surface and subsurface hydrology including terminologies, process, chemistry and anthropogenic influences. The course also incorporates the water resources of Bangladesh and the importance of Integrated Water Resource Management to reduce disaster risk.

Specific Objectives:

The course aims at explaining the different components of the water cycle, their behavior and the processes that govern them. The course offers an in depth understanding of surface hydrology, that is required to explain, describe, characterize and evaluate floods, storm surges, waterlogging and other hazards having surface water flow. The course also focuses on hydrogeology; studying the terminologies, processes, chemistry so as to characterize subsurface hydrological hazards. The course also incorporates study of the water resources in Bangladesh, which are often elements that are in risk in terms of different hazards and the importance of IWRM to ensure sustainable and resilient system.

Number of Classes: 28

Course Contents:

Topics	
Topic 1:	Hydrosphere, Hydrologic cycle and its components, Weather and hydrology, Precipitation, Rainfall-runoff relations, Evaporation, Transpiration and Infiltration Processes and their Measurements;
Topic 2:	Hydrograph; Unit Hydrograph; Streamflow type and Velocity; River-Stage and Discharge
Topic 3:	Hydrologic routing, Statistical methods in hydrology.
	In-Course-1
Topic 4:	River Pattern and Morphological processes, Behaviour of alluvial rivers, River training and bank protection works, Sediment movement in river channels, bed forms and flow regimes.
Topic 5:	Coast and coastal features, coastal zone processes
Topic 6:	Groundwater; Origin, Occurrence and distribution of Groundwater; Rock and sediments properties affecting Groundwater (physical and hydraulic properties); Geologic Formations as Aquifers; Groundwater Movement-- Darcy's Law; Types of Aquifers and Aquifers vulnerability; Isotope Hydrology; Groundwater contamination and Pollution; Saline water intrusion in aquifers;
	In-Course-2
Topic 7:	Groundwater and Surface water Resources of Bangladesh: IWRM approach.

Learning Outcomes:
By the end of the course students will be able to learn:

- The hydrologic cycle, their components and the process that govern the movement of water
- Surface hydrology; its terminologies, assessment of different parameters
- Hydrogeology; concept, types of aquifers and their properties, groundwater movements and their characteristics
- Chemistry of water; water pollution
- To understand different hydrological hazards
- Water resource evaluation in term of both source and exposed elements for disaster
- IWRM and its impact on reducing disaster risk

Instructional Strategies:
Visual aids like multimedia alongside whiteboard writings will be used to give lectures. Teaching methods will be lectures, group discussions, exercises, case studies, assignments, and presentations. The techniques of experiential learning like role-playing, question and answer sessions will be used to increase participation. In addition, problem-solving and hands-on field learning example is encouraged.

Assessment:
Formative (30%): Incourse Examination/Assignment /Presentation
Summative (70%): Course Final Examination

References:

1. Chow V.T. (1964) Handbook of Applied Hydrology. McGraw Hill. US.
2. P. Jaya Rami Reddy. (2011) A Text Book of Hydrology. Laxmi Publications (pvt) Ltd, New Delhi, India.
3. K. Subramanya. (2014) Engineering Hydrology. McGraw Hill. US.
4. Kazmann R.G. (1972) Modern Hydrology. Joana Cotler Books. New York. US.
5. Matthess G. (1982) The Properties of Groundwater. Wiley-Blackwell. US.
6. Raghunath H.M. (1990) Groundwater Hydrology. Wiley Eastern Ltd. India.
7. Todd D.K. (1980) Groundwater Hydrology. 2nd Edition. Wiley-Blackwell. US.
8. United Nations Development Program (UNDP) (1982) Ground Water Survey: The Hydrogeological Conditions of Bangladesh. UNDP Technical Report. US.
9. Ward and Robinson (1975) Principals of Hydrology, Mcgraw Hill Publication
10. CEM: Coastal Engineering Manual. Contributor, United States. Army. Corps of Engineers. Publisher, U.S. Army Corps of Engineers, 2002.

Course Number and Title: DSCRHT 110 Society and Disasters
Credit: 02
Introduction to the Course:
Globally, disasters are on the increase due to climate change, impacting communities and nations with grave social and economic consequences and threatening the survival, dignity and livelihoods of the vulnerable sections of their populations. Shifting socio-economic situations, unplanned urbanization, environmental degradation, climate variability and change, geological hazards, competition for scarce natural resources, and the threat of epidemics are factors that compound the impact of disasters. This course adopts an interdisciplinary perspective appropriate to analyze these complex issues. This course addresses all stages of climate resilience and disaster management in a comprehensive and holistic manner from societal perspectives. In the first half of the course students will examine different theories and frameworks for understanding the link between society and disasters and climate. This will provide a critical platform for the second part of the course,

where students will focus on different thematic areas of disasters governance and society, using case study disasters and climate resilience from Bangladesh and all around the world.

Specific Objectives:

This course, Society and Disasters tends to provide students with critical perspectives to examine this natural disasters/society interface, to focus on natural and manmade disasters being better understood as social disasters with natural triggers, to develop an understanding how forms of social vulnerability to hazards emerge and shape subsequent situation of climate resilience, and to examine how disasters and climate change are disrupting events that can critically jolt and shape future social, economic and political outcomes in the context of governance and politics.

Number of Classes: 19

Course Contents:

Topics

Topic 1: Evolution of Human Society, Civilization and Disaster, Agricultural Revolution, Industrial Revolution.

Topic 2: Social Sciences Issues of Disaster: Social Structure, Institution, Change, Problems, Control, Legislation, Stratification etc.; Unequal Distribution of Resources and Opportunities, Role and Status Conflict; Gender and Social Disparity.

Topic 3: Social Philosophy of Disaster Management: Human Rights and Social Justice Perspectives as Indicated in different National and International Conventions; The Constitution of Bangladesh; NGO, Civil Society and Corporate Social Responsibilities. Ethical Considerations in Disaster.

In-Course-1

Topic 4: Social Protection for Community Resilience: Resource Mobilization and Resilience, Social Security and Safety Net Programs (Case Study: Bangladesh and Southeast Asia), Interventions of Family, Neighbors, Kin, Community and Religion. Local Government, Voluntarism.

Topic 5: Role of Media in Disaster.

Topic 6: Bangladesh Studies: Evolution of Bangladeshi Society, Natural and Human Resources of Bangladesh, Government and Politics, Settlements (Urban and Rural).

Topic 7: Community Responses to Disaster: Disaster Recovery and Community Change, Victim and Non-Victim Responses to Disaster.

In-Course-2

Topic 8: Disaster Mythology and Sources of Disaster Myths in Society (Bangladesh Perspective).

Topic 9: Socio-Political context of Disasters: Understanding Vulnerability and Risk from a Social and Political Perspective: Developed and Developing Nations; Poverty. Key Stakeholders, Interests and Activities. Climate Change and Urbanization, Understanding Vulnerable Groups from a Social and Political Perspective: Discussion of Age, Gender, Social Capital and Ethnicity.

Topic 10: Framing Disasters and Resilience from a Social and Political Perspective.

Learning Outcomes:

By the end of the module students will be able to:

- Understand and critically evaluate the natural disasters/society interface.
- Analyze the key concepts and terminology commonly used in climate resilience.
- Explain the main principles and values of the social philosophy of disaster management.
- Explore and critically evaluate the demographic issues and how it works, especially in disasters/society context.
- Be familiar with and critically evaluate the roles and responsibilities of the policy makers.
- Use the Psycho-Social Interventions of disasters in their work.
- Apply the needs of proper disaster management from different societal perspectives.

- Explore and critically evaluate different approaches, in order to apply 'best practice' in terms of possible response/s to climate resilience.

Instructional Strategies:

Visual aids like Multimedia will be used to present lectures. All the materials will be provided in soft copies or hard copies. Soft copies will be provided through a common group email account. Teaching methods will be: lectures, group discussion, exercises, case studies, assignments and presentations. The techniques of experiential learning like role play, question and answer sessions, practical research and report writing will be used to increase participation. Students are expected to be enthusiastically involved in the classroom activities. In addition, problem solving and on-line discussions will be highly appreciated.

Assessment:

Formative (30%): In course Examination/Assignment
Summative (70%): Course Final Examination

References:

1. Anthony G. (2013) Sociology, Polity Press, UK
2. Bankoff G. (2004) Cultures of Disaster: Society and Natural Hazard in the Philippines. Routledge. US.
3. Barker R.L. (2008) The Social Work Dictionary. NASW Press. US.
4. Engels F. (2000) The Origin of the Family, Private Property and the State
5. Kottak (2014) Introductory Anthropology
6. Moran E.F. (2010) Environmental Social Science: Human Environment Interactions and Sustainability. Wiley-Blackwell. US.
7. Sapir D.G. and Santos I. (2013) The Economic Impacts of Natural Disasters. Oxford University Press. UK.
8. Shafie H. (2009) Endowed Wisdom: Knowledge of Nature and Coping with Disaster in Bangladesh. CDMP. Dhaka.
9. Fischer, Henry W., III. 1998. Response to Disaster: Fact Versus Fiction and It's Perpetuation. Lanham, Maryland: University Press of America, Inc.
10. Oliver-Smith, Anthony. 1999. The Angry Earth: Disaster in Anthropological Perspective edited by Anthony Oliver-Smith and Susanna M. Hoffman. New York: Routledge.

Course Number and Title: DSCRHT 111 Applied Linear Algebra

Credit: 02

Introduction to the Course:

This course study will provide knowledge of the linear domain, nature of liner problem, a different method of solving linear problems.

Specific Objectives:

The specific objectives of this course are to use mathematically correct language and notation for Linear Algebra, to become computational proficient involving procedures in Linear Algebra, to understand the axiomatic structure of a modern mathematical subject and learn to construct simple proofs, and to solve problems that apply Linear Algebra to Physics, Economics, and Engineering including Disaster Science and Climate Resilience.

Number of Classes: 19

Course Contents:

Topics

Topic 1: Matrices and Determinants: Review of matrix and determinants, different types of matrices, elementary row and column operations, and row-reduced echelon matrices, the method for finding the inverse of the matrix.

Topic 2: System of Linear Equations: System of linear equations (homogeneous and non-homogeneous) and their solutions, application of matrices and determinants for solving system of linear equations, Gaussian and Gauss-Jordan eliminations, applications of linear systems: Network analysis (traffic flow), electrical circuits.

In-Course-1

Topic 3: Vector Spaces: Real vector space, subspace, sum and direct sum of subspaces, linear independence and dependence, basis, dimension, solution space and null space, row space, column space, and null space, rank, and nullity.

Topic 4: Linear Transformations: Linear transformation from Rn to Rm, properties of linear transformations, matrix representation of linear transformations.

In-Course-2

Topic 5: Eigenvalues and Eigenvectors: Definition of eigenvalues and eigenvectors, diagonalization. Cayley- Hamilton theorem, applications of Eigenvalues and Eigenvectors.

Learning Outcomes:

Upon successful completion of this course, students will:

- Solve systems of linear equations using multiple methods, including Gaussian elimination and matrix inversion.
- Carry out matrix operations, including inverses and determinants.
- Demonstrate understanding of the concepts of vector space and subspace.
- Demonstrate understanding of linear independence, span, and basis.
- Determine eigenvalues and eigenvectors and solve eigenvalue problems.
- Apply principles of matrix algebra to linear transformations.
- Demonstrate understanding of inner products and associated norms.

Instructional Strategies:

Visual aids like multimedia alongside whiteboard writings will be used to give lectures. Teaching methods will be lectures, group discussions, exercises, case studies, assignments, and presentations. The techniques of experiential learning like role-playing, question and answer sessions will be used to increase participation. In addition, problem-solving and hands-on field learning example is encouraged.

Assessment:

Formative (30%): In course Examination/Assignment

Summative (70%): Course Final Examination

References:

1. Anton H. and Rorres C. (2000) Linear Algebra with Applications. 8th Edition. Wiley-Blackwell. US.
2. G. and Strang, G. (1993) Introduction to linear algebra (Vol. 3). Wellesley, MA: Wellesley-Cambridge Press.
3. Greub W.H. (1967) Linear Algebra. Springer. Netherlands.
4. Singh, K. (2013) Linear algebra: step by step. OUP Oxford.
5. Ron Larson (2015), Elementary Linear Algebra, 8th Edition, CENGAGE Learning.

Course Number and Title: DSCRHT 112 Basic Statistics and Probability

Credit: 02

Introduction to the Course:

This course will begin with an overview of data types and descriptive Statistics. There will be extensive coverage of probability topics along with an introduction to discrete and continuous probability distributions. The course also includes some discussion on linear regression and estimation using confidence intervals and hypothesis testing.

Specific Objectives:

The objective of this course is to provide an understanding for the undergraduate student on statistical concepts to include measurements of location and dispersion, probability, probability distributions, sampling, estimation, hypothesis testing, regression, and correlation analysis, multiple regression and forecasting.

Number of Classes: 19

Course Contents:

Topics

Topic 1: Statistics – definition and scope: definitions of statistics - past and present, its nature and characteristics, population and sample, descriptive and inferential statistics, scope and applications of statistics, abuse of statistics, sources of statistical data, primary and secondary sources.

Topic 2: Processing of Data: measurement scales, variables, attributes, tabulation, frequency distribution, graphical presentation of data, details of different types of graphs and charts with their relative merits and demerits, stem-and-leaf plot.

Topic 3: Characteristics of Statistical Data: measures of location, central tendency and their types, dispersion, skewness, kurtosis and their properties, moments, box-and-whiskers plots.

In-Course-1

Topic 4: Basic Concepts of Probability: different approaches of defining probability – classical, axiomatic, empirical and subjective, laws and theorems of probability, conditional probability, Bayes' theorem and its uses and importance in statistics.

Topic 5: Random Variable and its Probability Distribution: discrete and continuous random variables, probability mass function, probability density function, distribution function, function of random variable and its distribution, joint distribution, marginal and conditional distributions, independence of random variables, detailed study of binomial, Poisson and normal distribution.

In-Course-2

Topic 6: Correlation and Regression Analysis: bivariate data scatter diagram, simple correlation, Pearson's correlation coefficient, basic concept of regression, regression model, estimation of parameters (OLS method) in regression model.

Learning Outcomes:

By completing this course the student will learn to perform the following:

- How to calculate and apply measures of location and measures of dispersion -- grouped and ungrouped data cases.
- How to apply discrete and continuous probability distributions to various business problems.
- Perform Test of Hypothesis as well as calculate confidence interval for a population parameter for single sample and two sample cases. Understand the concept of p-values.
- Learn non-parametric test such as the Chi-Square test for Independence as well as Goodness of Fit.
- Compute and interpret the results of Bivariate and Multivariate Regression and Correlation Analysis.

Instructional Strategies:

Visual aids like Multimedia alongside whiteboard writings will be used to present lectures. All the materials will be provided. Teaching methods will be: lectures, group discussion, exercises, assignments and presentations.

Assessment:

Formative (30%): Incourse Examination/Assignment /Presentation

Summative (70%): Course Final Examination

References:

1. Islam M.N. 2010. An Introduction to Statistics and Probability. Book World. Bangladesh.

2. Davis C.J (2002) Statistics and Data Analysis in Geology, Wiley and Sons
3. Newbold P., Carlson W. and Thorne B. (2012) Statistics for Business and Economics. 8th Edition. Prentice-Hall. US.
4. Ross S.M. (2008) A First Course in Probability. 8th Edition. Pearson. US.
5. Roy M.K. (2004) Fundamentals of Probability and Probability Distribution. Romax Publications. Bangladesh
6. Roy M.K. and Paul J.C. (2012). Business Statistics. First Edition. Dhaka

Course Number and Title: DSCRHL 113 Earth Materials Lab
Credit: 02
Introduction to the Course:
The course offers specimen study minerals, rocks, and soils which are the building blocks of the crust. The study of these materials not only play a vital role in interpreting the geological history of the Earth but also empowers the student to identify these in nature which can be used to assess further environmental issues, potential hazard scenarios. The course builds on the theory course DSCRHT-107.
Specific Objectives:
The course offers the visual study of the physical properties of minerals and rocks. Identification of minerals and rocks are in hand specimens using their diagnostic properties. These allow the students to understand the hazards that may occur due to certain physical or chemical property of rocks. The course also help to better understand soil profiles through hands on investigations.
Contact Hour: 42 Hours
Course Contents:
Topics
Topic 1: Hand specimen study of rock forming minerals.
Topic 2: Hand-specimen study of common Igneous, Metamorphic and Sedimentary rocks
Topic 3: Soil Profiles.
Learning Outcomes:
The hands on study of the earth materials will allow the student to
- Develop higher order of cognitive learning through visual study of the properties of the hand specimen. Also, the course will allow the students to identify these materials using their characteristic properties.
- The course will allow the psychomotor learning of through different tests to identify the properties of the materials.
- The practical approach towards studying properties of earth materials also plays a big impact in affective domain of educational activities.

Instructional Strategies:
Lecture; Presentation; Hands-on study; Investigation of property and identification of unknown specimens.
Assessment:
Formative (40%): Attendance, Laboratory work, Submission of assignment/Lab notebook
Summative (60%): Practical Examination
References:
1. Berry L.G. and Mason B. (1968) Elements of Mineralogy. W.F. Freeman. US.
2. Berry L.G., Mason B. and Dietrich R. V. (1983) Mineralogy: Concepts, Descriptions and Determinations. W.F. Freeman. US.

3. Pettijohn F.J. (1983) Sedimentary Rocks. 3rd Edition. Harpercollins. UK.
4. Read H.H. (1962) Rutley's Elements of Mineralogy. Thomas Murby and Co. UK.
5. Tyrrell G.W. (1973). The Principles of Petrology. Wiley-Blackwell. US.

Course Number and Title: DSCRHF 114 Field Work
Credit: 02
Introduction to the Course:
Fieldwork provides an 'unparalleled opportunity' to study the real world. It reinforces classroom based learning; and triggers all three domains of the educational learning. The fieldwork allows a higher order of cognitive learning, directly develops the psychomotor learning and inspires affective learning. Field studies require integration of content knowledge, observation and interpretation, analysis, experiment and theory and all their representations. All lines of evidence need to come together to form a coherent, internally consistent interpretation. Practices that are emphasized in the field instruction such as question-asking, observation, representation, and communication are important to the formative training of the students. This course mainly comprises of field activities complimented by theory classes. The fieldwork is carried out in a hilly terrain, usually Jaintiapur-Tamabil, Sylhet for 3-5 days where the student grasp the concept of field study and use their knowledge to conduct the fieldwork, interpret the data, determine the regional structures, mapping, depositional sedimentary environment, stratigraphy, social surveying, identification of hazard and environmental problems.
Specific Objectives:
The main objective of this course is to introduce the students to the concept of fieldwork; how to conduct the research work collecting and analyzing the data recorded and registered in the field as well as the natural environmental system encompassing the geological and geographical phenomena and how to document them in the form of systematic report writing. Students are to learn the basic geological and geographical field methods, procedures of field measurements, recording and preservation of data for further analysis. The students will also learn to investigate the structure and lithology in order to understand the geological environments and tectonics that played a part in developing the area and produce a geological map. In addition, students will also develop the capacity to identify hazards and environmental problems of the study area and also practically apply sociological tools learnt so far in order to collect data.
Course Contents:
Topics

Topic 1:	Preparation for field work: Theory classes, Expectations and reality in the field, methodology and equipment usage, base maps preparation, field code of conduct, formation of field groups and field committees.
Topic 2:	During the field work: field observation, documentation, and mapping, Mapping exercises, field note writing, summarize and plot field data on the map daily
Topic 3:	After the Field: Instructions on report writing, completion of the geological map, and construction of geological cross section showing large-scale geological structures; writing field report

Learning Outcome
- Concept of Fieldwork, Learn different Field methods, Using field instruments,
- Determination of the attitude of beds, Identification of the regional structure
- Lithology characterization; Learn to interpret of Sedimentary Structures to identify for
- Sedimentary Depositional Environment
- Understand formational process of the study area as well as the Bengal Basin

- Creation of a geological map using the collected data
- Identification of different geomorphic features
- Application of the social surveying tools
- Identification of hazards from the field observations
- Interpretation of the field data
- Integration of different field components; creation of a comprehensive report

Instructional Strategies:

The theoretical part of the courses conducted in two parts: firstly through presentations just before the fieldwork and secondly during the fieldwork through lectures, Question asking, discussions. The teaching method for theory part of the course is lectures, exercises, assignments, and presentations. The faculty members will provide the materials. For the fieldwork, the students are divided into groups in order to develop team rapport. However, students are to document the data and prepare the report individually. Students are to collect the data at different stations through observation and field equipment. Field subcomponents are conducted simultaneously for each station within the study area. A base map, provided by the department, is to be used to create a geological map. Each student is to submit a comprehensive report after the completion of the fieldwork.

Assessment:

Formative (40%): Attendance, Laboratory work, Submission of assignment/Lab notebook
Summative (60%): Practical Examination

Reference:

1. Black J.A. and Champion D.J. (1976) Methods and Issues in Social Research. Wiley-Blackwell. US.
2. Compton R.R. (1962) Manual of Field Geology. Wiley-Blackwell. US.
3. Low J.W. (1957) Geological Field Methods. Harper. US.
4. May T. and Williams M. (1996) An Introduction to the Philosophy of Social Research. UCL Press. UK.
5. Moser C.A. and Kalton G. (1971) Survey Methods in Social Investigation. 2nd Edition. Heinemann Educational. UK.

Course Number and Title: DSCRHT 201 Applied Differential Equation

Credit: 03

Introduction to the Course:

In the sciences and engineering, mathematical models are developed to aid in the understanding of physical phenomena. These models often yield an equation that contains some derivatives of an unknown function. Such an equation is called a differential equation. Therefore, to understand and to investigate problems involving the motion of fluids, the flow of current in electric circuits, the dissipation of heat in solid objects, the propagation and detection of seismic waves, or the increase or decrease of populations, among many others, it is necessary to know something about differential equations. That is why, from the early days of the calculus the subject of differential equations has been an area of great theoretical research and practical applications, and it continues to be so in our day.

Specific Objectives:

The course is designed to serve the needs of a one semester course in basic theory as well as applications of differential equations. Usually, introductory differential equations courses are taken by students who have successfully completed a first-year calculus course. In this course, students will study first order and selected higher order differential equations with their applications. Through the identification of different types of ordinary differential equations and select and apply appropriate methods to solve them , the course will become a cohesive whole rather than a collection of unrelated topics.

Number of Classes: 28

Course Contents:

Topics

Topic 1: Ordinary Differential Equations and Their Solutions: Order and degree of an ordinary differential equation, classification of differential equations, solutions of differential equations, formation of differential equations, Initial value problems, Boundary value problems (definitions and examples), Basic existence and uniqueness theorems (statement and illustration).

