Curriculum

Department of Disaster Science and Management

Faculty of Earth and Environmental Sciences

University of Dhaka

BS Sessions 2018-2019 to 2019-2020

July 2018

Department of Disaster Science and Management (DSM)
Faculty of Earth and Environmental Sciences
University of Dhaka (DU)
Curriculum for B.S. Honors in DSM
(Semester-System Course Structure)

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1. Introduction to the Department:

The Department of Disaster Science and Management started its journey in 2012 with a vision to provide international standard high-quality education and research in the area of hazard science and disaster management. Perhaps, the department aims to emphasize more on research. As hazards and climate change are two crucial phenomena, the whole world is experiencing now; the department would like to manage the extreme events based on solid understandings of science inherent to those phenomena.

Particularly countries like Bangladesh experiencing extreme events very frequently need efficient manpower to guide the community in the proper way as well as to broaden the existing understanding of hazards and climate change from real life experiences.

The world is not only threatened by natural extreme events but also, anthropogenic disasters like terrorism, war, and technological disasters have a tremendous impact on socio-economical imbalance. Along with these social aspects, gender issues in disaster management also need to be addressed in a more sophisticated way.

So far, huge knowledge has been agglomerated from numerous national and international projects working on reducing the risk and vulnerability of crisis situations. It's high time to bring this knowledge in an academic format and to enhance the existing knowledge. This is how the department has emerged. Currently the department is offering Bachelor and masters program in disaster science and management.

2. Introduction to the Program:

2.1 Title of the program:
Bachelor of Science in Disaster Science and Management

2.2 Duration of the program:
Under the Semester System, the four-year B.S. Honors (integrated) Degree in Disaster Science and Management (DSM) at the University of Dhaka is a program comprised of eight semesters. Duration of the BS honors program is four years, six months for each semester.

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 processesrather as manifestations of unresolved problems of development. In the current paradigm shift from theresponse 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 arecrucial for risk reduction and aware of sustainable development. The advancement of knowledge onscientific and social aspects to resilient crisis management has also evolved as an imperative forsustainable development.

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

3. Structure of the Curriculum:
Bachelor of Science in Disaster Science and Management program require to attend the entire courses equivalent to 160 credit hours. Out of total courses, theory courses involve 160 credit hours; practical, field and project work involve 36 credit hours, and viva vocé8 credit hours.

3.1 Definition of credit and Distribution of courses over the Semester:
Each semester shall be of 20 weeks

- 15 weeks for class teaching
- 2 weeks for preparation
- 3 weeks for holding the semester final examination

For a 4 credit or 3 credit courses there shall be three lecture classes per week i.e., a total of 45 lecture classes of 1 hour duration and for 2 credit course there shall be a two lecture classes per week i.e. , a total of 30 lecture classes of 1 hour duration. The duration of annual DSM fieldwork for two-credit equivalent Field Works courses is 05-10 workdays in the field.

The course and credit over eight semesters is illustrated below:

Year	Semester	Number of Courses	Credit
Year One	1st Semester	7	15
	2nd Semester	8	18
Year Two	3rd Semester	9	18
	4th Semester	8	21
Year Three	5th Semester	8	21
	6th Semester	8	21
Year Four	7th Semester	7	22
	8th Semester	8	24
4 Years	8 Semesters	63 Courses	160 Credits

Course and Credit Distribution:

[Applicable for session 2014-15 to 2018-19]

Course/Credit	Total Theory	Total Practical	Total Viva	Total Field/Project	Total
Course	43	12	4	4	63
Credit	114	26	8	12	160

3.2: Modules

In order to have a quick impression and understanding of 64 courses spanned in 04 years, the courses have been distributed into 06 modules. They are:

Module-I: Basic Disaster Management Sciences

Module II: Tools and Techniques

Module III: Hazard Understanding, Analysis and Assessment

Module IV: Vulnerability Assessment and Risk Management

Module V: Crisis Response and Preparedness

Module VI: Policy, Planning and Legal Aspects

Short description of the module is given below:

Module-1: Basic Disaster Management Sciences

To address the disaster risk reduction from the realistic point of view of sustainable development using various tools, techniques and available knowledge, an application of basic and applied sciences is essential. This module consists of tailor-made courses of earth sciences, mathematics, statistics, engineering and social sciences related to natural and man-made disaster. The main objective of this module is to familiarize and develop the level of understanding of the background knowledge of the students with respect to the occurrences of the disasters and their management issues. The knowledge of this module will sharpen the student to find-out the association of disaster with basic sciences and how to apply this information towards hazard identification, vulnerability and risk reduction.