Topic 2: Solution of First Order Equations: Separable equations, homogenous equations, exact differential equations, linear and Bernoulli equations, Special integrating factors, Substitutions and transformations, modeling with 1st order differential equations

In-course-1

Topic 3: Solution of Higher Order Linear Differential Equations: Basic theory of linear differential equations, reduction of order, homogeneous linear equations with constant coefficients, Non homogeneous equations (method of undetermined coefficients, variation of parameters, Cauchy-Euler differential equations).

Topic 4: Systems of Linear Differential Equations: Homogeneous and non-homogeneous systems of linear differential equations with constant coefficients

Learning Outcomes:

By the end of the course students will know how to create and analyze mathematical models using first order and higher order differential equations.

Instructional Strategies:

Visual aids like Multimedia alongside whiteboard writings will be used to present lectures. All the materials will be provided. Teaching methods will be: lectures, group discussion, exercises, case studies, assignments and presentations. The techniques of experiential learning like role play, question and answer sessions, practical research and report writing will be used to increase participation. In addition, problem solving and hands on field learning is encouraged.

Assessment:

Formative (30%): Incourse Examination/Assignment /Presentation

Summative (70%): Course Final Examination

References:

1. Zill D.G. (2009) A First Course in Differential Equations with Applications. 9th Edition. Cengage Learning. India.
2. Bronson, R., and Costa, G. B. (2014). Schaum's outline of differential equations. McGraw-Hill Education.

Course Number and Title: DSCRHT 202 Geological and Hydro-meteorological Hazards

Credit and Credit Hours: 02

Introduction to the Course:

Among the different types of disaster, the geological and hydro-meteorological hazards are the most commonly occurring as well as most devastating in terms of damage and loss. Climate change has further deteriorated the situation causing an increase in the amplitude for the hazards. The course has been designed to better understand the basic characteristics of these hazards; frequency, magnitude and intensity variability, types, spatial and temporal distribution, impacts etc. After the completion of the course, the student will be able to identify; characterize and analyze these hazards. The assessment of hazard is an essential component for risk assessment, and consequent sustainable disaster risk reduction measures. Hence, the course addresses different aspects of the earthquake, landslide, subsidence, flood, tsunami, erosion etc. Due to the geographic location, tectonic settings the above-mentioned

hazards pose serious threat; this course briefly incorporates the present status of these hazards in different parts of Bangladesh.

Specific Objectives:

A student is expected to learn the basics of specific geological and hydrometeorological hazard, hazard characterization and profiling, process, procedures and assumptions used for hazard analysis. Understanding, analyzing, evaluating and creating connects between the hazards in terms of magnitude, intensity and frequency shall allow a student to better understand the disaster risk framework.

Number of Classes: 19

Course Contents:

Topics	
Topic 1:	Introduction to Geological and Hydro-meteorological Hazards.
Topic 2:	Earthquakes: concept, causes, characteristics, relation to geology, types and effects of Earthquakes
Topic 3:	Volcanoes: concept, origin, types of volcano, volcanic eruption types and products, different volcanic hazards
Topic 4:	Tsunami: concept, tsunami generation, characteristics, Seiches, coastal effects and vulnerability
	In-Course-1
Topic 5:	Landslide, Avalanche: causes, mechanism, classification, measurement and effects
Topic 6:	Land subsidence and sinkholes
Topic 7:	Flood: definition, hazard characteristics, causes, types, mitigation measures (structural and non-structural), Flood Action Plan (FAP)
Topic 8:	Riverbank erosion: causes and effects, mechanism, types and relation to lithology, mitigation measures, early warning
	In-Course-2
Topic 9:	Coastal erosion and storm surge: coastal geomorphic features, beach erosion and replenishment, storm surge characteristics
Topic 10:	Salinity intrusion: cause, mechanism, mitigation measures
Topic 11:	Arsenic contamination: concept, mechanism, mitigation measures
Topic 12:	Geological and Hydro-meteorological Hazards in Bangladesh

Learning Outcomes

By the end of the course students will be able to:

- Understand basics of specific geological and hydrometeorological hazard,
- Types, mechanism, temporal and spatial variability of these hazards
- hazard characterization and profiling, process, procedures and assumptions used for hazard analysis.
- Understanding, analyzing, evaluating and creating connects between the hazards in terms of magnitude, intensity and frequency in order to better understand the disaster risk framework.
- Correlation between hazards and tectonics, petrology and other branches of earth sciences.
- Present context of the hazards in Bangladesh

Instructional Strategies:

Visual aids like Multimedia alongside whiteboard writings will be used to present lectures. All the materials will be provided. Teaching methods will be: lectures, group discussion, exercises, case studies, assignments and presentations. The techniques of experiential

learning like role play, question and answer sessions, practical research and report writing will be used to increase participation. In addition, problem solving and hands on learning is encouraged.

Assessment:

Formative (30%): Incourse Examination/Assignment /Presentation

Summative (70%): Course Final Examination

References:

1. Hyndman D. and Hyndman D. 2010. Natural Hazards and Disasters. 3rd Edition. Cengage Learning. India.
2. Bell F.G. (1999) Geological Hazards. CRC Press. US.
3. Bird E. (2008) Coastal Geomorphology. 2nd Edition. Wiley-Blackwell. US.
4. Kusky T.M. (2005) Encyclopedia of Earth Sciences. Infobase Publishing. New York. US.
5. Lutgens F.K. and Tarbuck E.J. (2013) Earth: An Introduction to Physical Geology. 11th Edition. Pearson. USA.
6. Plummer C., Carlson D. and Hammersley L. (2014) Physical Geology. 15th Edition. McGraw Hill. US.

Course Number and Title: DSCRHT 203 Climatic Hazards and Climate Change

Credit: 02

Introduction to the Course:

In the course "Basics of Climatology and Meteorology" students get the basic ideas about atmospheric processes that determine weather and climate. In this course student will use their knowledge from "Basics of Climatology and Meteorology" to learn the causes, description, distribution of different climatic/hazards elaborately. Student will also learn climate change: causes, evidences, impact, response as well as global political issues regarding climate change.

Specific Objectives: To learn atmospheric extremes and climate change issues.

Number of Classes: 19

Course Contents:

Topics

Topic 1: Climatic and Meteorological Hazards: origin, life cycle, types, effects and measurement: extreme temperature, drought, fog, polar vortex, wildfire (forest fire and land fire), tropical cyclone, extra-tropical cyclone, local severe storms: thunderstorms, nor'westers, tornadoes.

Topic 2: Climatic and Meteorological Data Source (National and International): Bangladesh Meteorological Department (BMD) and Bangladesh Space Research and Remote Sensing Organization (SPARRSO), WMO, etc.

In-Course-1

Topic 3: Introduction to climate change: definition, scope, multidisciplinary approaches

Topic 4: Science of Climate Change: milankovitch cycle, natural and anthropogenic factors, greenhouse gases (GHG) and greenhouse effects

Topic 5: Evidence of climate change: past (proxy data), present (human perception, marker species, instrumental data), future (climate modeling)

Topic 6: Global Atmospheric and oceanic circulation: general circulation model, El-Nino and La-Nina and climate change

Topic 7: Impact of Climate Change: sector issues in regional and international context (agriculture, energy budget, society and culture, indigenous people, disease, extreme events and climatic hazards, sea-level change, climatic induced international migration etc)

In-Course-2

Topic 8: Response to climate change: adaptation and mitigation measures, loss and damage issue in global climate change dialogue, climate change and green recovery

Topic 9: National, Regional and International Response to Climate Change: International Treaties, Protocols, IPCC, and UNFCCC (COP: historical development, success and failure),

Topic 10: Climate Change and Climate Politics: grouping among countries (Annex I, Annex II, Non- Annex, OECD, EIT, AOSIS, LDC, etc), Clean Development Mechanism (CDM), carbon trading, national and individuals interest, climate ethics and justice

Topic 11: Climate Change in the Context of Bangladesh: Climate Change and Bangladesh, Bangladesh Climate Change Strategic and Action plan, National Adaptation Program of Action (NAPA), Climate Fund Use and Misuse : National and International (BCCTF: Bangladesh Climate Change Trust Fund, BCCRF: Bangladesh Climate Change Resilient Fund)

Learning Outcomes:

- What are the atmospheric extremes
- Causes, structure, distribution of the atmospheric extremes
- Causes, evidences, impact, response as well as global political issues regarding climate change.
- Causes, structure, distribution of the atmospheric extremes and climate change issues of Bangladesh

Instructional Strategies:

Visual aids like Multimedia will be used to present lectures. All the materials will be provided in soft copies or hard copies. Soft copies will be provided through common group email account. Teaching methods will be: lectures, group discussion, exercises, case studies, assignments and presentations. The techniques of experiential learning like role play, question and answer sessions, practical research and report writing will be used to increase participation. Students are expected to be enthusiastically involved in the classroom activities. In addition, problem solving, and on-line discussions will be highly appreciated.

Assessment:

Formative (30%): Incourse Examination/Assignment /Presentation
Summative (70%): Course Final Examination

References:

1. Asian Development Bank (ADB) (1994) Climate Change in Asia: Bangladesh Country Report. Manila. Philippines.
2. Bankoff G., Frerks G.and Hilhorst D. (2004) Mapping Vulnerability: Disasters, Development, and People. Earthscan. UK.
3. Barrie Pittock (2009) Climate Change: the science, impacts and solutions, CSIRO Publishing.
4. Cook, K.H. (2013) Climate Dynamics. Princeton University Press.
5. Donner L., Schubert W.andSomerville R. 2011. The Development of Atmospheric General Circulation Models: Complexity, Synthesis and Computation. Cambridge University Press. UK.
6. Erda L., Bolhofer W.C., et al. (1996) Climate Change Vulnerability and Adaptation in Asia and the Pacific. Springer. Netherlands.
7. Farmer G.T. and Cook J. (2013). Climate Change Science: A Modern Synthesis. Springer. Netherlands.
8. Hyndman D. and Hyndman D. (2010). Natural Hazards and Disasters. 3rd Edition. Cengage Learning. India.
9. Knight C.G. and Jäger J. 2009. Integrated Regional Assessment of Global Climate Change. Cambridge University Press. UK.
10. O'Neil B.C. et al (2001) Population and Climate Change. Cambridge University Press.
11. Pittock A. 2009. Climate Change: The Science, Impacts and Solution. 2nd Edition. Routledge. US.

12. Savindra Singh (2005). Climatology. Prayag Pustak Bhawan, Allahabad, India
13. Willium James Burroughs (2007) Climate Change-A Multi-disciplinary Approach, Cambridge University Press

Course Number and Title: DSCRHT 204 Anthropogenic Hazards
Credit: 02
Introduction to the Course: Human induced hazards are growing in recent industrialized and urban settlement especially in Bangladesh. This course mainly deals with hazards in industry due to natural and human activity.
Specific Objectives: This course will expand student's knowledge of human induced, engineering failure and natural hazards.
Number of Classes: 19
Course Contents:
Topics

Topic 1:	Human-induced hazards: concept, characteristics, hybrid disaster, hazard classification, (FEMA and UNDRR)
Topic 2:	Engineering failure: cause, effect, creep and fatigue, case studies
Topic 3:	Fire hazard: concept and terminologies, fire triangle, classification, control measures, fire extinguishment- detection, extinguisher types, fire precaution, risk assessment (regular and industrial)
Topic 4:	Reactive and toxic chemicals, compressed gasses: reactive chemical hazard types, Toxic and reactive hazards from mixtures, oxidizing agents, explosive chemicals, General principles for storage, hazards arising in chemicals processing, chemical reactions and hazard ratings, chemical explosion
	In-Course-1
Topic 5:	Nuclear hazard: concept, reactions, radioactive chemicals, sources of radiation, mitigation and control measures, Ruppur power plant and case studies
Topic 6:	Mining hazard and blowout: cause, type, effect, case studies
Topic 7:	Civil unrest, terrorism and war: cause, factors, types, motivations, effects, refugee and humanitarian crisis, case studies
	In-Course-2
Topic 8:	Transportation accident: types, causes and their effects.
Topic 9:	Environmental Pollution, Hazardous Wastes, Reuse, Recycling, Resource Recovery
Topic 10:	Industrial hazards, Work place health and safety
Topic 11:	Cyberattack/ cyberterrorism
Topic 12:	World's Worst Manmade and Technological Hazards: Beirut explosion (2020), Bhopal Gas Tragedy (1985), Chernobyl Tragedy, Fukushima Meltdown, The Gulf of Mexico Blowout, The Love Canal Tragedy, Exxon Valdez Oil Spill, Twin tower collapse, Banqiao dam failure, Rana Plaza tragedy, Nimtoli tragedy, Syria Chemical Weapons etc.
Topic 13:	Manmade Hazards: Bangladesh Context (Rana Plaza Event), Addressed Part in National Policies, Policy implications

Learning Outcomes:
By the end of the course students will be able to:
- Differentiate between natural hazards and manmade hazards.
- Explain engineering and mechanical reasons behind the engineering failure, chemical explosion, nuclear hazards, mine hazards etc.
- Explain reasons behind civil unrest and its consequences
- Fire safety and possible risk associated with it

- Assess industrial safety and potential risk, terrorist activity and their causes including geo politics, socio economic, cultural influences.

Instructional Strategies:

Visual aids like Multimedia will be used to present lectures. All the materials will be provided in soft copies or hard copies. Soft copies will be provided through common group email account. Teaching methods will be: lectures, group discussion, exercises, case studies, assignments and presentations. The techniques of experiential learning like role play, question and answer sessions, practical research and report writing will be used to increase participation. Students are expected to be enthusiastically involved in the classroom activities. In addition, problem solving and on-line discussions will be highly appreciated.

Assessment:

Formative (30%): Incourse Examination/Assignment /Presentation
Summative (70%): Course Final Examination

References:

1. Carson P. and Mumford C. (1994) Hazardous Chemicals Handbook. Butterworth-Heinemann. Oxford. UK.
2. Davamani V. (2012) Technologies for Sustainable Green Environment. NIPA. India.
3. Dickenson et al (1999) Fire Service Emergency Care, Prentice Hall
4. Kevin Cassedy (1953) Fire Safety and Loss prevention, BH Publication
5. Jeremy Stranks (2012) Health and Safety at Work, Kogan Page
6. Macaulay T. (2008) Critical Infrastructure: Understanding its Component Parts, Vulnerabilities, Operating Risks, and Interdependencies. CRC Press. US.
7. Paul B.K. (2011) Environmental Hazards and Disasters. Wiley-Blackwell. US.
8. Schlager N. (1995) Breakdown: Deadly Technological Disasters. McGraw-Hill. US.
9. Shah V. (2009) Emerging Environmental Technologies. Springer. Netherlands.
10. King, R. W., and Magid, J. (2013). Industrial Hazard and Safety Handbook: (Revised Impression). Elsevier.

Course Number and Title: DSCRHT 205 Climate Resilience and Public Health
Credit: 03

Introduction to the Course:

This course encompasses climate resilience and public health. Identification, personal protective equipment, symptoms of exposure and abatement of biological hazards are covered in great detail in this course. This course is intended to familiarize students with a wide range of biological hazards that may be encountered in community- and work environments, including commercial, nonindustrial, industrial and health care settings. Also, this course is designed to provide an overview of public health and from the perspective of climate resilience covering topics such as the legal basis and history of public health, public health structure, communications and interactions, and epidemiology. Emphasis will be placed on the role of the public health core functions, its role in policy development, infectious disease, climate resilience issues, emergency preparedness, global issues, and public health research.

Specific Objectives:

This course, Climate Resilience and Public Health tends to provide the basic concepts, types and causes behind biological hazards; to apply the concepts of bio/medical-safety and risk assessment to analyze some practical problems of human epidemics in the context of climate change; to select relevant knowledge elements obtain solutions for some common problems towards control and monitor of public health, which is relevant in climate resilience; and to demonstrate reflective practice in the areas of public health.

Number of Classes: 28

Course Contents:

Topics

Topic 1: Biological hazards and its impact on climate and health.
Topic 2: Public health and climate change.
Topic 3: Epidemiology and climate resilience.

In-Course-1

Topic 4: Environmental epidemiology and impact of climate change on health.
Topic 5: Public health and its role in disaster management: an integrated approach (COVID-19 situation as case study).
Topic 6: Epidemiological approach of public health.
Topic 7: Psychosocial needs and stress management in mass emergency and disaster management.

In-Course-2

Topic 8: Management of water-borne and vector-borne diseases.
Topic 9: Health policy and management: public health surveillance, public health emergencies.
Topic 10: Child-Centered health adaptation for climate resilience.
Topic 11: One World, One Health Approach: concept, components and its importance

Learning Outcomes:

By the end of the module students will be able to:

- Outline the biological agent risk groups.
- Identify ways in which community people are exposed to biological agents leading to epidemics in different environments.
- Recognize the types of health effects of climate change.
- Describe how to carry out risk assessment in the public health and climate resilience context.
- Analyze the measures used to safeguard public health practices during emergencies in large populations.

Instructional Strategies:

Visual aids like Multimedia will be used to present lectures. All the materials will be provided in soft copies or hard copies. Soft copies will be provided through common group email account. Teaching methods will be: lectures, group discussion, exercises, case studies, assignments and presentations. The techniques of experiential learning like role play, question and answer sessions, practical research and report writing will be used to increase participation. Students are expected to be enthusiastically involved in the classroom activities. In addition, problem solving and on-line discussions will be highly appreciated.

Assessment:

Formative (30%): In course Examination/Assignment /Presentation
Summative (70%): Course Final Examination

References:

1. Aschengrau, A., and Seage, G. (2018). Essentials of Epidemiology in Public Health. Jones and Bartlett Learning.
2. Fallon, L., Fleming, J. F., and Zgodzinski, E. (2012). Essentials of Public Health Management. Jones and Bartlett Learning.
3. Filho, W. L., Azeiteiro, U., and Alves, F. (2016). Climate Change and Health. Springer International Publishing.
4. Levy, B., and Patz, J. (2015). Climate Change and Public Health. Oxford University Press.
5. Noji E.K. (1996) The Public Health Consequences of Disasters. Oxford University press.
6. Schneider, M. J. (2020). Introduction to Public Health. Jones and Bartlett Learning.
7. Seabert, D., McKenzie, J., and Pinger, R. (2021). McKenzie's An Introduction to Community and Public Health. Jones and Bartlett Learning.

8. Somerville, M., Kumaran, K., and Anderson, R. (2016). Public Health and Epidemiology at a Glance. Wiley-Blackwell.

Course Number and Title: DSCRHT 206 Built Environment
Credit: 02
Introduction to the Course:
This course highlights the overall concept of the built environment and the impacts of natural and man-made disasters on it. The contents of the course include prevailing rules and regulations to build a resilient built environment. The course will explore the role of the construction industry in post-disaster reconstruction and making the built environment more resilient by applying the concept of build back better.
Specific Objectives:
This course enables students to learn about built environment and its components and to create a built environment that is not vulnerable to a disaster.
Number of Classes: 19
Course Contents:

Topics	
Topic 1:	Built Environment: Introduction and its components.
Topic 2:	Structural forms and systems for buildings, bridges, communication and transmission structures.
Topic 3:	Types of construction materials - steel, reinforced and prestressed concrete etc.
	In-Course-1
Topic 4:	Physical and chemical properties of built materials.
Topic 5:	Loads on structures; structural dynamics; types of foundation, concept of bearing capacity, settlement
Topic 6:	Impact of Built Environment on Health, sustainable design, towards environment-friendly built environment
	In-Course-2
Topic 7:	Concept on building code, general building requirements, control and regulations; structural design; construction practice and safety; building services; Alteration, Addition and Change of Existing Building Codes.
Topic 8:	Building Construction Considering Energy Efficiency and Safety

Learning Outcomes:
By the end of the course students will be able to learn:
- Understand the built environment and its components.
- Know the properties of engineering materials
- Evaluate the different types of loads imposed on a structure.
- Apply the BNBC in designing and building the infrastructures to make it resilient
- Incorporate the safety and security issues in the built environment and how to apply build back better concept.

Instructional Strategies:
Visual aids like multimedia alongside whiteboard writings will be used to give lectures. Teaching methods will be lectures, group discussions, exercises, case studies, assignments, and presentations. The techniques of experiential learning like role-playing, question and answer sessions will be used to increase participation. In addition, problem-solving and hands-on field learning example is encouraged.
Assessment:
Formative (30%): Incourse Examination/Assignment /Presentation
Summative (70%): Course Final Examination
References:
1. Bangladesh Housing and Building Research Institute. 1993. Bangladesh National

Building Code.
2. Chan A.P.C. and Cheung E. 2014. Public Private Partnership in International Construction. Taylor and Francis Group. US.
3. Douglas J. and Ransom B. 2013. Understanding Building Failures. 4th Edition. Taylor and Francis. US.
4. Johnston S.A., Nicholas S.S. and Parzeen J. 2013. The Guide to Greening Cities. 2nd Edition. Island Press. US.
5. Punmia B.C., Jain A.K. andJain A.K. 2005. Comprehensives Basic Civil Engineering. Laxmi Publications. India.
6. Tymkow P., et al. 2013. Building Services Design for Energy Efficient Buildings. Routledge. UK.
7. Dowrick D.J. 2009. Earthquake Resistant Design and Risk reduction. 2nd Edition. Wiley- Blackwell. US.

Course Number and Title: DSCRHT 207 Introduction to Computer Programming
Credit: 02
Introduction to the Course:
In this course the student will gain a broad understanding of modern computer programming. The student will acquire introductory skills in problem analysis, solution design, and program construction. Through practical programming activities, the student will gain an appreciation of the nature and history of computer programming.
Specific Objectives:
- Understanding the concepts of programming language.
- Developing algorithms and computer program.
- Read, write and analyze data from external source with visualization.

Number of Classes: 19
Course Contents:

Topics	
Topic 1:	Introduction To Programming Concept: Algorithms, flowchart and pscudocode, function concept, the main function; elementary data types; different types operators and expression; statements-assignment statement, conditional statement; loop control constructs-while loop, for loop; array and pointer; data structures; command level argument passing; file I/O- input and output functions, programming.
Topic 2:	Matlab: Environment, Matrices and Operators, Functions, Toolbox, Data Types, Image and Signal Analysis.
Topic 3:	Python: Data strictures, Scripting, Math and computation, algorithm development, data acquisition, data analysis, exploration, and visualization

Learning Outcomes:
- Solve basic programming problems using a variety of skills and strategies.
- Use pseudo-code and visual modeling to prepare clear and accurate program documentation and models.
- Examine working programs to identify their structures.
- Apply appropriate techniques to create entry-level programs from models.

Instructional Strategies:
Lecture, Presentation, Hands-on Exercises, and Lab work.
Assessment:
Formative (40%): Attendance, Laboratory work, Submission of assignment/Lab notebook
Summative (60%): Practical Examination

References:

1. Harvard Shielt (1997) Teach Yourself C, Mcgraw Hill
2. Martin H. Trauth (2015) Matlab Recipe for Earth Sciences, Springer
3. The MathWorks, MathLab Simulink Student version manual (2020) - MathLab online book.

Course Number and Title: DSCRHL 208 Environmental Pollution Lab
Credit: 02
Introduction to the Course:
Pollution measurement with the lab techniques is very important for environmental impact assessment (EIA) to implement any project. This course introduces various methods and measurement techniques required to apply theoretical knowledge acquired in DSCRHT 103 (Theory) courses. This course aims to study pollution in the Bangladesh and its neighboring nations in general.
Specific Objectives:
Environmental Pollution Studies lab is concerned about determining the level and extent of contamination in air, water and soil. It also aims to determine and describe how the contamination is transported from different spheres of the Earth. It involves surveys various aspects of pollution (e.g. sources, content, and impacts). The lab course therefore involves assessment of different sites all over the country. It will helps to learn more about the health impacts associated with air, water and sound pollutants. Familiarizing with the environmental pollution laboratory kits which will make them gain a deeper understanding of air and water quality.
Contact Hour: 42 Hours
Course Contents:

Topics	
Topic 1:	Chemical and titrimetric analysis
Topic 2:	Water quality analysis: Water sampling: methods and techniques, preservation, On site water parameter measurement: pH, EC, TDS, DO, determination, classification. Arsenic, Nitrate, etc. analysis using field kits, Acidity and alkalinity determination, Carbonate, bicarbonate analysis, Hardness determination, Chloride determination and Microbial contamination assessment
Topic 3:	Soil analysis: Grain size analysis, Sample collection, processing, digestion and preparation; On site pH and EC measurement; On site nutrient and other basic parameter measurement using field kit
Topic 4:	Air and sound pollution: Noise level detection and On site air quality assessment
Topic 5:	Advanced analysis using Atomic absorption spectrometer, Ion chromatograph, spectrophotometer etc.

Learning Outcomes:
Accomplishing hands-on exercise in the pollution lab and in the field with field kits, students will be able to –

- Work with Atomic Absorption Spectrometry for water quality analysis with setting up the machine.
- Measure different types of elements with chemical reactions with simple lab kits
- Understand the ambient standards and measurements of air, water and sound pollution
- Measure different kinds of air polluting materials
- Perform different chemical test in the lab and in the field condition with hand held kits

Instructional Strategies:
Lecture, Presentation, Hands-on Exercises, Field work and Lab works

Assessment:
Formative (40%): Attendance, Laboratory work, Submission of assignment/Lab notebook
Summative (60%): Practical Examination

Reference:

1. WHO (2011). Guidelines for drinking-water quality. WHO chronicle, 38(4), 104-108.
2. Vesilind, P. A., and DiStefano, T. D. (2006). Controlling environmental pollution: An introduction to the technologies, history and ethics. DEStech Publications, Inc.
3. Peirce, J. J., Vesilind, P. A., and Weiner, R. (1998). Environmental pollution and control. Butterworth-Heinemann.
4. Rao, C. S. (2007). Environmental pollution control engineering. New Age International.
5. Alloway, B., and Ayres, D. C. (1997). Chemical principles of environmental pollution. CRC press.
6. Harrison, R. M. (Ed.). (2012). Handbook of air pollution analysis. Springer Science and Business Media.
7. Li, Y., and Migliaccio, K. (Eds.). (2010). Water quality concepts, sampling, and analyses. CRC Press.

Course Number and Title: DSCRHT 209 Seismology and Geodesy
Credit: 03
Introduction to the Course:
Earthquake is the most frequently occurring and most devastating hazard to date. Seismology deals with the scientific approach towards the study of earthquakes, the propagating elastic waves and their characteristics. Coupled with geodesy, seismology helps better understand earthquakes, their characteristics, and possible associated hazards.
Specific Objectives:
The specific objectives of this course are to understand seismicity and earthquakes, to learn the characteristics of earthquakes, to understand earthquake measurements and prediction, and finally synchronization with geodesy to understand the earthquakes.
Number of Classes: 28
Course Contents:
Topics

Topic 1: Seismicity and Earthquake: Brief history of seismology, historical and instrumental seismicity

Topic 2: Basic Seismological Theory: Waves on a string, stress and strain, seismic waves, Snell's law, plane wave reflection and transmission, surface waves, dispersion, normal modes of the earth

Topic 3: Wave Propagation: Waves in unbounded area, waves in a semi-infinite body, waves in layered body

In-Course-1

Topic 4: Seismogram and Seismographs: Introduction to seismogram and seismographs, earthquake depth calculation

Topic 5: Seismic Sources: Isotropic, double couple and CLVD

Topic 6: Focal Mechanism: Moment tensor and moment tensor inversion

Topic 7: Attenuation: Geometrical spreading, scattering, multi-pathing, anelasticity, green function; anisotropy

In-Course-2

Topic 8: Earthquake Prediction: Electromagnetic fields generated by earthquakes; paleo-seismicity, earthquake-related hydrological and geochemical changes, seismicity in and around Bangladesh

Topic 9: Seismic Sensors: Seismometers, accelerometers; sensor calibration; seismic networks and data formats

Topic 10: Geodesy: Basic concepts of geodesy, scope of geodesy, GPS: DGPS/cGPS; InSAR; GPS constellation and signals; satellite clocks and time, error sources, geodetic coordinate system, integration of datasets: seismology and geodesy

Learning Outcomes:

By the end of the course students will be able to understand:

- Seismicity and wave propagation
- Earthquake characteristics
- Earthquake mechanism
- Earthquake measurement and prediction
- Geodesy and the integration of geodesy and seismology

Instructional Strategies:

Visual aids like multimedia alongside whiteboard writings will be used to give lectures. Teaching methods will be lectures, group discussions, exercises, case studies, assignments, and presentations. The techniques of experiential learning like role-playing, question and answer sessions will be used to increase participation. In addition, problem-solving and hands-on field learning example is encouraged.

Assessment:

Formative (30%): In course Examination/Assignment /Presentation
Summative (70%): Course Final Examination

References:

1. Kramer S.L. (1996) Geotechnical Earthquake Engineering. Prentice Hall.UK.
2. Stein, S. and Wysession, M. (2009) An introduction to seismology, earthquakes, and earth structure. John Wiley and Sons.
3. Lee W.H.K. and et al. (2002) International Handbook of Earthquake and Engineering Seismology. Academic Press. UK.
4. Leon Reitter (1991) Earthquake Hazard Analysis: Issues and Insights. Columbia University Press, New York
5. Müller J.and Torge W. (2012) Geodesy. De Gruyter. Germany.
6. P. Borman (2002) New Manual on Seismological Observatory Practice. A GFZ Publication
7. Seth Stein and Michael Wyssession (2012) An Introduction to Seismology, Earthquakes and Earth Structures. Blackwell Publication
8. Smith J.R. (1997) Introduction to Geodesy: The History and Concepts of Modern Geodesy. Petersfield. UK.
9. Yeats R.S., Sieh K. and Allen C.R. (1996) The Geology of Earthquakes.Oxford University Press. UK.

Course Number and Title: DSCRHT 210 Numerical Analysis and Sampling Techniques

Credit: 02

Introduction to the Course: This course will introduce students to a wide range of statistical sampling techniques that are used to make inferences about a population. The part on numerical analysis will present a broad range of numerical methods for solving mathematical problems that arise in Science and Engineering.

Specific Objectives: The specific objectives of this course are twofold. Firstly it is to provide a deep understanding on how to implement sampling designs that are more complex than a simple random sample. And secondly, it also aims to provide a basic understanding of the derivation, analysis, and use of these numerical methods, along with a rudimentary

understanding of finite precision arithmetic and the conditioning and stability of the various problems and methods.

Number of Classes: 19

Course Contents:

Topics

Topic 1: Introduction: Basic concepts of sampling, sampling frame, sample versus census, requirements of a good sample, selection bias, measurement bias, sampling and non-sampling errors, probability and non-probability samples, types of probability samples.

Topic 2: Simple Random Sampling: Simple random sampling, estimates of population characteristics and their standard errors, confidence intervals, sampling for proportions, sample size estimation for means and proportions.

Topic 3: Systematic sampling: estimating population characteristics, systematic sampling in some special populations.

Stratified Sampling: Definition and basic ideas, theory of stratified sampling, allocating observations to strata, defining strata.

Cluster sampling with equal probabilities: Notation for cluster sampling, one-stage cluster sampling, two-stage cluster sampling, designing a cluster sample.

In-Course-1

Topic 4: Concept of Numerical Mathematics: Difference table, finite difference operators, interpolation and extrapolation.

Topic 5: Interpolation and inverse interpolation: uses of Newton's forward and backward interpolation formula; Lagrange's formula, subdivision of intervals, divided differences.

Numerical integration: Simpson's rule, Weddle's rule, trapezoidal rule, Gauss's quadratic formulae.

In-Course-2

Topic 6: Solution of transcendental equations: method of interpolation or of false position, Newton-Raphson method, method of iteration.

Learning Outcomes:

By completing this course the student will learn to perform the following:

- Students will learn when to use and how to implement sampling designs that are more complex than a simple random sample.
- They will also understand why the sampling design used to collect data determines how we choose to graph the data, estimate certain parameters, and quantify the uncertainty in these estimates with a margin of error. .
- Students will be able to choose, develop and apply the appropriate numerical techniques for their problem, interpret the results, and assess accuracy.

Instructional Strategies:

Visual aids like Multimedia alongside whiteboard writings will be used to present lectures. All the materials will be provided. Teaching methods will be: lectures, group discussion, exercises, assignments and presentations.

Assessment:

Formative (30%): Incourse Examination/Assignment /Presentation

Summative (70%): Course Final Examination

References

Texts (Sampling Techniques)

1. Cochran W.G. (1977) Sampling Techniques. 3rd Edition. Wiley-Blackwell.US.
2. IslamM.N.(2008)AnIntroductiontoSamplingMethods.BookWorlds.Bangladesh.
3. Levy P.S. and Lemeshow S. (2008) Sampling of Populations: Methods and Applications.4thEdition. Wiley-Blackwell.US.
4. Singh D. and Chaudhury F.S. (1987) Theory and Analysis of Sample Survey design.

Wiley- Blackwell.US.

Texts (Numerical Analysis)

1. Scarborough J.B. (1955) Numerical Mathematical Analysis. Johns Hopkins Press.USA.
2. Mallick S.A. and Uddin M. A. (2007) Numerical Mathematics.
3. Hildebrand F.B. (1987) Introduction to Numerical Analysis. Dover Publications.USA.

Course Number and Title: DSCRHT 211 Bangladesh Studies and Climate Resilience Approach

Credit: 02

Introduction to the Course: The course will look into the topics related to the history of Bangladesh and the evolution of the disaster management practices throughout the history. There will be comparative discussions between the approaches of colonial, post colonial and post liberation periods. It will also shed light on the administrative structure and working modalities of the government of Bangladesh.

Specific Objectives: This course has been designed to help the students in obtaining a comprehensive idea about the history, culture and heritage of Bangladesh. It will introduce students to the economy, society, politics, diplomacy and foreign policy of Bangladesh. Students will learn about the challenges and potentials of Bangladesh in shaping its peaceful and sustainable future. It will also assist the students in assessing roles and contribution of Bangladesh in the regional and international bodies which are dedicated to achieve sustainable development.

Number of Classes: 19

Course Contents:

Topics

Topic 1: History of disaster management in different periods: Early Bengal (AD 600–c.1538), The Mughal Empire (c.1550–1764), Bengal under British rule (1764–1911), The heritage, language and culture of Bangladesh.

Topic 2: Evolution of Disaster Management in post colonial period Bangladesh: Post Colonial Nationalist Resistance: Pakistan Period and the Growth of Nationalism, Relation of Disaster Management with historical evolution of Bangladesh (from specific focus on 1970s Cyclone).

Topic 3: Emergence of Bangladesh: Liberation War of 1971, Political changes in Bangladesh since 1975; the role of Bangladesh in world affairs; political development and democratic transitions in the country, evolution of disaster management approaches during the period.

In-Course-1

Topic 4: Constitution of Bangladesh: Draft, Basic Features and Amendments, aspects of disaster management in the constitution, guidelines of the constitution for the national development and resilience

Topic 5: Public Administration in Bangladesh Structure and function of the Executive, Legislature and Judiciary in Bangladesh. History of the Disaster Management Ministry and Interlinked Responsibilities of Line Ministries: Flow Diagram of Disaster Management History, Disaster Management Act and Bureau, Linked Responsibilities of 19 Line Ministries regarding DRR ,Details of SOD. Detailed Discussion on Cyclone Preparedness Programme of Bangladesh: Focused on its Organogram.

Topic 6: Development planning in Bangladesh: Disaster Management Approach in 5^{th} and 6^{th} Five Years Plan of Bangladesh, Details of Comprehensive Disaster Management Programme (CDMP) I and II.

In-Course-2

Topic 7: Components of Flood Action Plan (FAP) in Bangladesh.

Learning Outcomes:

By the end of the course students will be able to learn:

- The social system and cultural heritage of Bangladesh.
- The evolution of disaster management practices in the country.
- The challenges of colonial, postcolonial and post liberation period for disaster management.
- The administrative structure and working modalities of government.
- The development planning system for disaster management in Bangladesh.

Instructional Strategies:

Visual aids like Multimedia alongside whiteboard writings will be used to present lectures. All the materials will be provided. Teaching methods will be: lectures, group discussion, exercises, case studies, assignments and presentations. The techniques of experiential learning like role play, question and answer sessions, practical research and report writing will be used to increase participation. In addition, problem solving and hands-on field learning is encouraged.

Assessment:

Formative (30%): Incourse Examination/Assignment
Summative (70%): Course Final Examination

References:

1. Ahmad Q.K. (1994) Bangladesh: Past two Decades and the Current Decade. Dhaka: Bangladesh unnayan parishad. Bangladesh.
2. Badrul Imam (2003) Energy Resources of Bangladesh, a UGC Publication
3. Baquee A. (1998) Peopling in the Land of Allah Jaane: Power, Peopling and Environment: The Case of Char-lands of Bangladesh. University Press Limited. Dhaka.
4. Brammer H. (1997) Agricultural Development Possibilities in Bangladesh. University Press Limited. Dhaka.
5. Brammer H. (2000) Agroecological Aspects of Agricultural Research in Bangladesh. University Press Limited. Dhaka.
6. Brammer H. (2002) Land Use and Land Use Planning in Bangladesh. University Press Limited. Dhaka.
7. Choudhury G. W. (1993) The Last Days of United Pakistan. University Press Limited. Dhaka.
8. Faaland J. and Parkinson J.R. (1976) Bangladesh: The Test Case for Development. University Press Limited. Dhaka.
9. Gritzner C.F. Bangladesh: Modern World Nations. Chelsea House Publishers.US.
10. Novak J.J. (1993) Bangladesh: Reflection on the Water. University Press Limited. Dhaka.Rasheed K.B.S. (2008) Bangladesh: Resource and Environmental Profile. A. H. Development Publishing House. Dhaka

Course Number and Title: DSCRHT 212 Principles of Remote Sensing

Credit: 02

Introduction to the Course: Remote Sensing has become the ideal method for both rapid and detailed investigations. The technique allows the ability to investigate from a distance; conveniently eliminating the time required for mobilization, especially during post disaster damage and need assessment. Also, the technique allows better understanding of phenomena at a regional scale that can be difficult on field. Remote sensing can also provide reconnaissance survey for detailed field study afterwards saving time and resource.

Specific Objectives: This course has the following deliverables:

1. Understanding the principles of remote sensing
2. Learning the typology of remote sensing
3. Mechanism and processing of data
4. Application of remote sensing in disaster management

Number of Classes: 19

Course Contents:

Topics

Topic 1: Introduction; Scope; Concepts and Principles of Remote Sensing; Air- and Space-borne.

Topic 2: Electromagnetic Radiation and Its Interaction with Atmosphere and Earth Surface

Topic 3: Sensors, Sensor Types and Sensor Characteristics

In-Course-1

Topic 4: Pre-processing: Visualization and Radiometric Operation; Image Enhancement, Correction Data for Imperfection of Sensor, Atmospheric Correction

Topic 5: Visual Image Interpretation; Digital Image Classification

Topic 6: Rectification and Terrain Analysis; Georeferencing, Geocoding , DEM and DSCR

In-Course-2

Topic 7: Remote sensing application in Disaster Science Climate Resilience

Learning Outcomes:

By the end of the course students will be able to understand:

- The principles of remote sensing and different types
- Sensor mechanism and their variations
- The preprocessing, processing and post processing of the data
- Interpretation of the analysis
- Different applications in disaster management

Instructional Strategies:

Lecture; Presentation; Hands-on study; online learning, software learning

Assessment:

Formative (30%): Incourse Examination/Assignment /Presentation
Summative (70%): Course Final Examination

References:

1. Lillesand T.M., Kiefer R.W. and Chipman J.W. (2004) Remote Sensing and Image Interpretation. 5th edition. Wiley-Blackwell. US.
2. ITC (2010) A Core Book Of Geo-information Science and Earth Observation: A System based Approach.
3. Rashed T. and Jurgens C. (2010) Remote Sensing of Urban and Suburban Areas. Springer. Netherlands.
4. Weng Q. (2009) Remote Sensing GIS Integration: Theories, Methods and Applications. McGraw Hill. US.

Course Number and Title: DSCRHT 213 Geographic Information System and Database Management

Credit: 02

Introduction to the Course:

This course is for introducing the students with the state-of-the-art technology and tools called Geographic Information Systems (GIS) for spatial planning. GIS is a system for geospatial data capturing, editing, manipulating, storing, analyzing and presentation. GIS plays a major role in the field of Disaster Risk Reduction and Climate Change studies by answering the five questions – 1. Location what is at..? 2. Situation/Condition where does it

exist? 3. Trends what has changed since...? 4. Patterns what spatial patterns exist? 5. Modeling What if...?

Specific Objectives:

This course assists students to learn about Geographic Information Systems (GIS) basic and its application in the field of Disaster Management and Climate Resilience studies. This course also gives an introductory idea of spatial and non-spatial database concept.

Number of Classes: 19

Course Contents:

Topics

Topic 1: Introduction to GIS: Development of GIS, Scope

Topic 2: Data and Information: Data Type, Typology: Spatial Relationship

Topic 3: Map Projection and Coordinate System: Reference Surface for Mapping, Map Projections, Coordinate Transformations

Topic 4: Data Entry and Preparation: Data Acquisition, Digitizing from Existing Documents, Data Preparation, Map Standards and Design

Topic 5: Data Quality: Accuracy Precision

In-course-1

Topic 6: Introduction to Database Management and Database Management Systems

Topic 7: Data types, Tables, Relational Data Model

Topic 8: Query with SQL: Data fetching, inserting and manipulating

Topic 9: Entity relationship diagrams: Data models and problem solving

Topic 10: Schema conversion and Normalisation

Topic 11: Network and Network Analysis

In-course-2

Topic 12: Vector Analysis: Overlay: Intersect, Clip Overwrite; Neighborhood Operation: Buffer and Thiessen Polygon

Topic 13: Raster Analysis: Measurement: Location, Distance, Area Size, Classification, Overlay: Arithmetic Operation, Comparison Operators, Logical Operators, Conditional Expressions, Decision Tables

Topic 14: Applied Perception, Visualization, Presentation, WebGIS

Topic 15: Application of GIS in Disaster Management

Learning Outcomes:

- Understand Geographic Information Systems (GIS), Geospatial Data, Projection, Cartography
- Work with commercial and open source GIS software.
- Know what georeferencing of spatial datasets is.
- Create projection and change coordinate systems of spatial datasets.
- Create vector data by digitizing Hardcopy map / Satellite image / Google Earth, GPS survey.
- Understand data editing, topology building, data processing storing and linking spatial data with non-spatial data
- Analyze spatially for extracting new information and decision making.
- Create symbol and make map (cartography) for presentation
- What is database Table and data type?
- Apply Structured Query Language (SQL) for data fetching, inserting and manipulating.
- Apply GIS tools for disaster risk reduction / post disaster management with hazard /disaster related in-situ and satellite data.

Instructional Strategies:

Lecture, Presentation, Hands-on Exercises, and Lab work.

Assessment:

Formative (40%): Attendance, Laboratory work, Submission of assignment/Lab notebook
Summative (60%): Practical Examination

References:

1. Bonham-Carter G.F. (1991) Geographic Information Systems for Geoscientists: Modeling with GIS. Elsevier. UK.
2. Decker D. 2001. GIS Data Sources. Wiley-Blackwell. US.
3. ITC (2010) A Core Book of Geo-information Science and Earth Observation: A System based Approach.
4. Tasha W. Shelly S. (2006) A to Z GIS: An Illustrated Dictionary of Geographic Information Systems / Edition 1, RIC International

Course Number and Title: DSCRHL 214 Remote Sensing Lab
Credit: 02

Introduction to the Course: The disasters have increased multifold over the years. For a sustainable solution and carrying out risk management and crisis management activities, Understanding and accurately analyzing risk is essential. Remote sensing has become the preferred technique for both rapid and detailed assessments. It is efficient in terms of time and resource with an appreciable accuracy.

Specific Objectives: The course is designed to allow the students to use different tools and techniques for hazard identification, distribution, profiling, categorized map etc. for different hazards. The course incorporates conduction of different statistical and spatial analyses for different parameters of different hazards. The course also offers basic hazard modeling and simulation for some of the hazards.

Contact Hour: 42 Hours

Course Contents:

Topics

Topic 1: Introduction to ERDAS Imaging
Topic 2: Projection and coordinate system
Topic 3: Georeferencing
Topic 4: Preprocessing of image: composite, mosaic, atmospheric correction and image enhancement
Topic 5: Image classification: supervised, unsupervised and hybrid classification
Topic 6: Accuracy assessment
Topic 7: Change detection
Topic 8: Application of remote sensing in disaster and climate science

Learning Outcomes: The hands on study of the earth materials will allow the student to learn:

- Different remote sensing software
- Different data acquisition methods
- Data preprocessing
- Visual Image Interpretation; Digital Image Classification
- Rectification and Terrain Analysis; Georeferencing, Geocoding , DEM DSM
- Data Analysis techniques; classification, interpolation, etc.
- Data Interpretation
- Data Visualization
- Different aspects if Remote sensing application in Disaster Management

Instructional Strategies:

Lecture; Presentation; Hands-on study; online learning, software learning

Assessment:

Formative (40%): Attendance, Laboratory work, Submission of assignment/Lab notebook
Summative (60%): Practical Examination

References:

1. Leica Geosystems Geospatial Imaging. (2006). ERDAS IMAGINE: Tour Guides
2. Nayak, S., Zlatanova, S. (Eds.). (2008). Remote sensing and GIS technologies for monitoring and prediction of disasters. Springer Science Business Media.