Module I	Course Name	Total Credit
Basic Disaster Management Sciences	Introduction to Disaster Science and Management	2
	Fundamentals of Earth Sciences	3
	Introduction to Environment and Ecosystem	2
	Basic Calculus for Disaster Sciences	2
	Earth Materials Lab.	2
	Viva vocé	2
	Basics of Climatology and Meteorology	3
	Introduction to Hydrology and Water Resources	2
	Society and Disasters	2
	Basic Statistics and Probability for Disaster Sciences	2
	Applied Linear Algebra	2
	Field Works and Reporting	2
	Applied Differential Equation	2
	Introduction to Computer Sciences and Programming	2
	Fundamentals of Built Environment	4
Total		34

Module II: Tools and Techniques

Paradigm shift of disaster management involves the proper application of social, scientific and engineering tools for the adequate assessment of hazard, vulnerability and risk. Without knowing the proper application of tools and techniques, the assessment with regard to risk reduction could be biased, over estimated or underestimated. This module comprises of the best available computational and instrumental tools and techniques to strengthen both theoretical and practical background of the structural and non-structural vulnerability reduction. Through the completion of the courses under this module, the student will be able to know and apply the techniques and technology for the proper assessment of risk and develop the pathway towards the risk reduction.

Module II	Course Name	Total Credit
Tools and Techniques	Basic Cartography and Mapping Techniques	2
	Geodetic Surveying & Mapping	2
	Seismology & Geodesy	3
	Numerical Analysis and Sampling Techniques	3
	Principles of Remote Sensing	2
	Geographic Information System and Database Management	3
	Remote Sensing Lab.	2
	GIS Lab.	2
	Disaster Statistics Lab	2
	Research Methodology and Knowledge Management	4
	Geo-informatics and MIS in Disaster Management: Theory & Practices	3
Total		28

Module III: Hazard Understanding, Analysis and Assessment

Any hazard is the fundamental cause of vulnerability and risk that leads to a disastrous event. Understanding and analyzing the hazard in terms of magnitude, intensity and frequency promotes the level of preparedness vis-a-vis capacity enhancement towards risk reduction. The objective of this module is to increase the mathematical (probabilistic and deterministic) and analytical (field survey and relevant commutation) investigations of various aspects of natural, man-made and climate change induced hazards for addressing structural and non-structural vulnerability reduction. From this module the students will learn basics of specific hazard,

hazard characterization and profiling, process, procedures and assumptions used for hazard analysis.

Module III	Course Name	Credit
Hazard Understanding and Analysis	Applied Geomorphology and Tectonics	3
	Geological and Hydro-meteorological Hazards	2
	Climatic Hazards and Climate Change	2
	Chemical, Industrial and Technological Hazards	2
	Biological Hazards and Public Health	2
	Hazard Analysis Lab.	2
	Environmental Pollution Lab	2
	Viva vocé	2
	Geophysical Application: Principle and Practices	2
	Geotechnical Application: Principle and Practices	2
	Field Works and Reporting	2
Total Credit		23

Module IV: Vulnerability Assessment and Risk Reduction

The risk management phase consists of the elements of mitigation, prevention, preparedness, prediction and early warning. Having the proper understanding of hazards as well as knowing the tools and techniques for hazard analysis and assessment, this module deals with the most delicate aspect of vulnerability assessment leading to risk mitigation and reduction. This module comprises of risk reduction approaches developing the generic and scenario based risk modeling of the major natural hazards. Climate risk modeling and adaption is also an integral part of the module. With the completion of the courses of this module, 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.