Course Number and Title: DSCRHL 215 GIS Lab
Credit: 02
Introduction to the Course:
Geographical Information System (GIS) is very important to understand the spatial distribution. This course includes tools and techniques required to apply theoretical knowledge acquired in DSCRHT 213 (Theory) course.
Specific Objectives:
This course enables students to collect, create, edit, store, manipulate, analysis and present geospatial information using GIS Application (ArcGIS, QGIS, Google Earth, OSM).
Contact Hour: 42 Hours
Course Contents:
Topics
Topic 1: Introduction to Desktop and Online GIS Applications: ArcGIS, QGIS, Google Earth, OSM
Topic 2: Projection and Coordinate System
Topic 3: Georeferencing
Topic 4: Working with Attribute Data
Topic 5: Creating Spatial Data from primary and secondary sources
Topic 6: Data Editing
Topic 7: Geoprocessing
Topic 8: Spatial and Network Analysis
Topic 9: Map Presentation
Topic 10: Database and Table
Topic 11: GIS Application in Disaster Management
Learning Outcomes:
- Work with proprietary and open source GIS software
- Do georeferencing of raster and vector data for GIS analysis
- Change projection and coordinate system of data obtained from different sources.
- Extract vector data by digitizing Hardcopy map / Satellite image / Google Earth, GPS survey etc. to create layers of different real world features / objects.
- Perform data editing, topology building, data manipulation, processing, data storing and linking spatial data with attribute data
- Analyze different layers spatially for extracting new information and decision making
- Symbolize data and map making (cartography) for presentation
- Create database and table, fetching, inserting data etc.
- Apply GIS tools for disaster risk reduction / post disaster management with hazard /disaster related in-situ and satellite data.

Instructional Strategies:
Lecture, Presentation, Hands-on Exercises, Lab work and may involve short field visits.
Assessment:
Formative (40%): Attendance, Laboratory work, Submission of assignment/Lab notebook
Summative (60%): Practical Examination
References:
1. Michael Law, Amy C., (2018) Getting to Know ArcGIS Desktop
2. Understanding GIS: An ArcGIS Project Workbook, Second Edition
3. Ryan Lanclos, Matt A., (2021) Dealing with Disasters: GIS for Emergency Management

Course Number and Title: DSCRHL 215 Disaster Statistics Lab
Credit: 02
Introduction to the Course:
The lab will cover material that complements and enriches the content covered in DSCR 112 and DSCR 210. Lab sessions early in the semester will review some of the statistics that will be needed in the course. The lab will also provide an introduction to the R statistical programming package, which the students will use in future courses.
Specific Objectives:
The lab specifically aims to teach about the R statistical programming package which will be used to practically calculate and analyze the statistical concepts the students learned from mainly DSCR 112 and partially from DSCR 210.
Contact Hour: 42 Hours
Course Contents:
Topics
Topic 1: Descriptive Statistics
Topic 2: Processing of Data
Topic 3: Testing the characteristics of statistical data
Topic 4: Calculating probability and probability distributions
Topic 5: Correlation analysis
Topic 6: Regression analysis
Learning Outcomes:
By completing this lab the student will learn to perform the following:
- Frequently work with the core packages of R
- Attach R with github and, push or pull the data easily
- Calculate and estimate the parameters from real life data
- Plot and analyze the statistical data
- Clean large scale data sets in R

Instructional Strategies:
Lecture, Presentation, Hands-on Exercises, Field work and Lab works
Assessment:
Formative (40%): Attendance, Laboratory work, Submission of assignment/Lab notebook
Summative (60%): Practical Examination
References:
1. Grolemund, G., Wickham, H. (2017). R for Data Science. O'Reilly Media.
2. Wickham, H. (2017). Advanced R. Routledge
3. Field A., Miles, J., Field, Z. (2012). Discovering Statistics Using R. Sage Publishers.

Course Number and Title: DSCRHF 217 Field Work
Credit: 02
Introduction to the Course:
Fieldwork provides an 'unparalleled opportunity' to study the real world. It reinforces classroom-based learning; and triggers all three domains of the educational learning. The fieldwork allows a higher order of cognitive learning, directly develops the psychomotor learning and inspires affective learning. Field studies require integration of content knowledge, observation and interpretation, analysis, experiment and theory and all their representations. All lines of evidence need to come together to form a coherent, internally consistent interpretation. Practices that are emphasized in the field instruction such as question-asking, observation, representation, and communication are important to the formative training of the students. This course mainly comprises of field activities complimented by theory classes. The fieldwork is carried out in one of the hazard prone areas of Bangladesh. The field incorporates the initial characterization of hazards from the

remotely sensed historical data to identify and analyze hotspots; assess the overall the hazard scenario, vulnerability and exposure using remotely sensed historical data, field observation, measurements, social surveying and geographical information systems in order to finally analyze the risk for the specific hazard.

Specific Objectives:

The main objective of this course is to strengthen the students' knowledge of hazard characterization, remote sensing and GIS through satellite image acquisition, processing, analyzing, ground-truthing, field observation and data collection using different equipment and social surveying followed by analysis through different GIS tools. The course will allow the students to design, co conduct a fieldwork that focuses on GIS-RS tools for hazard and risk assessment under the supervision of faculty members.

Number of Days: 05 to 10 days

Course Contents:

Topics

Topic 1: Preparation for Field Work

Topic 2: During Field Work: Field observation, data collection using different equipment, recognition of reliable secondary data sources, social surveying and finally analysis.

Topic 3: After Field Work: Lab analysis of primary and secondary data for standard field report

Learning Outcomes:

- The highest order of cognitive learning through designing and investigation of the study area in terms of hazard, vulnerability, exposure and risk
- Remote sensing: satellite image acquisition, preprocessing, processing, analyzing, visualization
- Field observation, ground truthing the remotely sensed data, field measurements, Social surveying
- Application of GIS tools: analysis, interpretation
- Visualizing the output
- Integration of different components; creation of a comprehensive report

Instructional Strategies:

Visual aids like Multimedia alongside whiteboard writings will be used to present lectures. All the materials will be provided. Teaching methods will be: lectures, group discussion, exercises, case studies, assignments and presentations. The techniques of experiential learning like role play, question and answer sessions, practical research and report writing will be used to increase participation. In addition, problem solving and hands on field learning is encouraged.

Assessment:

Assessment of Field Knowledge (40%)

Field Report (60%)

References:

1. Bonham-Carter G.F. (1991) Geographic Information Systems for Geoscientists: Modeling with GIS. Elsevier. UK.
2. ITC (2010) A Core Book of Geo-information Science and Earth Observation: A System based Approach.
3. Weng Q. (2009) Remote Sensing GIS Integration: Theories, Methods and Applications. McGraw Hill. USA.
4. Hyndman D. and Hyndman D. (2010) Natural Hazards and Disasters. 3rd Edition. Cengage Learning. India.
5. Moser C.A. Kalton G. (1971) Survey Methods in Social Investigation. 2nd Edition. Heinemann Educational. UK.

6. Chang, K. T. (2006). *Introduction to geographic information systems*. McGraw-Hill Higher Education. USA.

Course Number and Title: DSCRHT 218 (Viva vocé)
Credit: 02
Introduction to the Course:
Viva vocé ("living voice"), by tradition, is an oral examination that is carried out not as a substitute, but to complement the written exam. The course is designed to ensure the development of the student's ability to apply, analyze, evaluate and create using the acquired knowledge along with the ability to remember and understand. This course is unique in a sense that it does not have a scheduled class time but the all the courses up to 3rd semester and before constitutes the syllabus. Also, this course is designed to ensure a comprehensive understanding of the subject as a whole with clear a conceptual framework which can help the students explain, evaluate and create the correlations among the individual courses.
Specific Objectives:
This semester mainly focuses on hazard understanding, analysis and assessment. So a student is expected to learn the basics of specific hazard, hazard characterization and profiling, process, procedures and assumptions used for hazard analysis. Understanding, analyzing, evaluating and creating connects between the hazards in terms of magnitude, intensity and frequency shall allow a student to better understand the disaster risk framework.
Course Contents:
The course contents include the courses taught up to 3rd and 4th Semester with an emphasis on the present Semester.
Learning Outcomes:
Understanding, analyzing, evaluating and creating connects between the hazards in terms of magnitude, intensity and frequency shall allow a student to better understand the disaster risk framework. The oral examination process itself can allow a student to grow in the following aspects:

- Develop and demonstrate oral communication ability;
- Provide experience with the communications identified as most challenging in the workplace, i.e., interaction with a superior;
- Help students develop explanatory skills, powers of persuasion, oral poise and self-confidence
- Understand and demonstrate the principles of audience-centered message adaptation;
- Locate, use, and correctly cite appropriate evidence in supporting their claims;
- Demonstrate communication behaviors appropriate for effective comprehensive and supportive listening;

Instructional Strategies:
Questions and Answers; Establishing Rapport; Discussion on topics; Problem solving; Speech on given topics.
Assessment:
The oral exam is to be conducted by the 4th Semester Examination Committee for the respective session. The committee consists of four faculty members led by a chairman. The members evaluate the performance of a student individually and discretely; the average of which is the number that is awarded to the student and is graded accordingly.
Reference: Provided in the individual course contents.

Course Number and Title: DSCRHT 302 Vulnerability and Risk Assessment
Credit: 03

Introduction to the Course: Vulnerability is the degree of loss to a given element at risk (or set of elements) resulting from a given hazard at a given severity level. The distinction between this definition and that of risk is important to note. Risk combines the expected losses from all levels of hazard severity, taking account also of their occurrence probability. The 'intangible' aspects of vulnerability will often be as important as the quantifiable aspects. The vulnerability and risk assessment is considered the one of the most important, if not the most important core of disaster management framework. Disaster management has seen a shift in paradigm from being crisis management focused to risk management focused. Risk assessment portion of the risk management framework consists of Risk analysis and Risk evaluation. Risk analysis generally contains the following steps: hazard identification, hazard assessment, elements at risk/exposure analysis, vulnerability assessment and risk estimation. The course has been preceded by hazard assessments and will be succeeded by sector wise Risk treatment/control to identify hazard-type wise risk reduction measures for conceptualization of the sustainable risk management framework.

Specific Objectives: This course, Vulnerability and Risk Assessment tends to:

1. Provide students with critical perspectives to understand the disaster management framework
2. Help the students develop a clear understanding of different components of vulnerability- both tangible and intangible and ability to conduct exposure analysis; vulnerability assessment; risk estimation and, consequently, risk assessment for a specific hazard
3. Aid the students to develop multi hazard risk assessment for a specific area/ region

Number of Classes: 28

Course Contents:

Topics

Topic 1: Scope of vulnerability and risk assessment

Topic 2: Hazard identification tools, hazard assessment, natural and technological hazard assessment

Topic 3: Vulnerability assessment, components and characteristics of vulnerability, conceptual frameworks of vulnerability, vulnerability assessment methods.

In-Course-1

Topic 4: Elements at risk, types of elements at risk, exposure analysis

Topic 5: Risk evaluation, risk perception, risk transfer

Topic 6: Uncertainty: aleatory and epistemic uncertainty

Topic 7: The purpose of risk assessment, qualitative and quantitative approach of risk assessment/risk estimation

In-Course-2

Topic 8: Risk modeling: concept and steps, risk modeling tools (e.g. HAZUS, CAPRA, OpenQuake)

Topic 9: Environmental Impact Assessment (EIA), Social Impact Assessment (SIA), Hazard Impact Assessment (HIA), Disaster Impact Assessment (DIA) Framework and Methodology

Topic 10: Hazard specific vulnerability risk assessment procedures; multi-hazard risk assessment

Learning Outcomes:

By the end of the module students will be able to:

- Conceptualize, analyze and evaluate disaster risk management framework
- Conduct exposure and vulnerability assessment
- Identify both tangible and intangible vulnerabilities
- Calculate risk estimation and, consequently, risk analysis for specific hazard for a specific area/ region
- Conduct multi hazard risk assessment for a specific region

- Explore and critically evaluate risk, in order to identify the 'best practice' in terms of disaster risk reduction measures.

Instructional Strategies:

Visual aids like Multimedia will be used alongside whiteboard writing to present lectures. All the course materials will be provided. Teaching methods will be: lectures, group discussion, exercises, case studies, assignments and presentations. The techniques of experiential learning like role play, question and answer sessions, practical research and report writing will be used to increase participation. In addition, problem solving and hands on field learning is encouraged.

Assessment:

Formative (30%): Incourse Examination/Assignment /Presentation
Summative (70%): Course Final Examination

References:

1. Birkmann J. (2013) Measuring Vulnerability to Natural Hazards: Towards Disaster Resilient Societies. United Nations University Press. Japan.
2. Macaulay T. (2008) Critical Infrastructure: Understanding its Component Parts, Vulnerabilities, Operating Risks, and Interdependencies. CRC Press. US.
3. Ostrom L.T. Wilhelmsen C.A. (2012) Risk Assessment: Tools, Techniques and Their Application. Wiley-Blackwell. US.
4. Schneider S.K. (2011) Dealing with Disaster: Public Management in Crisis Situations. 2nd Edition. M.E. Sharpe. US.
5. Schumann A.H. (2011) Flood Risk assessment and Management. Springer. Netherlands.
6. Wisner B. (2004) At Risk: Natural Hazards, People's Vulnerability and Disasters. Routledge. US.
7. Westen et al (2011), A Guidebook of Multi-hazard Risk Assessment, Public Works

Course Number and Title: DSCRHT 303 Community based Risk Assessment and Planning

Credit: 02

Introduction to the Course:

Bottom-up approach of planning in case of disaster management is considered as a better option for building community resilience. Accordingly, assessment of the risk by the community and devising risk reduction initiatives by themselves gives better results. Considering the scenario, this course is designed to make the students understand and apply the concept of risk assessment by the community itself.

Specific Objectives:

This course is designed to perform field level community risk assessment. The students will be devised with techniques and methods to carry out field level risk assessment sessions with community people.

Number of Classes: 19

Course Contents:

Topics

Topic 1: Most Vulnerable People in Disaster: Issues and Concerns, Social Exclusion and Vulnerabilities.

Topic 2: Social Exclusion Analysis Framework, Guidelines for Gender Sensitive Risk Reduction Measures.

Topic 3: Tools of Community Based Risk Assessment (CBRA): Hazard Mapping, Social Mapping, Community Rural Appraisal, Transect Walk, Seasonal Calendars, Historical Timeline, Focus Group Discussion, Venn diagram, Vulnerability Matrix.

In-Course-1

Topic 4: Introduction and Purpose of Urban Risk Reduction (URA). Difference between URA and CRA.

Topic 5: Participants of URA, Steps of URA Framework for URA.

Topic 6: Participation of Stakeholders in CBRA, Role of Local authority in Community based Disaster Risk Management.

Topic 7: Bottom-Up Inclusive Participatory Approach, Stakeholder Participation, PGIS, Volunteered Geographic Information (VGI).

In-Course-2

Topic 8: Application of GIS and RS techniques in Citizen Science.

Topic 9: Case Studies of CBRA: Best Practices.

Learning Outcomes:

After completion of the course students will be able to:

- Understand the Community Risk Assessment as a participatory process for assessing hazard, vulnerably, risks, ability to cope, preparing coping strategies.
- Conduct FGD sessions in the field.
- Analyze community risk reduction options and implementation plan
- Apply RS and GIS in a participatory way to prepare a community risk map.

Instructional Strategies:

Visual aids like Multimedia will be used to present lectures. All the materials will be provided in soft copies or hard copies. Soft copies will be provided through a common group email account. Teaching methods will be: lectures, group discussion, exercises, case studies, assignments, presentations and field work. Question and answer sessions, and report writing will be used to increase participation. Students are expected to be enthusiastically involved in the classroom activities. In addition, problem solving and on-line discussions will be highly appreciated.

Assessment:

Formative (30%): In course Examination/Assignment /Presentation

Summative (70%): Course Final Examination

References:

1. ADPC, Plan Bangladesh Islamic Relief Worldwide. (2010) Urban Risk Assessment: A Facilitator's Guidebook.
2. Ministry of Food Disaster Management, Government of the People's Republic of Bangladesh. (2009) Practicing Gender and Social Exclusion in Disaster Risk Reduction. Dhaka. Bangladesh.
3. Map Action (2011) Field Guide to Humanitarian Mapping
4. UN-HABITAT (United Nations Human Settlement Program) (2007) Enhancing Urban Safety and Security: Global Report on Human Settlements 2007. EarthScan Publication. London.

Course Number and Title: DSCRHT 304 Geophysical Application: Principal and Practices

Credit: 03

Introduction to the Course:

Geophysical tools are becoming increasingly popular to better understand the subsurface scenario. The information is essential to understand the behavior of natural hazards through the subsurface, occurrence of a hazardous event within the subsurface, and the subsurface characteristics so that human infrastructures can be built accordingly without generating newer and higher risk.

Specific Objectives:

This course has the following deliverables: Understanding the principles of geophysical tools, the behavior of earth materials under these investigations, the range of different materials,

comparisons and complementing different tools and techniques, learning different investigation tools and interpretation techniques.

Number of Classes: 28

Course Contents:

Topics

Topic 1: Introduction: Scope and objectives of geophysics, disciplines of geophysics, active and passive methods

Topic 2: Physical properties of earth materials: Stress and strain, Young's modulus, shear and bulk modulus, Poisson's ratio, P and S waves, surface waves, seismic velocity, acoustic impedance, ground acceleration, etc.

Topic 3: Basic Concepts of the Seismic Method: Snell's law; wavefronts; ray paths, reflection and transmission coefficients, elastic constants

In-Course-1

Topic 4: Seismic Refraction –Basic Theory

Topic 5: Physical basis of refraction: Head waves; critical angle, travel time equation for simple plane horizontal layer model, extension of travel time equation to multiple layers, ambiguities arising from dipping layers

Topic 6: Seismic Reflection: Basic theory

Topic 7: Geometry of Reflection: Travel-time equation; normal and deep move out, reflection records, seismic sections

In-Course-2

Topic 8: Principles and scope: Principles and scope of gravity, magnetic, electrical and resistivity methods

Topic 9: Theory and Applications: Theory and applications of GPR, PS logging, MASW, microtremor etc.

Learning Outcomes:

By the end of the course students will be able to understand:

- Geophysics as a subject and its disciplines; application in disaster science
- Principles, scope and application of different geophysical tools
- Basics of investigation tools; mobilization, mechanism, data collection, data processing and data interpretation

Instructional Strategies:

Visual aids like multimedia alongside whiteboard writings will be used to give lectures. Teaching methods will be lectures, group discussions, exercises, case studies, assignments, and presentations. The techniques of experiential learning like role-playing, question and answer sessions will be used to increase participation. In addition, problem-solving and hands-on field learning example is encouraged.

Assessment:

Formative (30%): In course Examination/Assignment/Presentation

Summative (70%): Course Final Examination

References:

1. Burger H.R. Burger D.C. (1992) Exploration Geophysics of the Shallow Subsurface. Prentice Hall. US.
2. Dobrin M.B. (1988) Introduction to Geophysical Prospecting. 4th Edition. McGraw-Hill. US.
3. Howell B.F. (1959) Introduction to Geophysics. McGraw-Hill. US.
4. Keller C.V. Frischnecht F.C. (1966) Electrical Methods in Geophysical Prospecting. Pergamon. Oxford.
5. Kearey and Brooks (1984) An Introduction to Geophysical Exploration, Blackwell Publication
6. Milsom J.J. and Eriksen A (2011) Field Geophysics. 4th Edition. Wiley-Blackwell. US.

7. Reynolds J.M. (1997) An Introduction to Applied and Environmental Geophysics. Wiley-Blackwell. US.
8. Stacey F.D. Davis P.M. (2008) Physics of the Earth. 4th Edition. Cambridge University Press. UK.
9. Telford W.M., Geldart L.P. Sheriff R.E. (1990) Applied Geophysics. 2nd Edition. Cambridge University Press. UK.

Course Number and Title: DSCRHT 305 Geotechnical Application: Principles and Practices

Credit: 03

Introduction to the Course:

This Course will provide different theory and available tools in area engineering geology and geotechnical engineering to deal with the geotechnical hazards.

Specific Objectives:

This course will help to acquire knowledge of the mechanical properties and stability of the rocks and sediments that will carry engineering structures. Increase the students' ability to understand the need to anticipate the impact of subsidence, rains, floods, landslides, volcanoes and earthquakes on the foundations that bear these structures.

Number of Classes: 28

Course Contents:

Topics

Topic 1: Introduction: Introduction and scope, origin of soil and grain size, weight–volume relationships

Topic 2: Plasticity and Structure of Soil: Liquid limit, plastic limit, shrinkage limit, liquidity index and consistency index, activity and soil structure

Topic 3: Classification of Soil: Textural classification, classification by engineering behavior, AASHTO classification system and unified soil classification system

In-Course-1

Topic 4: Soil Compaction: Compaction—general principles, standard proctor test, factors affecting compaction, modified proctor test, compaction of organic soil and waste materials, evaluation of soils as compaction material

Topic 5: Seepage: Introduction, Laplace's equation of continuity, continuity equation for solution of simple flow problems, flow nets, seepage calculation from a flow net, flow nets in anisotropic soil, mathematical solution for seepage

Topic 6: In Situ Stresses: Stresses in saturated soil without seepage, stresses in saturated soil with upward and downward seepage, seepage force, heaving in soil, effective stress in partially saturated soil, capillary rise in soils, effective stress in the zone of capillary rise

Topic 7: Stresses in a Soil Mass: Normal and shear stresses on a plane, the pole method of finding stresses along a plane, stresses caused by a point load, vertical stress caused by a vertical line load horizontal line load vertical strip load embankment loading center of a uniformly rectangular loaded area

In-Course-2

Topic 8: Compressibility of Soil: Contact pressure and settlement profile, fundamentals of consolidation, normally consolidated and overconsolidated clays, calculation of settlement from one-dimensional primary, correlations for compression index, correlations for swell index, secondary consolidation settlement, time rate of consolidation, calculation of consolidation settlement under a foundation

Topic 9: Shear Strength of Soil: Introduction, Mohr-Coulomb failure criterion, inclination of the plane of failure caused by shear, laboratory test for determination of shear strength parameters, stress path.

Topic 10: Lateral Earth Pressure: At-Rest, Rankine, Coulomb and curved failure surface

Topic 11: Slope Stability: Factor of safety, stability of infinite slopes, infinite slope with

steady-state seepage, finite slopes—general, analysis of finite slopes with plane and circular failure surfaces, ordinary method of slices, Bishop's simplified method of slices

Topic 12: Soil Bearing Capacity: Soil bearing capacity for shallow foundations

Topic 13: Soil Improvements: Densification techniques, reinforcement techniques, grouting and mixing techniques, drainage techniques, verification of soil improvement, retaining walls

Topic 14: Site Characterization (Subsoil Exploration): Planning for soil exploration, in situ geotechnical tests; geotechnical soil classification, boring methods, common sampling methods sample disturbance, correlations for standard penetration test

Learning Outcomes:

By the end of the Course students will be able to:

- Understand index and dynamic properties of soil.
- Understand strength and nature of construction materials in terms of normal, shear and tensile strength.
- Explain soil and rocks mechanical behaviors
- Apply different techniques for soil improvements, measure bearing capacity and to detect engineering bedrock.

Instructional Strategies:

Visual aids like multimedia alongside whiteboard writings will be used to give lectures. Teaching methods will be lectures, group discussions, exercises, case studies, assignments, and presentations. The techniques of experiential learning like role-playing, question and answer sessions will be used to increase participation. In addition, problem-solving and hands-on field learning example is encouraged.

Assessment:

Formative (30%): In course Examination/Assignment/Presentation
Summative (70%): Course Final Examination

References:

1. Das, B.M. (2021) Principles of geotechnical engineering. Cengage learning.
2. Chen W.F. Lui E.M. (2006) Earthquake Engineering for Structural Design. CRC Press. US.
3. Coduto D.P., Yeung M.C. Kitch W.A. (2011) Geotechnical Engineering. 18th Edition. Pearson. US.
4. Kramer S.L. (1996) Geotechnical Earthquake Engineering. Prentice Hall. US.
5. Kumar K. (2008) Basic Geotechnical Earthquake Engineering. New age International Publishers. India.
6. McDowell P.W., Barker R.D., et al. (2002) Geophysics in Engineering Investigations. Geological Society of London and CIRIA. UK.
7. Paul D.K. Sharma M.L. (2006) Earthquake Engineering. Elite Publishing House. India.

Course Number and Title: DSCRHT 306 Urban and Regional Planning: Risk Mitigation Concept

Credit: 02

Introduction to the Course: This course will introduce the basic concept of urban and regional planning issues to the student in context of disaster risk mitigation. Students will also learn current issues of urban and regional planning and development.

Specific Objectives: To learn basic concept of urban and regional planning and risk mitigation concept in urban area.

Number of Classes: 19

Course Contents:

Topics

Topic 1: Definition, objective and scope of urban planning. Urban functions, activities and land use components. Modern principles of planning—town centre, residential area, recreational area, industrial area, commercial area, transportation network, metropolitan region, satellite town, new town, special areas like airport, seaport, railway station, bus terminal.

Topic 2: Distinction between urban and rural areas. Analysis of rural settlement patterns. Social and cultural characteristics of rural communities. Meaning of rural development. The concept, nature and scope of integrated rural development. Integration of functional and spatial aspects in the context of rural development. Planning procedures for integrated rural development

Topic 3: Regionalization and the delineation of planning region, Levels of planning - national, regional, sub-regional and local. Need and scope of regional planning. Steps of planning.

In-Course-1

Topic 4: Risk Components in Urban and Rural Planning

Topic 5: Risk Reduction Issues in Urban and Rural Planning, Integration of Risk Information into planning

Topic 6: Disaster Risk Reduction Enhanced Land Use Planning (LUP), Importance of Disaster Risk Information in LUP, Steps adopted in Disaster Risk Sensitive Land Use Planning (DRSLUP) -identifying the existing land use pattern, disaster risk assessment, vulnerability assessment, hazard characterization, consequence analysis, risk estimation, risk evaluation, mainstreaming disaster risk assessment result in LUP, Land use planning options, Enabling environment for incorporating disaster risk information in LUP, Application of GIS and RS in LUP mapping.

In-Course-2

Topic 7: Urban Resilience and its implication in Urban Risk Management.

Learning Outcomes:

Student will learn

- Basic concept of urban and regional planning, history of cities and planning
- Urban and regional planning process
- Development of contemporary cities
- Transport planning
- How Risk can be mitigated, and resilience can be achieved in urban area?

Instructional Strategies:

Visual aids like Multimedia will be used to present lectures. All the materials will be provided in soft copies or hard copies. Soft copies will be provided through common group email account. Teaching methods will be: lectures, group discussion, exercises, case studies, assignments and presentations. The techniques of experiential learning like role play, question and answer sessions, practical research and report writing will be used to increase participation. Students are expected to be enthusiastically involved in the classroom activities. In addition, problem solving, and on-line discussions will be highly appreciated.

Assessment:

Formative (30%): Incourse Examination/Assignment /Presentation

Summative (70%): Course Final Examination

References:

1. Dewberry L.N. Davis. (2008) Land Development Handbook. 3rd Edition. McGraw-Hill. US.

2. George C.K. (2007) Basic Principles and Methods of Urban and Regional Planning. 3rd Edition. Libro-Gem Books. Lagos.
3. Hall P. Jones M.T. (2010) Urban and Regional Planning. 5th Edition. Routledge. UK.
4. Institution of Civil Engineers. (1995) Megacities: Reducing Vulnerability to Natural Disasters. Thomas Telford. UK.
5. Vale L.J. Campanella T.J. (2005) The Resilient City: How Modern Cities Recover from Disasters. Oxford University Press. UK.

Course Number and Title: DSCRHL 307 Geotechnical Engineering and Geophysics Lab

Credit: 02

Introduction to the Course:

This course lab will introduce various geotechnical lab tests and geotechnical investigations to determine the index and dynamic soil properties.

Specific Objectives:

The main objective of this lab is geotechnical site characterization. The specific objectives are determination of physical / index properties of soils, soil shear strength parameters and dynamic soil parameters.

Contact Hour: 42 Hours

Course Contents:

Topics

Topic 1: Physical / Index Property Tests on Soils: a) Field identification test, b) Moisture content determination test, c) Determination of specific gravity of coarse-grained and fine-grained soils, d) Sieve analysis, e) Hydrometer analysis, f) Determination of Atterberg limits of fine-grained soils (Determination of liquid limit, plastic limit, and shrinkage factors), g) Determination of in situ dry density.

Topic 2: Engineering Property Tests on Soils: a) Determination of coefficient of permeability of soils (Constant head permeability test and Variable head permeability test), b) Determination of compaction characteristics of soils, c) Direct Shear Test, d) Unconfined compression test, e) Triaxial Compression Test (UU, CU, and CD), f) Consolidation test.

Topic 3: Data acquisition, processing, and interpretation: a) Downhole seismic test, b) MASW, c) Microtremor, and d) GPR.

Learning Outcomes:

Upon completion of this lab the student should able be to operate proficiently basic geotechnical and geophysical instruments to design and carry out geotechnical and geophysical surveys. After accomplishing hands-on exercise in the geotechnical engineering and geophysics lab, students will be able to measure

- Moisture content, specific gravity, grain size, liquid limit, plastic limit, and shrinkage factors and dry density of soil sample.
- Shear strength parameters, angle of internal friction and cohesion
- Shear wave velocity, fundamental period
- In addition, identify buried utility services

Instructional Strategies:

Lecture, Presentation, Hands-on/Practical Exercises, Lab works, Assignment, Discussions

Assessment:

Formative (40%): Attendance, Laboratory work, Submission of assignment/Lab notebook
Summative (60%): Practical Examination

References:

1. Punmia B.C. (2005), Soil Mechanics and Foundation Engg., 16th Edition Laxmi
2. Publications Co., New Delhi.

3. 2.Lambe T.W., Soil Testing for Engineers, Wiley Eastern Ltd., New Delhi.
4. Head K.H., (1986), Manual of Soil Laboratory Testing, Vol. I, II, III, Princeton Press,
5. London.
6. Bowles J.E. (1988), Engineering Properties of Soil and Their Measurements, McGraw
7. Hill Book Co. New York.
8. Coduto, Donald P. (1999), Geotechnical Engineering: Principles and Practices, 2nd ed., Prentice Hall, New Jersey
9. US Army (2001), Engineering Manual (EM) 110-1-1804: Engineering and Design, Geotechnical Investigations
10. US Army (1997), Field Manual (FM) 5-410: Military Soils Engineering.
11. Coduto D.P., Yeung M.C. Kitch W.A. (2011) Geotechnical Engineering. 18th Edition. Pearson. US.
12. Kramer S.L. (1996) Geotechnical Earthquake Engineering. Prentice Hall. US.
13. Kumar K. (2008) Basic Geotechnical Earthquake Engineering. New age International Publishers. India
14. Burger H.R. Burger D.C. (1992) Exploration Geophysics of the Shallow Subsurface. Prentice Hall. US.
15. Dobrin M.B. (1988) Introduction to Geophysical Prospecting. 4th Edition. McGraw-Hill. US.
16. Howell B.F. (1959) Introduction to Geophysics. McGraw-Hill. US.
17. Kearey and Brooks (1984) An Introduction to Geophysical Exploration, Blackwell Publication.
18. Milsom J.J. and Eriksen A (2011) Field Geophysics. 4th Edition. Wiley-Blackwell. US.
19. Reynolds J.M. (1997) An Introduction to Applied and Environmental Geophysics. Wiley Blackwell. US.
20. Telford W.M., Geldart L.P. Sheriff R.E. (1990) Applied Geophysics. 2nd Edition. Cambridge University Press. UK.
21. McDowell P.W., Barker R.D., et al. (2002) Geophysics in Engineering Investigations. Geological Society of London and CIRIA. UK.

Course Number and Title: DSCRHL 308 Risk Sensitive Landuse Planning
Credit: 02
Introduction to the Course:
Due to population growth and development land use planning is becoming a very important issues nowadays. It is important of assess risk of land before initiation of any development work otherwise development will increase risk of disaster. In this course student will learn to know how risk factors are instigated with land use planning and how we can use it to achieve resilience.
Specific Objectives:
To learn preparation of risk sensitive land use maps and use of those maps in planning.
Contact Hour: 42 Hours
Course Contents:

Topics	
Topic 1:	Disaster Risk Reduction Enhanced Land Use Planning (LUP)
Topic 2:	Importance of Disaster Risk Information in LUP
Topic 3:	Steps adopted in Disaster Risk Sensitive Land Use Planning (DRSLUP) -Identifying The Existing Land Use Pattern; Integration of Disaster Risk Assessment, Vulnerability Assessment, Hazard Characterization, Impact Analysis, Risk Evaluation in LUP, Mainstreaming Disaster Risk Assessment Result in LUP, and Land Use Planning Options
Topic 4:	Enabling environment for incorporating disaster risk information in LUP

Topic 5: Overview of the risk sensitive land use policies; policy implications and the lack thereof

Topic 6: Application of GIS and RS in LUP mapping.

Learning Outcomes:

Students will learn:

- Theory of land use planning
- How to prepare land use maps
- How to intergrade risk factors in land use maps
- Use of spatial tools and techniques to prepare risk sensitive land use maps

Instructional Strategies: Lecture, Presentation, Hands-on Exercise and Assignment,

Assessment:

Formative (40%): Attendance, Laboratory work, Submission of assignment/Lab notebook
Summative (60%): Practical Examination

References:

1. Hall P. Jones M.T. (2010) Urban and Regional Planning. 5th Edition. Routledge. UK.
2. Institution of Civil Engineers. (1995) Megacities: Reducing Vulnerability to Natural Disasters. Thomas Telford. UK.
3. Vale L.J. Campanella T.J. (2005) The Resilient City: How Modern Cities Recover from Disasters. Oxford University Press. UK.

Course Number and Title: DSCRHT 309 Climate Resilience Development: Economic Concept

Credit: 02

Introduction to the Course:

The course has three major focus areas. Firstly, it will discuss about the issues of the evolution of development ideas and the changing patterns of development paradigms in the context of climate change and sustainable development. Secondly, it will shed light on the basic concepts of micro and macro economics. Finally, a comparative discussion of the economic and development thoughts will be made in the context of Bangladesh.

Specific Objectives:

The specific objectives of the course are to develop the deep insight among the learners about the changing patterns and challenges of development paradigms, introductory concepts of economics and the development regime of Bangladesh. This course will help them to critically think about the social, political and economic issues happening around the contemporary world.

Number of Classes: 19

Course Contents:

Topics

Topic 1: Introduction; Basic understanding of development; Evolution of development theories, sustainable development, human development; Vulnerability and underdevelopment; Relationship between development, climate change, resilience.

Topic 2: The fundamentals of economics; Introducing economic way of thinking; Applying graphs to economics; Production possibilities and opportunity cost; Market demand and supply; Markets in action; Markets and government in a modern economy.

Topic 3: Microeconomics fundamentals; Applications of supply and demand; Demand and consumer behavior; Elasticity of demand and supply; Demand and consumer behavior; Theory of production and analysis of cost; Market structures (Perfect competition, Monopoly, Monopolistic competition and oligopoly).

In-Course-1

Topic 4: Macroeconomics fundamentals; Measuring the size of national economy; Business cycle and economic growth; Inflation and growth; Macroeconomic theory and policy (Monetary policy, fiscal policy); Growth, development and the global economy; Unemployment, inflation and economic policy.

Topic 5: Human development index; Basic concept of Human development; Calculation of the individual and gross index; Evolution of the index.

Topic 6: Climate change, resilience development industry in Bangladesh; Impact of disaster on microeconomic and macroeconomic indicators of Bangladesh; Cost-benefit analysis of disasters, long and short time impacts of climate change.

In-Course-2

Topic 7: Global development strategies and disaster management, SDGs, SFDRR; International development and humanitarian industry.

Topic 8: Case Study of some costly disasters: Bhola cyclone (1970), Cyclone Gorky (1991), Bangladesh, Flood (1988, 1998,2007), Kobe Earthquake (2005), Sichuan Earthquake (2008), The Great East Japan Earthquake(2011), Northridge Earthquake (1994), Hurricane Katrina (2005).

Learning Outcomes:

By the end of the course students will be able to learn:

- The development theories and their current state of evolution
- The role of environment and climate change in the development thinking
- The introductory theories of micro and macro economics
- The disaster development nexus and its current status in Bangladesh
- The economic growth and development regime in Bangladesh and the globe.

Instructional Strategies:

Visual aids like Multimedia alongside whiteboard writings will be used to present lectures. All the materials will be provided. Teaching methods will be: lectures, group discussion, exercises, case studies, assignments and presentations. The techniques of experiential learning like role play, question and answer sessions, practical research and report writing will be used to increase participation. In addition, problem solving and hands on field learning is encouraged.

Assessment:

Formative (30%): Incourse Examination/Assignment
Summative (70%): Course Final Examination

References:

1. Asian Disaster Preparedness Center (ADPC) (2012) Natural Disasters and Development (Module 2). Regional Training Course on Pre-Disaster Natural Hazard Loss Estimation. Bangkok. Thailand.
2. Collins A.E. (2009) Disaster and Development. Routledge. UK.
3. Hansjurgens B. Antes R. (2008) Economic Management of Climate Change: Risk, Mitigation Adaptation. Springer. Netherlands.
4. Oliver M.J. Aldcroft D.H. (2007) Economic Disasters of the Twentieth Century. Edward Elgar publication. UK.
5. Tietenberg T. Lewis L. (2009) Economic Development and Environmental Gain. 6th Edition. Prentice Hall. US.
6. Chiang, Alpha. C and Waignwright (2005), Fundamental Methods of Mathematical Economics. 4th Edition. New York: McGraw-Hill.
7. Samuelson, Paul A., and Nordhaus, William (2001), Economics, 17th Edition. New York: McGraw-Hill.

8. Salvatore, Dominick (2004), Microeconomic Theory. Schaum's Outline Series. 3rd Edition. New York: McGraw-Hill,
9. Bankoff G. (2004) Cultures of Disaster: Society and Natural Hazard in the Philippines. Routledge. US.
10. Gilbert Rist. (2004) The History of Development: From Western Origins to Global Faith. Zed Books. Chicago
11. Todaro M.P. Smith S.C. (2015) Economic Development. 12TH Edition. Pearson Higher Education. USA.

Course Number and Title: DSCRHT 310 Seismic Risk Reduction Approach
Credit: 03
Introduction to the Course:
Earthquake disasters account for the highest damage and loss. It is essential that the policy and the infrastructures are developed considering earthquake risks. The earthquake itself cannot be controlled but there are different approaches to reduce the associated risks. This course builds on the courses titled "Seismology and Geodesy" and "Vulnerability and Risk Assessment".
Specific Objectives:
This course has the following deliverables; Understanding different aspects of earthquake vulnerability and risk, seismic response of soils and structures, the concept of seismic risk-sensitive structure design and earthquake risk modeling, and risk management.
Number of Classes: 28
Course Contents:

Topics

Topic 1: Earthquake risk reduction: Introduction, Earthquake risk and hazard, The social and economic of earthquakes consequences, Earthquake consequences and their acceptability, Economic consequences of earthquakes, Earthquake risk reduction actions

Topic 2: Seismic Hazard Analysis: Deterministic and probabilistic

Topic 3: Structural Dynamics: SDOF and MDOF; Seismic Response of Soils and Structure

In-Course-1

Topic 4: Earthquake tips: Introduction and scope, seismic effects on structures, seismic effects on buildings architectural features, why buildings twist, seismic design philosophy, open-ground storey buildings, short columns effects, shear walls, base isolation and seismic dampers etc.

Topic 5: Costs of Earthquakes: Preparedness for earthquakes, the earthquake emergency

Topic 6: Earthquake Resistance of Buildings: Strong and weak building types, building response to earthquakes, how buildings resist earthquakes, structural form and earthquake resistance, choice of structural materials, codes of practice for engineered buildings, improving the resistance of non-engineered buildings, strengthening existing buildings, repair and strengthening of historical buildings

Topic 7: Earthquake Risk Modelling: Loss estimation, definition of terms, vulnerability assessment, the psi scale of earthquake ground motion, the HAZUS methodology, human casualty estimation, applications of loss estimation, uncertainty in loss estimation

In-Course-2

Topic 8: Liquefaction: Liquefaction hazard analysis and its counter measure

Topic 9: Slope: Seismic slope stability analysis and its counter measure

Topic 10: BNBC: Bangladesh National Building Code

Topic 11: Case study : An Optimized Retrofitting of Soft Storey RC Buildings in Nepal -A Socio-Technical Approach using Numerical Optimization, Japan seismic risk reduction approach before and after of 1995 Kobe earthquake, 2015 Nepal earthquake, 1985 Mexico earthquake

Learning Outcomes:
By the end of the course students will be able to understand:
- The different aspects of earthquake hazard, vulnerability and risks
- Assessing seismic response of soils and structures
- Different components of seismic hazard analysis, i.e. analysis of slope stability, liquefaction, etc.
- Considerations in the design and construction works; different techniques developed to minimize the risk
- Scenario-based earthquake risk modeling and potential damages
- Earthquake risk management

Instructional Strategies:
Visual aids like multimedia alongside whiteboard writings will be used to give lectures. Teaching methods will be lectures, group discussions, exercises, case studies, assignments, and presentations. The techniques of experiential learning like role-playing, question and answer sessions will be used to increase participation. In addition, problem-solving and hands-on field learning example is encouraged.

Assessment:
Formative (30%): In course Examination/Assignment/Presentation
Summative (70%): Course Final Examination

References:

1. Murty, C.V.R. (2005) Earthquake tips. Indian Institute of Technology Kanpur, India.
2. Coburn, A. and Spence, R. (2003) Earthquake protection. John Wiley Sons.
3. Day, R.W. (2012) Geotechnical earthquake engineering handbook: with the 2012 International building code. McGraw-Hill Education.
4. Balassanian S., Cisternas A. Melkumyan M. (2000) Earthquake Hazard and Seismic Risk Reduction, Series: Advances in Natural and Technological Hazards Research. Springer. Netherlands.
5. Bozorgnia and Bertero. Earthquake Engineering: From Engineering Seismology to Performance based Engineering, CRC Press
6. Dowrick D. (2009) Earthquake Resistant Design and Risk Reduction. 2nd Edition. Wiley- Blackwell. US.
7. Kramer S.L. (1996) Geotechnical Earthquake Engineering. Prentice Hall. US.

Course Number and Title: DSCRHT 311 Hydro-meteorological Risk Reduction Approach
Credit: 03
Introduction to the Course:
Hydro-meteorological hazards are the two most frequent and impact communities and nations all around the world with grave social and economic consequences and threatening the survival, dignity and livelihoods of the vulnerable sections of their population. The course incorporates risk assessment and discusses possible structural and non-structural risk reduction measures for different hydro-meteorological hazards, i.e. flood, riverbank erosion, tsunami, landslides, groundwater contamination etc.

Specific Objectives:
This course has the following deliverables:
1. Risk assessment of different hydro-meteorological hazards.
2. Understand scenario models for some of the hydro-meteorological hazards.
3. Identify possible structural and non-structural risk reduction measures for different hydro-meteorological hazards and evaluate them.

Number of Classes: 28

Course Contents:

Topics

Topic 1: Hydro-meteorological hazard modeling risk assessment: An introduction

Topic 2: Physical, social, economic and environmental vulnerability of flood, drought, cyclone and river bank erosion

Topic 3: Flood/ Riverine hazard

People and livelihood related to river and flood consequences of development in flood plains, recurrence period/flood frequency curves

Flood types; their characteristics and associated vulnerabilities, causes of flood, flood modelling, impacts of climate and rainfall, soil, catchment hydrology and water balance model

Elements at risk, flood risk assessment, risk reduction: structural and nonstructural measures

Watershed management integrated river basin management, integrated flood management, implementation plan and monitoring, trans-boundary international river laws, policies and organizations, FAP, water policy of bangladesh, Farraka Barrage and Bangladesh, flood forecasting

In-Course-1

Topic 4: Riverbank Erosion: causes, contributing factors, types of failures, riverbank protection measures, riverbank erosions in Bangladesh: scenario and practices

Topic 5: Coastal hazards (tsunami, coastal flooding, coastal storms, coastal erosion, accretion, saline water intrusion, sea level rise, land subsidence), required dataset, frequency, coastal hazard vulnerability assessment, mitigation measures, early warning, integrated coastal zone management.

Topic 6: Introduction to mountainous hazards, overview of mountainous Vulnerability assessment and risk reduction.

Estimating the probability of landslides, estimating the consequences, landslide vulnerability assessment, and evaluation and quantifying landslide risks. mountainous risk reduction methods (structural and nonstructural: monitoring, prediction and early warning; engineered structures; geophysical tools in mountainous hazard investigation; education, capacity building and public awareness).

Landside risk reduction initiatives in Bangladesh

In-Course-2

Topic 7: Arsenic Contamination in Groundwater of Bangladesh and Mitigation options

Learning Outcomes:

By the end of the course students will be able to learn:

- Risk assessment of hydro-meteorological hazards.
- Generic and Scenario-based risk modeling
- Risk estimation for different scenarios in case of hydro-meteorological hazards
- Identification of different Structural and Nonstructural Risk Reduction measures
- Evaluation of different risk reduction measures through from different aspects, i.e. Cost-benefit analysis
- Risk visualization for different hazards

Instructional Strategies:

Visual aids like multimedia alongside whiteboard writings will be used to give lectures. Teaching methods will be lectures, group discussions, exercises, case studies, assignments, and presentations. The techniques of experiential learning like role-playing, question and answer sessions will be used to increase participation. In addition, problem-solving and hands-on field learning example is encouraged.

Assessment:

Formative (30%): Incourse Examination/Assignment /Presentation

Summative (70%): Course Final Examination

References:

1. Bird E. (2011) Coastal Geomorphology: An Introduction. Wiley-Blackwell. US.
2. Cicin-Sain B. et al. (1998) Integrated Coastal and Ocean Management: Concepts and Practices. Biliana. Island Press. US.
3. Diaz H.F. Markgraf V. (2000) El Niño and the Southern Oscillation: Multiscale Variability and Global and Regional Impacts. Cambridge University Press. UK.
4. Finkl C.W. (Ed.) (2013) Coastal Hazards. Springer. Netherlands.
5. Glade T. et al (Ed.) (2005) Landslide Hazard and Risk. Wiley-Blackwell. US.
6. Lee E.M. Jones D.K.C. (2004) Landslide Risk Assessment. Thomas Telford Publication. UK.
7. Ministry of Water Resources, Government of the People's Republic of Bangladesh. (2005) Bangladesh Coastal Zone Policy. Bangladesh Secretariat. Dhaka.
8. Sassa K. Canuti P. (2008) Landslides-Disaster Risk reduction. Springer. Netherlands.
9. The H. John Heinz III Center for Science, Economics, and the Environment, 2000. The Hidden Costs of Coastal Hazards: Implications for Risk Assessment and Mitigation. Island Press. US.
10. United Nations Environment Programme (UNEP). (2005) Assessing Coastal Vulnerability: Developing a Global Index for Measuring Risk.
11. Wallendorf L. et al. (2011) Solutions to Coastal Disasters 2011. ASCE Publications. US.
12. Westen C.J. et al: Multi-hazard Risk Assessment, ITC
13. WMO (2008). Guide to Hydrological Practices, WMO.

Course Number and Title: DSCRHT 312 Population, Migration and Shelter Management

Credit: 02

Introduction to the Course:

This course will introduce population issues, concepts, theories and methods by encompassing the entire field of demography, including principle and practice. It offers an overview of various aspects of demographic growth and transition relating to changes in health and mortality, fertility, migration, age structure, urbanization, family and household structure. This course also examines the relations between population and development and their potential consequences from a social, economic and geographical perspective. Moreover, this course will provide an overview of the different perspectives of migration and refugee numbers and trends, causes of population movements, the impact of environmental migration, and promotes the formulation of innovative and practical responses to population movements and shelter management issues of migrants and refugees. Other topics include global variation in population size and growth, various demographic perspectives and their modern implications, environmental impacts, and population policy.

Specific Objectives:

This course will help students to learn fundamentals regarding the key components of demography: fertility, mortality and migration and their societal implications; understand the mechanisms underlying the demographic transition theory; be able to identify and manipulate key demographic components that range from the local to the global spatial scales and for different population segments, to appreciate the complexity of contemporary processes of migration from a range of different perspectives, to analyze key principles (legal, political and ethical) related to refugees, forced and environmental migration, to apply a critical perspective to the shelter management towards resilience.

Number of Classes: 19

Course Contents:

Topics

Topic 1 Demographic factors and processes: fertility, mortality, migration, marriage and nuptiality, life expectancy, birth rate, death rate etc.

Topic 2 Population distribution and density: population distribution, population density, factors affecting population density and distribution (physical, economic, political and social).

Topic 3 Population growth, demographic theories and model: population growth, malthus theory, demographic transition model, optimum population theory etc.

Topic 4 Population and resources: population resource or burden, optimum population, over - population, under population.

Topic 5 Migration: types of migration (internal migration, external migration, emigration, immigration, voluntary migration, population transfer or involuntary or forced migration, impelled or reluctant or imposed migration, return migration, seasonal migration), people who migrate (emigrant, immigrant, refugee, internally displaced person or idp) determinant or factors of migration (push factors and pull factors: environmental, political, economic, cultural), rural-urban migration, impact of migration: diffusion, assimilation, acculturation,; migration theories.

In-Course-1

Topic 6 Urban and rural population, population policies, population and disaster.

Topic 7 Environmental migration: definitions, types & patterns.

Topic 8 Environment induced internal and international migration: disaster and migration, the characteristics of migrants, changing livelihoods, IDPs- Asian & African cases and effects of migration on urbanization: examples of Bangladesh.

Topic 9 Climate change induced migration and its impacts: population response and way towards resilience.

Topic 10 Climate change induced environmental migration and shelter management (Bangladesh Perspective): population response to cyclones, floods, and river bank erosion and landslides: examples of Bangladesh.

Topic 11 Gender dimension of environmental migration: the impacts of climate change on women and gender specific migration behaviour.

In-Course-2

Topic 12 Refugee: definition, causes behind refugee, shelter management of refugees and environmental refugees.

Topic 13 Managing migration- role of different organizations (UNHCR, IOM, ILO, BMET, BOESL).

Topic 14 Causes behind refugee in Bangladesh and refugee management in Bangladesh.

Learning Outcomes:

By the end of the Course students will be able to:

- Learn fundamentals regarding the key components of demography: fertility, mortality and migration and their societal implications; understand the mechanisms underlying the demographic transition theory; be able to identify and manipulate key demographic components that range from the local to the global spatial scales and for different population segments.
- appreciate the complexity of contemporary processes of migration from a range of different perspectives;
- Critically analyze key principles (legal, political and ethical) related to refugees and forced migration;

- Explain the causes of international migration, drawing from both theory and empirical evidence;
- Assess the positive and negative impacts of international migration on source, transit, and destination countries;
- Describe the international legal frameworks that set out the rights of migrants and refugees and the responsibilities of states;
- Develop an inter-agency shelter response and advocacy strategy, using current humanitarian shelter and settlements standards, principles, and approaches**.**

Instructional Strategies:

Visual aids like Multimedia will be used to present lectures. All the materials will be provided in soft copies or hard copies. Soft copies will be provided through a common group email account. Teaching methods will be: lectures, group discussion, exercises, case studies, assignments and presentations. The techniques of experiential learning like role play, question and answer sessions, practical research and report writing will be used to increase participation. Students are expected to be enthusiastically involved in the classroom activities. In addition, problem solving and on-line discussions will be highly appreciated.

Assessment:

Formative (30%): In course Examination/Assignment /Presentation
Summative (70%): Course Final Examination

References:

1. Afifi T. & Jager J. (2010) Environment, Forced Migration and Social Vulnerability. Springer. UK.
2. Clarke J.I. (1965) Population Geography. Pergamon Press. Oxford. UK.
3. Edwards A. & Ferstman C. (2010) Human Security and Non-Citizens: Law, Policy and International Affairs. Cambridge University Press. UK.
4. Finnemore M. & Sikkink K. (1998) International Norm Dynamics and Political Change. International Organization, 52, pp. 887-917.
5. Guinness P. (2002) Migration: Access to Geography. Hodder & Stoughton. UK.
6. Hornby W.F. &Jones M. (1993) An Introduction to Population Geography. Cambridge University Press. UK.
7. Lucas D. & Meyer P.A. (1994) Beginning Population Studies. Australian National University.
8. Preston S., Heuveline P. &Guillot M. (2001) Demography: Measuring and Modeling Population Processes. Wiley-Blackwell. US.
9. Thomas B. (1972) Migration and Urban Development. Methuen and Co. Ltd. UK.

Course Number and Title: DSCRHT 313 Inequality and Disasters
Credit: 02

Introduction to the Course:

This course is designed to critically examine the relationship between social inequality and disaster vulnerability. Special emphasis will be placed on social theories of disaster vulnerability, research examining the experiences of socially marginalized populations during disasters, and strategies for reducing disaster vulnerability among marginalized populations.

Specific Objectives:

The course aims to develop the ability to understand the ways in which individuals and communities are vulnerable to natural hazards and disasters. The course is designed to

compare the ways in which social groups differ in experiencing natural disasters and climate change to apply a critical perspective to the ways in which social inequality is related to disaster and climate change induced vulnerability. This course will help students to employ social science inquiry, particularly sociological and anthropological theory and methods of research, to analyze the effects of disasters on socially marginalized populations. The objective here is to contrast the ways in which leading social theories of vulnerability help to understand the principles of social justice which can be used to reduce vulnerability among socially marginalized populations.

Number of Classes: 19

Course Contents:

Topics

Topic 1 Inequalities in Societies: definition, theory and causes of inequalities, (economic, gender, disabilities, political, socially exclusive groups, ethnicity, religion, minority, class and caste system, age, nationality etc.).

Topic 2 Social stratification: definition, causes and consequences, theory: Marxist, Weber's model.

Topic 3 Disasters & gender: concepts & definitions, gender-disaster relationship: spatial, social, and economic, causes of gender vulnerability, gender in DRR and DRM, mainstreaming gender in climate resilience, women in culture and society, assessing women's disaster resilience, gender vulnerability to natural hazards: social vulnerability & economic vulnerability, impact of different disasters from gender perspective: floods, cyclones, river bank erosion, draughts, landslide, earthquakes, fire hazard etc., disaster and health (reproductive & communicable): during and after disaster, disaster and security: personal security, food security & economic security, gender in coping and resilience: immediate strategy and long-term strategy, gender in policy framework (international and Bangladesh perspective).

Topic 4 Disabilities (mental and physical) and disaster.

Topic 5 Social inclusion perspective: socially exclusive groups and disaster.

In-Course-1

Topic 6 Class and caste system (race/ethnicity, religion, minority) and Disaster.

Topic 7 Age inequality and disasters.

Topic 8 Inequalities and health issues in disaster (mental and physical).

Topic 9 Social inequalities and responses, relief and rehabilitation in disaster.

Topic 10 Inequalities and disaster risk reduction measures: pre, during and post disaster phase; mainstreaming inequality issues in disaster risk reduction.

Topic 11 Social safety net/socio-economic safety net program.

In-Course-2

Topic 12 Policy, planning and legal aspects of inequality issues in disasters.

Topic 13 Intersectionality: definition, intersectional justice, forms and key concepts and practical application.

Topic 14 Theoretical interpretations of inequality: from classical to post-modern approach.

Topic 15 Measurement of inequality in societies.

Topic 16 Inequality, poverty and disasters.

Learning Outcomes:

By the end of the Course students will be able to:

1. Understand the leading social theories of disaster vulnerability and the ways in which they construct "vulnerability".
2. Compare the ways in which social groups differ in experiencing natural hazards and disasters.

3. Critically analyze the relationship between social inequality and disaster vulnerability.
4. Employ social science data and theories to analyze the effects of disasters on socially marginalized populations.
5. Explore the principles of social justice, which may be employed to reduce vulnerability among socially marginalized populations.

Instructional Strategies:

Visual aids like Multimedia will be used to present lectures. All the materials will be provided in soft copies or hard copies. Soft copies will be provided through a common group email account. Teaching methods will be: lectures, group discussion, exercises, case studies, assignments and presentations. The techniques of experiential learning like role play, question and answer sessions, practical research and report writing will be used to increase participation. Students are expected to be enthusiastically involved in the classroom activities. In addition, problem solving and on-line discussions will be highly appreciated.

Assessment:

Formative (30%): In course Examination/Assignment /Presentation
Summative (70%): Course Final Examination

References:

1. Babones S.J. (2009) Social Inequality and Public Health. Policy Press. UK.
2. Brunsma D.L., et al. (2007) The Sociology of Katrina: Perspectives on a Modern Catastrophe. Rowman & Littlefield. Maryland. US.
3. Butler T. & Watt P. (2006) Understanding Social Inequality. Sage. UK.
4. DeFronzo J. (2011) Revolutions and Revolutionary Movements. 4th Edition. Westview Press. US.
5. Ennals R. (2007) From Slavery to Citizenship. Hoboken. US.
6. Kerbo H. R. (2009) Social Stratification and Inequality. McGraw-Hill. US.
7. Marger M. (2013) Social Inequality: Patterns and Processes. 13th Edition. McGraw-Hill. US.
8. Neckerman K. (2004) Social Inequality. Russell Sage Foundation. US.
9. PPRC & UNDP. (2011) Social Safety Nets in Bangladesh, Review of Issues and Analytical Inventory: Volume I. Dhaka. Bangladesh
10. Price T.D. & Feinman G.M. (1995) Foundations of Social Inequality (Fundamental Issues in Archaeology). Vol. 1. Springer. US.

Course Number and Title: DSCRHL 314 Hazard Analysis and Risk Reduction Lab
Credit: 02

Introduction to the Course:

The disasters have increased multifold over the years. For a sustainable solution and carrying out risk management and crisis management activities, Understanding and accurately analyzing hazard is essential. The scientific approach to studying and analyzing hazards can lead to better understanding of the phenomenon and, it provides a framework for suitable actions and decisions for the policymakers. There has been a paradigm shift in disaster management approach from being crisis management oriented towards risk management focused. This course comprises of risk reduction approaches developing the generic and scenario based risk modeling of the major natural hazards as well as for major man-made hazards. With the completion of the course, the students will be able to make an application-oriented vulnerability and risk assessment and develop a hazard specific as well as multi-hazard risk reduction/mitigation plans.

Specific Objectives:
The course is designed to allow the students to use different tools and techniques for hazard identification, distribution, profiling, categorized map etc. for different hazards. The course incorporates conduction of different statistical and spatial analyses for different parameters of different hazards. The course also offers basic hazard modeling and simulation for some of the hazards. The course is designed to allow the students to use different tools and techniques for risk assessment for specific hazards as well as for multihazards; identify potential risk reduction measures; conduct cost benefit analysis and determine their suitability.

Contact Hour: 42 Hours

Course Contents:

Topics	
Topic 1:	Hazard Analysis: frequency analysis, intensity and magnitude determination, hazard profiling, analysis of physical hazard parameters, f-n curve, technological hazard analysis
Topic 2:	Element-at-risk mapping (high resolution image, OSM, census, etc.)
Topic 3:	Vulnerability assessment and vulnerability mapping; spatial multi-criteria analysis (SMCE)
Topic 4:	Risk assessment
Topic 5:	Multi-hazard risk assessment
Topic 6:	Damage mapping
Topic 7:	Rapid disaster mapping (flood, landslide, etc.)
Topic 8:	Cost-benefit analysis

Learning Outcomes:
The hands on study of the earth materials will allow the student to learn:

- Different tools and techniques for hazard identification, distribution, profiling, categorized map etc. for different hazards.
- Different hazard parameters and characteristics determination
- Different statistical and spatial analyses for different parameters of different hazards.
- Basic hazard modeling and simulation for some of the hazards.
- To assess vulnerability and conduct exposure analysis for specific hazards
- Assess risk for specific hazards as well as, multihazards and risk visualization
- Identify Suitable risk reduction measures
- Cost benefit analysis of the measures

Instructional Strategies:
Lecture; Presentation; Hands-on study; software based analysis.

Assessment:
Formative (40%): Attendance, Laboratory work, Submission of assignment/Lab notebook
Summative (60%): Practical Examination

References:

1. Westen et al. (2011), Multi-hazard Risk Assessment: Risk City Exercise Book 2011. United Nations University – ITC School on Disaster Geo-information Management (UNU-ITC DGIM)
2. ITC. (2018). ILWIS: User's Guide. University of Twente

Course Number and Title: DSCRHF 315 Field Work
Credit: 02
Introduction to the Fieldwork:
Fieldwork provides an 'unparalleled opportunity' to study the real world. It reinforces classroom-based learning; and triggers all three domains of educational learning. The

fieldwork allows a higher order of cognitive learning, directly develops the psychomotor learning and inspires affective learning. Field studies require integration of content knowledge, observation and interpretation, analysis, experiment and theory and all their representations. All lines of evidence need to come together to form a coherent, internally consistent interpretation. Practices that are emphasized in the field instruction such as question-asking, observation, representation, and communication are important to the formative training of the students. This course mainly comprises field activities complimented by theory classes. The fieldwork is carried out in one of the hazard prone areas of Bangladesh, preferably in a coastal district that faces salinity, drinking water scarcity as well as being exposed to strong storm surges caused by cyclones. The field incorporates the extensive characterization of hazards from the remotely sensed historical data to identify and analyze hazard hotspots. The field strongly emphasizes in-depth vulnerability and exposure analysis and consequent risk assessment through different social surveying tools complemented by field observation for multi hazard scenarios. The course helps the students identify possible risk reduction measures and evaluate them.

Specific Objectives:

The objective of the field works is to prepare vulnerability and risk maps based on the field investigations and using GIS and RS as well as proposing risk reduction measures (structural and non-structural) considering the gravity of the risk. Also, the students will perform Community Based Risk Assessment in this fieldwork to have insights about social aspects of DRR and Climate Resilience.

Contents:

This fieldwork builds on theory and practical courses taught up to the 6^{th} Semester with an emphasis on hazard assessment, vulnerability assessment, exposure analysis and consequent risk assessment using different social investigation tools for disaster risk management.

Learning Outcomes:

- The highest order of cognitive learning through designing and investigation of the study area in terms of hazard, vulnerability, exposure and risk.
- Understand different dimensions of vulnerability.
- Social Investigation tools: field designing, sampling and data collection, data processing and analysis using different software.
- Multi hazard risk assessment for the study area.
- Identify risk reduction measures and evaluate.
- Visualizing the output.
- Integration of different components; creation of a comprehensive report.

Instructional Strategies:

For the fieldwork, the students are divided into groups in order to develop team rapport. However, students are to document the data and prepare the report individually. Students are to collect the data through observation, surveying and field equipment. A base map, to be created by each student from the satellite image, is to be used to design the field and analyze. Each student is to submit a comprehensive report after the completion of the fieldwork.

Assessment:

The students are continuously monitored and their performances are assessed throughout the theory class component and the fieldwork. Students have to face a viva voce/present their findings to the Field Committee. The continuous assessment and the viva/presentation totals 50% of the marks. The field report, submitted after completion of the fieldwork, accounts for the remaining 50% of the total marks.

Reference:

1. Bonham-Carter G.F. (1991) Geographic Information Systems for Geoscientists: Modeling with GIS. Elsevier. UK.
2. ITC (2010) A Core Book of Geo-information Science and Earth Observation: A System based Approach.
3. Weng Q. (2009) Remote Sensing GIS Integration: Theories, Methods and Applications. McGraw Hill. USA.
4. Hyndman D. and Hyndman D. (2010) Natural Hazards and Disasters. 3rd Edition. Cengage Learning. India.
5. Moser C.A. Kalton G. (1971) Survey Methods in Social Investigation. 2nd Edition. Heinemann Educational. UK.
6. Chang, K. T. (2006). *Introduction to geographic information systems*. McGraw-Hill Higher Education. USA.
7. Westen et al (2011) Multi-hazard Risk Assessment Guidebook. Public Works. ITC. Netherlands.

Course Number and Title: DSCRHT 316 (Viva vocé)

Credit: 02

Introduction to the Course:

Viva vocé ("living voice"), by tradition, is an oral examination that is carried out not as a substitute, but to complement the written exam. The course is designed to ensure the development of the student's ability to apply, analyze, evaluate and create using the acquired knowledge along with the ability to remember and understand.

Specific Objectives:

This semester mainly focuses specific hazard, hazard characterization and profiling, process, procedures and assumptions used for hazard analysis. Understanding, analyzing, evaluating and creating connects between the hazards in terms of magnitude, intensity and frequency shall allow a student to better understand the disaster risk framework.

Course Contents: The course contents include the courses taught up to 5th and 6th semester with an emphasis on the present Semester.

Learning Outcomes: Understanding, analyzing, evaluating and creating connects between the hazards in terms of magnitude, intensity and frequency shall allow a student to better understand the disaster risk framework. The oral examination process itself can allow a student to grow in the following aspects:

- Develop and demonstrate oral communication ability;
- Provide experience with the communications identified as most challenging in the workplace, i.e., interaction with a superior;
- Help students develop explanatory skills, powers of persuasion, oral poise and self-confidence
- Understand and demonstrate the principles of audience-centered message adaptation;
- Locate, use, and correctly cite appropriate evidence in supporting their claims;
- Demonstrate communication behaviors appropriate for effective comprehensive and supportive listening;

Instructional Strategies:

Questions and Answers; Establishing Rapport; Discussion on topics; Problem solving; Speech on given topics.

Assessment:

The oral exam is to be conducted by the 6th Semester Examination Committee for the respective session. The committee consists of four faculty members led by a chairman. The members evaluate the performance of a student individually and discretely; the average of which is the number that is awarded to the student and is graded accordingly.

Reference:
Provided in the individual course contents.

Course Number and Title: DSCRHT 401 Crisis Planning, Response, Recovery and Rehabilitation
Credit: 03
Introduction to the Course:
Emergency Management is complex but important. Planning is done based on various context - Emergency Management Context, Public Policy Context and Jurisdictional Context. Again Emergency management differs from Emergency operation. Emergency and crisis planning deals with preparedness, recovery and emergency communications etc. This course covers planning aspects of emergency for effective emergency operations and deals with crisis management and discusses the framework, approaches, best practices of crisis management (response and recovery).
Specific Objectives:
This course is designed to teach how to plan for emergencies and how response, recovery and rehabilitation is achieved.
Number of Classes: 28
Course Contents:
Topics

Topic 1: Aims, purpose and scope of planning: types of crisis plans, standards and structure of a plan

Topic 2: Plan development and its activation: process of planning, dissemination of plan, need for revising plan, testing plan implementing capacity, integration of plans, multi-agency collaboration, disaster declaration process in Bangladesh (DM act)

Topic 3: Contingency planning: generic and scenario-based contingency plan for major responding organization

Topic 4: Emergency communications: guidelines for crisis communication, situational awareness, and emergency operations center (EOC) and Procedures.

In-course-1

Topic 5: Incident Command System (ICS) and Standard Operating Procedure (SOP)

Topic 6: Crisis Management Essentials

Topic 7: Framework and Approaches of Response and Recovery

Topic 8: Recognition of pre-disaster actions: warning and evacuation, pre-positioning of resources and supplies, last-minute mitigation and preparedness measures.

Topic 9: Recognition of post disaster actions: needs assessment, search and rescue, evacuation, First Aid, medical treatment, provision of relief (food and non-food items), health and disease monitoring, WASH, safety and security, critical infrastructure resumption, emergency social services, donations management, dead body management, debris management, volunteer management, media and private sector role.

Topic 10: Recovery and reconstruction planning: short-term measures, logistical constraints, restoration of services, reconstruction of damaged structures, long term recovery plan, build back better.

In-course-2

Topic 11: Emergency management training: the cause and effect model, the concept based approach, scenario based methods.

Topic 12: Dimension of disaster recovery: psychological recovery, environmental-, housing-, educational-, business-, agricultural-sector recovery.

Topic 13: Examples: response and recovery plan failures and successes around the world

Learning Outcomes:
- Understand the concept of emergency and crisis planning. Planning tactics and strategies.
- Prepare an emergency and crisis plan for particular hazard or for multiple hazards.
- Understand the crisis management

- Manage Response, Recovery and Rehabilitation after a disaster event.
- Handle debris, evacuation, search and rescue.
- Know the functions of Incident Command System.
- Be involved in cluster activities of development partner, GoB, NGO/INGO.
- Analyze the prepositioning options.

Instructional Strategies:

Visual aids like Multimedia alongside whiteboard writings will be used to present lectures. All the materials will be provided. Teaching methods will be: lectures, group discussion, exercises, case studies, assignments and presentations. The techniques of experiential learning like role play, question and answer sessions, practical research and report writing will be used to increase participation. In addition, problem solving and hands on field learning is encouraged.

Assessment:

Formative (30%): Incourse Examination/Assignment /Presentation
Summative (70%): Course Final Examination

References:

1. Haddow D., Bullock J. Coppola D.P. (2013) Introduction to Emergency Management. 5th Edition.Butterworth-Heinemann. UK.
2. Alexander D. (2002) Principles of Emergency Planning and Management. Oxford University Press. UK.

Course Number and Title: DSCRHT 402 Disaster and Climate Resilience: Institutions and Instruments

Credit: 02

Introduction to the Course:

The course has two major focus areas. Firstly, it will discuss the conceptual issues of institution and institutional theories. This part will discuss the ideas about the evolution of institutional theory, new institutionalism, good governance etc. The second part is applied as it focuses on the institutional aspects of disaster management and climate resilience in the country. This latter part will discuss the role of different formal and informal, government and nongovernment, national and international institutions in the context of Bangladesh and their roles in disaster and climate resilience.

Specific Objectives:

The specific objectives of the course are to develop the deep insight among the learners about the changing patterns of institutional theory and the need of good governance in bringing the institutional transformations required to achieve sustainable development in the country. This course will also help them know in-details about the different types of institutional structures and their roles in the context of disaster and climate resilience of Bangladesh.

Number of Classes: 19

Course Contents:

Topics

Topic 1: Theoretical aspects of Institutions and Governance; Institutional Theory, why institutions matter in Climate Resilience, types of Institutions and their Roles in Disaster Management and Climate Resilience, Principles of Good Governance.

Topic 2: Governmental Disaster Management Agencies; Government Emergency Management Structures: Fire Departments, Law Enforcement, Emergency Management and Civil Protection, Emergency Medical Services, Public Health, The Military and other Institutions.

Topic 3: Bilateral Disaster Management Assistance: Different types of Foreign Assistance,

How governments provide Bilateral Assistance, Monetary Assistance, Equipment and supplies, Expertise.

In-Course-1

Topic 4: Government Agencies Involved in Bilateral Assistance: Overseas Diplomatic Missions, International Development Agencies, National Disaster Management Agencies, Other Government Agencies and Military Resources.

Topic 5: Nongovernmental Organizations: Types of Nongovernmental Organizations involved in Emergency Management, The Emergency Management role of Nongovernmental Organizations, The Private Sector, Academia

Topic 6: Nongovernmental Emergency Management Operations: Funding, Coordination, NGO / Military Cooperation, Standards of Conduct, Case Study (The International Federation of Red Cross / Red Crescent Societies).

In-Course-2

Topic 7: Multilateral Organizations: Multilateral Organizations Explained, Regional International Organizations, The Emergency Management role of Multilateral Organizations.

Topic 8: The United Nations: The United Nations System, United Nations Agencies and Programs, The United Nations role in Emergency Management, The Consolidated Appeals Process, Disaster Management Act, Law, Plan and Policy: their Guidelines. International Instruments: Hyogo Framework for Action, SAARC Framework for Action, UNHABITAT, Disaster Management Act, Law and Policy in Bangladesh.

Learning Outcomes:

By the end of the course students will be able to learn:

- The institutional theories and their current state of evolution
- The role of good governance in achieving sustainable development.
- The role of different formal and informal institutions in the disaster management of Bangladesh.
- The international institutional context of disaster management and climate resilience.

Instructional Strategies:

Visual aids like Multimedia alongside whiteboard writings will be used to present lectures. All the materials will be provided. Teaching methods will be: lectures, group discussion, exercises, case studies, assignments and presentations. The techniques of experiential learning like role play, question and answer sessions, practical research and report writing will be used to increase participation. In addition, problem solving and hands-on field learning is encouraged.

Assessment:

Formative (30%): Incourse Examination/Assignment

Summative (70%): Course Final Examination

References

1. Ansell J. and Wharton F (1992) Risk: Analysis, Assessment, and Management. Wiley-Blackwell. US.
2. Asian Development Bank (ADB) (2005) Review of Asian Development Bank Policy and Assistance. Manila.
3. Asian Disaster Reduction Center (2005) Total Disaster Risk Management: Good Practices.
4. Broadleaf Capital International (1999) The Australian and New Zealand Standard on Risk Management. Broadleaf Capital International. Pymble. Australia.
5. Commonwealth of Australia (2004) Emergency Risk Management: Applications Guide. 2nd Edition. Emergency Management Australia. Australia.
6. Coppola D.P. (2011) Introduction to International Disaster Management. 2nd Edition. Butterworth Heinemann Press. US.

7. Ministry of Disaster Management Relief, Government of the People's Republic of Bangladesh (2010) National Plan for Disaster Management. Dhaka.
8. National Disaster Management Legal Frameworks: Plan, Policy, Act and SOD

Course Number and Title: DSCRHT 403 Climate Risk Modelling and Resilience
Credit: 03
Introduction to the Course:
This course is designed to introduce different models used in Atmospheric science and climate change study to the students. Adaptation to climate change is also discussed in this course as well.
Specific Objectives:
To get introductory ideas about climate model and learn resilience strategies to climate change.
Number of Classes: 28
Course Contents:
Topics

Topic 1: Introducing climate modeling: types of climate models- energy balance climate model, one dimensional radiative-convective climate model, and dimensionally constrained climate model, general circulation models, paleoclimatic model, and projections of future climate change.

Topic 2: Processes of climatic model development: sensitivity of climate model, model evaluation.

Topic 3: Hands-on climate risk modelling

Topic 4: Bias correction, statistical downscaling

In-course-1

Topic 5: Climate change impacts and types of Adaptation

Topic 6: Technologies options for adaptation: in coastal zones, for water supplies, agriculture, health, infrastructure.

Topic 7: Adaptive capacity and its determinants: economic resources, technologies, information and skills, infrastructure, institution, equity, endowed knowledge inclusion in adaptation.

In-course-2

Topic 8: Climate change mitigation, carbon trading, climate change and green recovery

Topic 9: Climate resilient cities and livelihoods.

Learning Outcomes:
- Details of Climate Models
- Use of Climate Models
- Climate Risk Modeling
- Achieving resilience to Climate Change

Instructional Strategies:
Visual aids like Multimedia alongside whiteboard writings will be used to present lectures. All the materials will be provided. Teaching methods will be: lectures, group discussion, exercises, case studies, assignments and presentations. The techniques of experiential learning like role play, question and answer sessions, practical research and report writing will be used to increase participation. In addition, problem solving and hands on field learning is encouraged.
Assessment:
Formative (30%): Incourse Examination/Assignment /Presentation
Summative (70%): Course Final Examination
References:

1. McGuffie K. Henderson-Sellers A. 2013. A Climate Modelling Primer. 3rd Edition. Wiley-Blackwell. US.
2. Erda L. 2009. Climate Change Vulnerability and Adaptation in Asia and the Pacific. Kluwer. Netherlands.
3. United Nations Framework Convention on Climate Change. 2006. Technologies for Adaptation to Climate Change. Bonn. Germany.

Course Number and Title: DSCRHT 404 Research Methodology and Knowledge Management

Credit: 03

Introduction to the Course:

The goal of Research Methodology is to learn how research is being done, and to put that knowledge into practice. The primary objective of this course is to reacquaint students with a variety of research traditions and related methodological and epistemological issues. First, the course will look at what it means to do research, the role of power in research relationships, and challenges posed by quantitative and qualitative data as well as critical research practices and mixed methods approaches. Second, the course aims to offer students an opportunity to address current methodological issues as they pertain to their own research interests thereby providing each with the potential to knowledgeably justify and explain her or his chosen methodology and method.

Specific Objectives:

This course will help students to understand research terminology, be aware of the ethical principles of research, ethical challenges and approval processes, to describe quantitative, qualitative and mixed methods approaches to research, to identify the components of a literature review process and to critically analyze published research.

Number of Classes: 28

Course Contents:

Topics

Topic 1: Science, Research and Scientific Enterprise.

Topic 2: Concept Measurements, Challenges and Constraints in Conducting Research.

Topic 3: Literature Review.

In-Course-1

Topic 4: Formulating Problems, Objectives and Questions; Assumption and Hypothesis.

Topic 5: Research Methods: Pre-field work, Field Work, without Field Work.

Topic 6: Citation and Reference List; Bibliographic Engines e.g., Mendeley.

In-Course-2

Topic 7: Critical Reading and Technical Writing, Argumentation.

Topic 8: Ethics and Professionalism in Science.

Topic 9: Ethics and Professionalism in Science.

Topic 10: Data and Data Collection Methods:
Data, Measurement Scale, Sampling Methods, Type of Data (Primary and Secondary), Sources of Data (Primary and Secondary), Data Collection Methods Quantitative, Qualitative (Observation Methods, Questionnaires, Methods, Interview, RRA/PRA, FGD); Quantitative Data Analysis, Interpretation and Result Validation Methods: (Univariate Methods, Bivariate Methods, Time Series Analysis, Signal Processing, Spatial Analysis, Image Processing, Multivariate Analysis and Directional Data Analysis).

Topic 11 Research Proposal Writing for Research Project.

Topic 12 Research Proposal Presentation.

Learning Outcomes:

After completion of the course the student should be able to:

- Describe how to design, collect and analyze data in qualitative and quantitative projects.
- Use appropriate statistical methods for the analysis of different data sets, interpret and present findings from statistical analyses in a clear, concise, and logical manner.
- Identify problems caused by systematic errors, bias and confounding in interpreting research data.
- Describe and discuss key characteristics of qualitative data collection methods and reflect on their main advantages and challenges.
- Describe key characteristics of main qualitative analysis methods including the role of the researcher in the process of analysis.
- Assess strengths and limitations of different sources of quantitative and qualitative data.
- Compare qualitative and quantitative approaches and understand when these are best used singly or in combination.

Instructional Strategies:

Visual aids like Multimedia will be used to present lectures. All the materials will be provided in soft copies or hard copies. Soft copies will be provided through a common group email account. Teaching methods will be: lectures, group discussion, exercises, case studies, assignments and presentations. The techniques of experiential learning like role play, question and answer sessions, practical research and report writing will be used to increase participation. Students are expected to be enthusiastically involved in the classroom activities. In addition, problem solving and on-line discussions will be highly appreciated.

Assessment:

Formative (30%): In course Examination/Assignment/Presentation
Summative (70%): Course Final Examination

References:

1. Dawson C. (2007) Laboratory Research Methods: A User-friendly Guide to Mastering Research Techniques and Projects. 3rd Edition. How to Books Ltd. UK.
2. D.G. Rossiter (2011) Research Skills and Methods, An ITC Publication
3. Fernandez I.B., Gonzalez A. and Sabherwal R. (2003) Knowledge Management and KM Software Package. Prentice Hall. US.
4. Rodriguez H. et al. (2006) Hand Book of Disaster Research (Handbooks of Sociology and social Research). Springer. Netherlands.
5. Singleton Jr. R.A. and Stratis B.C. (2009) Approaches to Social Research. 5th Edition. Oxford University press. UK.
6. Williams M. May T. 1996. Introduction to the Philosophy of Social Research. UCL Press. UK.

Course Number and Title: DSCRHT 405 Prediction and Early Warning
Credit: 03

Introduction to the Course:

The risk management includes preparedness which leads to warn people for any impeding disaster to mitigate damage and losses. So prediction and early warning is vital in the disaster management cycle. This course actually covers all the aspects to establish a people-centered robust early warning system to reach the community/household at the last mile. The course also clearly demarcate between community managed and community based Early Warning System (EWS).

Specific Objectives:

This course is to give clear idea about the existing Early Warning System in Bangladesh and what are the resources needed and how to establish an end-to-end EWS.

Number of Classes: 28

Course Contents:

Topics	
Topic 1:	Understanding Early Warning System: defining early warning system (ews), community based/managed early warning system, essential features of community based early warning systems, early warning practices and systems, the gap between warning and heeding.
Topic 2:	Application of technologies for monitoring and warning of hazards.
Topic 3:	Modeling techniques for early warning (flood, landslide, tsunami, flash flood, drought)
Topic 4:	Community-based early warning (case study: landslide)
	In-Course-1
Topic 5:	Key elements of early warning systems; risk knowledge, monitoring and warning, dissemination and communication, response capabilities
Topic 6:	Essentials of EWS; effectiveness, efficiency, equity, legitimacy
Topic 7:	Cross cutting issues; effective governance and institutional arrangements, a multi hazard approach, cultural diversity and gender perspectives, involvement of local communities
	In-Course-2
Topic 8:	Role of Government, Media, NGOs in early warning system.
Topic 9:	Electronic warning system: sensors, alarms information networks; role of communications system in early warning system of impending disasters; wire lines and wireless communication application.
Topic 10:	Awareness development through education, seminar, conference, Olympiad, poster, media etc.
Topic 11:	Early warning systems in Bangladesh.

Learning Outcomes:

After completion of the course students will be able to:

- Familiar with EWS of BMD and FFWC
- Understand Prediction and Early Warning concept and its modeling
- Formulate the community managed EWS.
- Apply RS and GIS and other modern technologies in newly developed EWS or update existing one.
- Know how to incorporate cross-cutting issues in EWS which is presently absent in most of the system
- Devise checklist or indicators to monitor and evaluate an existing EWS.

Instructional Strategies:

Visual aids like Multimedia will be used to present lectures. All the materials will be provided in soft copies or hard copies. Soft copies will be provided through common group email account. Teaching methods will be: lectures, group discussion, exercises, case studies, assignments, presentations and field work. Question and answer sessions, and report writing will be used to increase participation. Students are expected to be enthusiastically involved in the classroom activities. In addition, problem solving and on-line discussions will be highly appreciated.

Assessment:

Formative (30%): Incourse Examination/Assignment /Presentation

Summative (70%): Course Final Examination

References:

1. Bell F.G. (1999) Geological Hazards. Taylor and Francis. US.
2. Gasparini P. et al. (ed.) 2007. Earthquake Early warning System. Springer. Netherlands.

3. Glade t., et al. (Ed.) 2005. Landslide Hazard and Risk. Wiley-Blackwell. US.
4. Nayak S. 2008. Remote Sensing and GIS Technologies for Monitoring and Prediction of Disasters. Sringer. Netherlands.
5. Nemec Jr.J. et al. (Ed.) 1993. Prediction and Perception of Natural Hazard. Springer. Netherlands.
6. Sene K. (2008) Flood Warning, Forecasting and Emergency Response. Springer. Netherlands.
7. Shafie H. (2009) Endowed Wisdom: Knowledge of Nature and Coping with Disaster in Bangladesh. CDMP. Dhaka.
8. Tankut A.T. (Ed.) 2009. Earthquakes and Tsunamis. Springer. Netherlands.
9. Zschau J. Kèuppers A.N. 2003. Early Warning Systems for Natural Disaster Reduction. Springer. Netherlands.

Course Number and Title: DSCRHL 406 Numerical Simulation and Machine Learning Lab

Credit: 02

Introduction to the Course:

This course lab will cover machine learning basics, evaluation metrics, various algorithms and deep learning, for example, ANN, BNN and CNN. Game theory, agent-based modeling and simulation and different type's optimization technique will also be covered. In addition to machine learning different numerical methods (AEM, FEM, FVM, FDM, BEM, and DEM) will be addressed in this lab.

Specific Objectives:

The objective of this lab is to present the application of various numerical simulation (AEM, FEM, FVM, FDM, BEM, and DEM) and machine learning (Supervised, Unsupervised and Reinforcement) tools in the field of disaster science and climate resilience.

Contact Hour: 42 Hours

Course Contents:

Topics

Topic 1: Machine Learning Basics: Supervised, unsupervised, and reinforcement, bias-variance trade-off, overfitting and underfitting, data tuning and augmentation, gradient descent (batch, stochastic), resampling methods (bootstrapping, cross-validation), linear discriminant analysis (IDA), principal component analysis (PCA)

Topic 2: Evaluation Metrics: AUC, precision, recall, specificity, sensitivity, mean absolute percentage error, root mean square error.

Topic 3: Algorithms: Linear regression (usually performed through OLS), Logistic regression, Naive Bayes, K-Nearest Neighbors, K means clustering, Classification and regression trees (CARTs), Support vector machines, AdaBoost, Random-forest, ARIMA, Decision Trees, ID3, CHAID, C4.5, C5.0, Hierarchical Clustering.

Topic 4: Deep Learning: Artificial Neural Networks (ANN), Bayesian neural network (BNN), Convolutional Neural Networks (CNN).

Topic 5: Miscellaneous: Game theory and its applications, Agent-based Modeling and Simulation, Optimization for linear programming (LP), mixed-integer linear programming (MILP), quadratic programming (QP), second-order cone programming (SOCP), nonlinear programming (NLP), constrained linear least squares, nonlinear least squares, and nonlinear equations.

Topic 6: Numerical Simulation Basics: a) Introduction to applied element method (AEM), finite element method (FEM), finite volume method (FVM), finite difference method (FDM), boundary element method (BEM), and discrete element method (DEM)

Topic 7: Applications: a) Solution of simultaneous equations using MATLAB, b) Modeling of first and second-order hydraulic systems, c) Applications of curve-fitting to experimental data, d) Applications of numerical integration to evaluate moments of

inertia, friction work, and volumetric fluid flow

Learning Outcomes:

Upon completion of this lab, students will be able

- to analyze and identify significant characteristics of data sets, develop an understanding of training a learning algorithm including over-fitting, noise, convergence, and stopping criteria
- to apply machine learning tools in the field of disaster science and climate resilience, for example, liquefaction hazard assessment or Vs estimation using AI
- to apply numerical method in the field disaster risk reduction, for example, FEM based 2D seismic site response analysis, numerical simulation of direct shear test by DEM

Instructional Strategies:

Lecture, Presentation, Hands-on/Practical Exercises, Lab works, Assignment, Discussions

Assessment:

Formative (40%): Attendance, Laboratory work, Submission of assignment

Summative (60%): Practical Examination

References:

1. Bishop, Christopher. Neural Networks for Pattern Recognition. New York, NY: Oxford University Press, 1995. ISBN: 9780198538646.
2. Duda, Richard, Peter Hart, and David Stork. Pattern Classification. 2nd ed. New York, NY: Wiley-Interscience, 2000. ISBN: 9780471056690.
3. Hastie, T., R. Tibshirani, and J. H. Friedman. The Elements of Statistical Learning: Data Mining, Inference and Prediction. New York, NY: Springer, 2001. ISBN: 9780387952840.
4. MacKay, David. Information Theory, Inference, and Learning Algorithms. Cambridge, UK: Cambridge University Press, 2003. ISBN: 9780521642989. Available on-line here.
5. Mitchell, Tom. Machine Learning. New York, NY: McGraw-Hill, 1997. ISBN: 9780070428072.
6. Cover, Thomas M., and Joy A. Thomas. Elements of Information Theory. New York, NY: Wiley-Interscience, 1991. ISBN: 9780471062592.
7. P.E. Lewis and J.P Ward, The finite element method; Principles and Application, AddisonWesley, 1991.
8. Zienkiewicz and K. Morgan, Finite Elements and approximations, John Wiley and Sons.
9. C.F. Gerald and P.O. Wheatley, Applied Numerical Analysis, Addison-Wesley, 1998.
10. M.A. Celia and W.G. Gray, Numerical Methods for Differential Equations, Prentice-Hall Int. Inc.
11. G.D. Smith, Numerical solution of Partial differential equations, Clarendon press, Oxford, 1978
12. Stephen C. Chapra, McGraw Hill, 2010. Applied Numerical Methods with MATLAB for Engineers and Scientists, 2nd Edition.
13. Cleve Moler, Numerical Computing with MATLAB, Electronic edition: The MathWorks, Inc.,
14. Natick, MA, 2004, http://www.mathworks.com/moler. Print edition: SIAM, Philadelphia, 2004.http://ec-securehost.com/SIAM/ot87.html
15. L. V. Fausett, Applied Numerical Analysis Using MATLAB® 2/E, Prentice Hall, ISBN: 0132397285
16. S. Nakamura, Numerical Analysis and Graphic Visualization with MATLAB®, 2/e, Prentice Hall, 2002, ISBN:01306548921

A. Gilat and V. Subramaniam, Numerical Methods for Engineers and Scientists, John Wiley Sons, Inc., 2008, ISBN: 9780471734406

17. J. H. Mathews and K. D. Fink, Numerical Methods Using MATLAB®, 3rd ed, Upper Saddle River, NJ: Prentice Hall, 2004, ISBN: 0130652482
18. J. Kiusalaas, Numerical Methods in Engineering with MATLAB® , Cambridge University Press, 2005, ISBN: 0521852889

Course Number and Title: DSCRHL 407 Geoinformatics and MIS in Disaster Management and Climate Change

Credit: 02

Introduction to the Course:

This lab has two main focus areas. The major focus area of the lab is Geoinformatics. Geoinformatics, which includes Remote Sensing, Geographic Information System, Global Positioning Systems, and Internet Mapping Services, provides the most powerful technology for all phases of disaster management i.e. hazard mapping, monitoring, risk assessment, emergency response and reconstruction including early warning. Secondly, this lab will also discuss about the application of Management Information System (MIS) for disaster management and climate change. Major topics would include database management, effective utilizations of natural resources database in event of disaster and building decision support system for better administration.

Specific Objectives:

The specific objectives of this lab are to provide hands-on training on Geoinformatics so that the students can learn the latest in web mapping, remote sensing/UAV, location intelligence, spatial analytics, and more.

Contact Hour: 42 Hours

Course Contents:

Topics	
Topic 1:	Introduction to Geoinformatics
Topic 2:	Spatial Data Infrastructure (SDI), Geospatial platform and database management, Web GIS
Topic 3:	Remote sensing for disaster management
Topic 4:	Pre-processing and Information Extraction from LiDAR, RADAR, UAV Image
Topic 5:	Spatial modeling
Topic 6:	Introduction to information systems
Topic 7:	MIS for decision making

Learning Outcomes:

By completing this lab the student will learn to perform the following:

- Explore mapped data
- Relate GIS with remote sensing technologies
- Analyze spatial data, using GIS analysis tools
- Develop and manage geodatabases
- Apply Python as a GIS computer language
- Create maps, images and apps to communicate spatial data in a meaningful way to others

Instructional Strategies:

Lecture, Presentation, Hands-on Exercises, Field work and Lab works

Assessment:

Formative (40%): Attendance, Laboratory work, Submission of assignment/Lab notebook
Summative (60%): Practical Examination

References:

1. Brimicombe A. (2009) GIS for Environmental Modeling and Engineering. 2nd Edition. CRC Press. US.

2. Campagna M. (2005) GIS for Sustainable Development. CRC Press. US.
3. Karimi H.A. (2008) Handbook of Research on Geoinformatics. Information Science Reference, New York. US.
4. Oosterom P.V. et al. (Ed.) (2005) Geo-Information for Disaster Management. Springer. Netherlands.
5. Shamsi U.M. (2005) GIS Applications for Water, Waste Water and Stormwater Systems. CRC Press. US.
6. Weng Q. (2009) Remote Sensing and GIS Integration: Theories, Methods, and Applications. McGraw-Hill. US.
7. Kenneth C. Laudon and Jane P. Laudon. (2008). Management Information Systems Managing the Digital Firm (10th Economy Edition).

Course Number and Title: DSCRHT 408 Damage, Loss and Need Assessment
Credit: 02
Introduction to the Course:
The course has three major focus areas. They are the damage, loss and need assessment in the post disaster context. This course discusses about the established methods of damage and loss assessment and their application in different socioeconomic sectors. The sector specific damage and loss assessment follows the post-disaster need assessment.
Specific Objectives:
The specific objective of this course is to introduce the students with the established methods for disaster damage, loss and need assessment. Several agencies of the UN and some other international bodies have developed some toolkits on this purpose. This course aims to teach about these toolkits and talk about them by providing practical examples.
Number of Classes: 19
Course Contents:
Topics

Topic 1: Introduction: Concept of disaster damage and losses; Factors causing increase in damage and losses;

Topic 2: Damage and Loss Measures: Assessment versus estimation; Concept of Post-disaster Needs Assessment (PDNA); Concept of disaster damage and loss assessment (DaLa); Concept of pre-disaster loss estimation (PDLE).

Topic 3: Assessment Methodology: ECLAC, DaLa, PDNA.

In-Course-1

Topic 4: Steps in the Application of ECLAC (Economic Commission for Latin American and Caribbean region) Methodology.

Topic 5: Conducting Damage and Loss Assessments by Sector: Economic Sector, Social Sector, and Infrastructure and Cross Cutting sectors.

Topic 6: Post Disaster Need Assessment (PDNA): From Losses to economic Recovery Plan, From Damage to reconstruction Needs.

In-Course-2

Topic 7: Link between Risk Assessment and Damage Assessment

Topic 8: Latest Loss Estimation Modeling and Disaster Impact Analysis for Effective Policy F ormation: Cost Benefit Analysis, Applied Technology Council (ATC-13), HAZUS (Hazard in USA) Methodology, the ACM (Advanced Component Method), CatSim (Catastrophe Simulation) Model, Input-Output Model, Computable General Equilibrium (CGE) Model, the Social Accounting Matrix (SAM) Method and Econometric Model.

Learning Outcomes:
By the end of the course students will be able to learn:
- The damage, loss and need assessment techniques
- The methods for developing context specific disaster assessment toolkits.

Instructional Strategies:
Visual aids like Multimedia alongside whiteboard writings will be used to present lectures. All the materials will be provided. Teaching methods will be: lectures, group discussion, exercises, case studies, assignments and presentations. The techniques of experiential learning like role play, question and answer sessions, practical research and report writing will be used to increase participation. In addition, problem solving and hands on field learning is encouraged.

Assessment:
Formative (30%): Incourse Examination/Assignment
Summative (70%): Course Final Examination

References

1. Chakrabarti D. Bhat M.R. (2006) Micro-finance and Disaster Risk Reduction. Knowledge World. India.
2. Coppola D.P. (2007) Introduction to International Disaster Management. Elsevier. UK.
3. Hansjurgens B. Antes R. (Ed.) (2008) Economic Management of Climate Change Risk Mitigation Adaptation. Springer. Netherlands.
4. The World Bank. (2010) Damage, Loss and Needs Assessment: Guidance Notes. Washington DC.
5. GFDRR. (2013) Post Disaster Need Assessment Guidelines: Volume A.
6. GFDRR. (2008) Disaster Damage, Loss and Need Assessment: Training Guidelines. Dhaka. Bangladesh.

Course Number and Title: DSCRHT 409 Disaster in Agriculture and Food Security
Credit: 02

Introduction to the Course:
Smallholder farmers in Bangladesh are heavily rely on their local environments and natural resources i.e. land, water and energy for agricultural production and livelihoods. Thus, these vital resources provide the backbone of many rural livelihoods and their stability is key to securing the wellbeing of their entire communities. This course will equip with knowledge on protecting people's agriculture-based livelihoods from shocks and strengthening their capacity to absorb the impact of, and recover from, disruptive climatic events. This is a necessary ingredient for sustainable food and nutrition security. This course is also in line with the UN-led sustainable development goal. The present course aims to fill the current knowledge gap on the nature and magnitude of impacts of disasters triggered by natural and human-induced hazards on the agriculture sector and its subsectors (crops, livestock fisheries and forestry) in Bangladesh and other developing countries. The course will take an innovative approach to design well-informed risk reduction strategies and mitigation measures within the agriculture sector; several challenges also will be addressed to improve the information systems on the impact of farm production.

Specific Objectives:
- Understanding the basic concept of agriculture, it's development and food security.
- Exploring climate change issues and their impact on farm productivity.
- Analyzing the major risk of farm production systems due to climate change and disaster and its measures for sustainable agricultural growth and food security.

Number of Classes: 19

Course Contents:

Topics

Topic 1: Evolution of Agriculture (Domestication of Plants and Animals; Civilization, Agriculture and Disasters).

Topic 2: Famine, the Great Famine Ireland (Potato Famine), the Great Chinese Famine, Famine in British India and Bangladesh (Bengal Famine of 1770, The Great Bengal Famine of 1943, The Famine of 1974).

Topic 3: Green Revolution

In-Course-1

Topic 4: Basic Concept of Agriculture (Classification of Agriculture, Factors of Agriculture, Cropping Pattern, Cropping Intensity, Crop Rotation, Irrigation, Crop Calendar, Carrying Capacity, Cropping Methods etc.).

Topic 5: Agriculture of Bangladesh, Agro-ecological Zone of Bangladesh.

Topic 6: Agriculture and Disaster (Natural and Human-Induced)

Topic 7: Insect pest management

In-Course-2

Topic 8: Food Security

Topic 9: Climate Change, Food Security and Agricultural Risk Reduction in Bangladesh

Topic 10: Disaster Risk Reduction Measures in Agriculture

Topic 11: Early Warning System and Agricultural Risk Reduction

Learning Outcomes:

By the end of the course students will be able to define and differentiate the key concepts and understand the different issues on agricultural development, farm production, food security and climate change. Understanding these concepts will play an important role to assess the disaster risks and multi-sectoral strategies and methods for adaptation of climate-smart agriculture. They will gain knowledge on agricultural intervention on improved technologies for higher production and sustainable food security. This course will further contribute to enhancing the knowledge of the students on the government's agricultural policies, plans and development objectives to promote the agricultural sector to meet the UN-sustainable development goal.

Instructional Strategies:

Visual aids like multimedia alongside whiteboard writings will be used to give lectures. Teaching methods will be lectures, group discussions, exercises, case studies, assignments, and presentations. The techniques of experiential learning like role-playing, question and answer sessions will be used to increase participation. In addition, problem-solving and hands-on field learning example is encouraged.

Assessment:

Formative (30%): Incourse Examination/Assignment /Presentation
Summative (70%): Course Final Examination

References:

1. Brammer H. (1996) The Geography of Soil of Bangladesh. University Press Limited. Dhaka. Bangladesh.
2. Brammer H. (2012) The Physical Geography of Bangladesh. University Press Limited. Dhaka. Bangladesh.
3. Datta M. et al. (2008) Climate Change and Food Security. New India Publishing. India.
4. Hossain A. (2010) Fundamentals of Irrigation and On-farm Water Management: Volume 1. Springer. Netherlands.
5. Hossain A. (2011) Practices of Irrigation On-farm Water Management: Volume 2. Springer. Netherlands.
6. Lal R. (2010) Climate Change and Food Security in South Asia. Springer. Netherlands.
7. Rasheed K.B.S. (2008) Bangladesh: Resource and Environmental Profile. A. H. Development Publishing House. Dhaka.
8. Rasheed K.B.S. (2008) Water Resources Management: With Examples from Bangladesh. A H Development Publishing House. Dhaka.
9. Yu W.H. (2010) Climate Change Risks and Food Security in Bangladesh

Course Number and Title: DSCRHT 410 Mainstreaming Disaster Management and Climate Resilience

Credit: 02

Introduction to the Course:

The course has two major focus areas. Firstly, it will discuss the cross cutting issues of concerns in the disaster risk reduction agenda. And secondly, it focuses on the integration of these concerns into the development policy planning.

Specific Objectives:

The specific objective of this course is to develop insights on disaster risk reduction, climate change adaptation, gender issues etc., and their integration into the national level and development activities. The learners will come to know across the variety of concerns surrounding the mainstreaming disaster risk reduction agenda.

Number of Classes: 19

Course Contents:

Topics	
Topic 1:	Mainstreaming Disaster Management Framework: Fundamental Concepts of Mainstreaming, Process and Challenges of Mainstreaming, Techniques of mainstreaming, Advocacy and Entry Points.
Topic 2:	Disaster Risk Assessment: Hazard Characterization and Frequency Analysis, Consequence Analysis, Risk Estimation, Risk Prioritization.
Topic 3:	Mainstreaming Disaster Risk Assessment Results in Plan Formulation: Analyzing the Risk Impact to the Land use and Physical Framework, Identifying Development Issues, Goals, Objectives and Targets based on the Risks, Identifying DRR Measures, and Identifying Intervention Measures to Respond to Disaster Risk.
	In-Course-1
Topic 4:	Mainstreaming Gender issues in Disaster Management (From Bangladesh Perspective): GAD Approach.
Topic 5:	Mainstreaming Disaster Risk Reduction and Climate Change Adaptation in the development planning (Land use planning, Education, Environment and Natural Resources and Housing).
Topic 6:	Mainstreaming DRR in Investment Programming, Budgeting, Project Monitoring and Evaluation: Post Plan Formulation Mainstreaming, Investment Programming, Integration of Disaster Risk Reduction into National and Local Government Development Planning, Intra-government Horizontal and Vertical Integration.
	In-Course-2
Topic 7:	Mainstreaming Direct and Indirect Impact of Natural Disaster in SAARC and ASEAN countries.

Learning Outcomes:

By the end of the course students will be able to learn:

- How to mainstream the disaster risk reduction agenda into the development planning process.
- Cross cutting issues and challenges in mainstreaming the disaster risk reduction agenda.

Instructional Strategies:

Visual aids like Multimedia alongside whiteboard writings will be used to present lectures. All the materials will be provided. Teaching methods will be: lectures, group discussion, exercises, case studies, assignments and presentations. The techniques of experiential learning like role play, question and answer sessions, practical research and report writing will be used to increase participation. In addition, problem solving and hands-on field learning is encouraged.

Assessment:

Formative (30%): Incourse Examination/Assignment
Summative (70%): Course Final Examination

References

1. Asian Disaster Preparedness Center (ADPC) (2010) Urban Governance and Community Resilience Guides: Mainstreaming Disaster Risk Reduction. Manila. Philippines.
2. The Provention Consortium. (2007) Tools for Mainstreaming Disaster Risk Reduction: Guidance Notes for Development Organizations. Provention Consortium. Switzerland. Benson C. Twigg J.
3. The Provention Consortium. (2009) Mainstreaming Disaster Risk Reduction into Development: Challenges and Experience in the Philippines. Switzerland. Benson C.
4. UNDP-UNEP. (2011) Mainstreaming Climate Change Adaption into Development Planning. A Guide Book for Practitioners.
5. United Nations Development Programme (UNDP). (2010) Mainstreaming Disaster Risk reduction in sub national Development: land use/physical planning in Philippines.

Course Number and Title: DSCRHT 411 Project Planning, Monitoring and Evaluation
Credit: 02

Introduction to the Course:

This course aims at equipping the students with some applied knowledge of project management. All the disaster risk mitigation and reconstruction work demand formulation of projects and their regular monitoring and evaluation. The course focuses on the project life cycle approach to development, and provides the tools for good project planning, monitoring and evaluation. The environmental and social safeguard policy and compliance issues included in the course, provides the tools for mitigating conflicts with the affected communities and for better outcome.

Specific Objectives:

In this course the students will be able to understand the concept of project and programme management**,** to know the steps-by-step methods of project planning, development of project proposal and its appraisal processes**,** to build competence in designing monitoring and evaluation frameworks and plans and to explore the core concept of Environmental and Social Impact Assessments.

Number of Classes: 19

Course Contents:

Topics

Topic 1 Basic Concepts: Definition Characteristics of a Project and Program, Difference between Project and Program, Project and Programme Managers Role; Project Classification their Differences, Understanding Project Objective.

Topic 2 Project Life Cycle, Aspects and Activities of Different Phases, Project Generation and Screening.

Topic 3 Project Planning and Proposal Development: Definition, Purpose, Processes, Steps, Tips, Elements, Project Processing and Procedure in Bangladesh, Guidelines for Planning, Project Proformas, Uncertainty and Risk in Project Planning, Reason behind Project Failure.

In-Course-1

Topic 4 Project Appraisal: Different Aspects of Project Appraisal-Technical Aspect, Managerial Aspect, Social Aspect, Economic Aspect, Financial Aspect. Determination of Investment Worth, Cash Flow in a Project. Steps Involved in Approval Process of Investment Projects Project Processing and Procedure in Bangladesh, Guidelines for Planning, Project Proformas, Uncertainty and Risk in Project Planning, Reason behind Project Failure.

Topic 5 Logical Framework Approach in Project Management: Definitions and Use, Nine Different Steps in LFA, Building a Logframe Matrix, Elements of Project

Management.

Topic 6 Project Monitoring Evaluation: Definitions, Purpose and Objectives, Elements and Components of a Good ME System, ME Plan and Results Framework. Characteristics of a Good Indicator, Monitoring Report, Methods and Types of Evaluation.

In-Course-2

Topic 7 Environmental Impact Assessment (EIA) and Social Impact Assessment (SIA), Rapid Environmental Assessment (REA) etc: History, Steps and Procedures, Assessment Methods and Parameters, Categories of Environmental Screening, Components of a EIA Reporting Outline, Environmental Management Plan, =Benefits, Challenges, Bangladesh Key Environmental Concerns.

Learning Outcomes:

By the end of the course students will be able to:

- Differentiate between project and programme management, describe the step-by-step methods of project planning.
- Acquire the required competencies for the development of a good project proposal, Logframe and Results Framework.
- Have clear understanding of purposes, processes, standards and guiding principles for planning, monitoring and evaluation that can be applied to all development work.
- Develop a critical awareness of the importance of environmental and social impact assessments in making better informed decisions, improve outcomes, assess and resolve conflicts between social, environmental, economic, urban and rural developments, inform and empower people (including marginalized), increase social value/return on social investment.

Instructional Strategies:

Visual aids like Multimedia will be used to present lectures. All the materials will be provided in soft copies or hard copies. Soft copies will be provided through a common group email account. Teaching methods will be: lectures, group discussion, exercises, case studies, assignments, and presentations. The techniques of experiential learning like role play, question and answer sessions, practical research and report writing will be used to increase participation. Students are expected to be enthusiastically involved in the classroom activities. In addition, problem solving and on-line discussions will be highly appreciated.

Assessment:

Formative (30%): In course Examination/Assignment/Presentation
Summative (70%): Course Final Examination

References:

1. Chadha S. (1989) Managing Project in Bangladesh. University Press Limited. Dhaka.
2. Choudhury S. (1993) Project Management. Tata McGraw Hill Publishing Co. New Delhi
3. Dingle J. (1997) Project Management: Orientation for Decision Makers. John Wiley-Blackwell. US.
4. International Labor Organization. (2000) Project Preparation, Implementation, Monitoring, Evaluation: User's Hand Book. Dhaka.
5. NORAD. (1999) The Logical Framework Approach. Oslo.
6. Young T. (2003) The Project Management Manual. Penguin books. New Delhi.

Course Number and Title: DSCRHL 412 Damage and Need Assessment Lab
Credit: 02

Introduction to the Course:

This lab mainly aims to draw the conceptual aspects from DSCRHT 408 and practically apply them with real world data. This will talk about the application of damage, loss and need assessment tools in different socioeconomic sectors.

Specific Objectives:

The specific objective of this lab is to train the students with the practical knowledge of conducting damage, loss and need assessments in mainly post-disaster context.

Contact Hour: 42 Hours

Course Contents:

Topics	
Topic 1:	Damage, loss and need assessment for social sectors
Topic 2:	Damage, loss and need assessment for physical sectors
Topic 3:	Damage assessment: Cyclone Sidr
Topic 4:	Damage assessment: Cyclone Aila
Topic 5:	Econometric tools for damage, loss and need assessment

Learning Outcomes:

By completing this lab the student will learn to perform the following:

- Assess the damage, loss and needs in any kind of post-disaster situation

Instructional Strategies:

Lecture, Presentation, Hands-on Exercises, Field work and Lab works

Assessment:

Formative (40%): Attendance, Laboratory work, Submission of assignment/Lab notebook
Summative (60%): Practical Examination

References

1. The World Bank. (2010) Damage, Loss and Needs Assessment: Guidance Notes. Washington DC.
2. GFDRR. (2013) Post Disaster Need Assessment Guidelines: Volume A.
3. GFDRR. (2008) Disaster Damage, Loss and Need Assessment: Training Guidelines. Dhaka. Bangladesh

Course Number and Title: DSCRHP 413 Research Project

Credit: 06

Introduction:

In order to develop skilled personnel in problem identification, work-methodologies, scientific interpretation, producing a standard report; individual student shall carry out a supervised study independently on a specified topic (i.e., a Project assigned to them by the Academic Committee of the department). On completion of the Project, each student shall defend and submit written Project Report on the work undertaken. Upon the decision of Academic Committee project may also be completed by group work as well with field visit. Students may also carry out non-paid internship if academic committee could make liaison with organization/NGO/Agency or Industry.

Specific Objectives:

To learn how to conduct research independently as well in group under supervisor of faculty members.

Course Contents: Project Work

Learning Outcomes:

- They will learn to conduct research independently as well under supervisor of faculty members in group.
- Learning data collection methods
- Learning data analysis and presentation methods etc.

Instructional Strategies: Student will get supervision from faculty or professional both from the department and from industry. They must present and defend their research proposal (presentation). During final examination they must defend (presentation) their research project and must submit written copy for evaluation.

Course Number and Title: DSCRHV 414 (Viva vocé)
Credit: 02
Introduction to the Course:
Viva vocé ("living voice"), by tradition, is an oral examination that is carried out not as a substitute, but to complement the written exam. The course is designed to ensure the development of the student's ability to apply, analyze, evaluate and create using the acquired knowledge along with the ability to remember and understand. This course is unique in a sense that it does not have a scheduled class time but the all the courses up to 3rd semester and before constitutes the syllabus. Also, this course is designed to ensure a comprehensive understanding of the subject as a whole with clear a conceptual framework which can help the students explain, evaluate and create the correlations among the individual courses.
Specific Objectives:
This semester mainly focuses on vulnerability assessment and risk reduction and crisis response and preparedness. This course addresses both part of the disaster management cycle in detail. The course deals with the most delicate aspect of vulnerability assessment leading to risk mitigation and reduction as well as the post-disaster humanitarian approach considering mainly the emergency issues related particularly to the development and disparity aspects of disaster; post disaster damage assessment and planning for immediate and long term management of the crisis through the mobilization of humanitarian agencies and the community at risk
Course Contents:
The course contents include the courses taught up to 7th and 8th Semester with an emphasis on the present Semester.
Learning Outcomes:
With the completion of the course, the students will be able to make an application-oriented vulnerability and risk assessment and develop a hazard specific as well as multi-hazard risk reduction/mitigation plan with both technical and community-based early warning measures. the students will learn from the past how to develop post-disaster plan to coordinate complex operations that must be solved within the stipulated timeframe and efficiently following the cycle of crisis management. Moreover, the students will be familiar with the responsibility of the national and international players responding to humanitarian assistances.
The oral examination process itself can allow a student to grow in the following aspects:

- Develop and demonstrate oral communication ability;
- Provide experience with the communications identified as most challenging in the workplace, i.e., interaction with a superior;
- Help students develop explanatory skills, powers of persuasion, oral poise and self-confidence
- Understand and demonstrate the principles of audience-centered message adaptation;
- Locate, use, and correctly cite appropriate evidence in supporting their claims;
- Demonstrate communication behaviors appropriate for effective comprehensive and supportive listening;

Instructional Strategies:
Questions and Answers; Establishing Rapport; Discussion on topics; Problem solving; Speech on given topics.
Assessment:

The oral examination is to be conducted by the 8th Semester Examination Committee for the respective session. The committee consists of four faculty members led by a chairman of the Examination Committee. The members evaluate the performance of a student individually and discretely; the average of which is the number that is awarded to the student and is graded accordingly.