Module IV	Course Name	Credit
Vulnerability Assessment and Risk Reduction	Mitigation, Prevention and Preparedness	4
	Vulnerability and Risk Assessment	3
	Urban and Regional Planning: Risk Mitigation Concept	4
	Risk Sensitive Land use Planning Lab.	2
	Viva vocé	2
	Seismic Risk Reduction Approach	3
	Hydro-meteorological Risk Reduction Approach	3
	Risk Reduction Lab.	3
	Field Works and Reporting	2
	Climatic Risk Modeling and Adaptation	3
	Prediction and Early Warning	4
Total		33

Module V: Crisis Response and Preparedness

Based on the principles of building back better, the crisis management consists of the phase of response, recovery, reconstruction and rehabilitation. This module mainly deals with the post-disaster humanitarian approach considering mainly the emergency issues related particularly to the development and disparity aspects of disaster. The main objective of this module is to teach the post disaster damage assessment and make plans for immediate and long term management of the crisis through the mobilization of humanitarian agencies and the community at risk. Through the completion of this module, 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.

Module V	Course Name	Credit
Crisis Response and Preparedness	Disaster and Development: Economic Concept	3
	Population, Migration and Shelter Management	2
	Community based Risk Assessment and Planning: Theory and Practices	3
	Inequality and Disaster	2
	Response, Recovery and Rehabilitation	4
	Viva vocé	2
	Damage, Loss and Need Assessment	3
	Emergency and Crisis Planning	2
	Disaster in Agricultural and Food Security	3
	Damage and Need Assessment Lab.	2
	Research Project	6
Total		32

Module VI: Policy, Planning and Legal Aspects

Planning polices and legal aspects are essential parts of managing risks, crises and emergencies rising out of disasters. They are set to establish a formal basis for achieving the objectives of any government or non-government organizations, institutions or businesses which adopt and enforce them for the purpose of disaster management. Apart from basic disaster science, they make up the critical matrix of disaster management which involves agencies and people ranging from international financial institutions, global think tanks to government and local actors. Purpose of this module is to deeply inculcate the essence of plans, policies and legal aspects; their formulation, implementation, monitoring and evaluation techniques among students. This module will light upon the critical actors and factors involved in this whole process so to enable the learners to create, utilize and maintain plans themselves. They will also come across the history of disasters in Bangladesh and the role of various local and international actors in response to these events as well as the current trends and traits of disaster management with particular focus on legal and ethical issues.

Module VI	Course Name	Credit
Policy, Planning and Legal Aspect	Disaster Management: Institutions and Instruments	2
	Main-streaming Disaster Management: National and International Practices	3
	Project Planning, Monitoring and Evaluation	3
	Bangladesh Studies & Disaster Management Approach	2
Total		10

The modules have been differentiated into risk management and crisis management to show

Classification of Modules

Broad Category of Disaster Management	Modules
Risk Management	Basic Disaster Management Sciences
	Tools and Techniques
	Hazard Understanding, Analysis and Assessment
	Vulnerability Assessment and Risk Reduction
Crisis Management	Crisis Response and Preparedness
	Policy, Planning and Legal Aspect

3.3: Course Structure: B.S. (Honors) in Disaster Science and Management

Course ID	1st Semester	Credit	Course ID	2nd Semester	Credit
DSMHT:101	Introduction to Disaster Science and Management	2	DSMHT:108	Basics of Climatology and Meteorology	3
DSMHT:102	Fundamentals of Earth Sciences	3	DSMHT:109	Applied Geomorphology and Tectonics	3
DSMHT:103	Introduction to Environment and Ecosystem	2	DSMHT:110	Introduction to Hydrology and Water Resources	2
DSMHT:104	Basic Calculus for Disaster Sciences	2	DSMHT:111	Society and Disasters	2
DSMHL:105	Basic Cartography and Mapping Techniques	2	DSMHT:112	Basic Statistics and Probability for Disaster Sciences	2
DSMHL:106	Earth Materials Lab.	2	DSMHT:113	Applied Linear Algebra	2
DSMHV:107	*Viva vocé*	2	DSMHL:114	Geodetic Surveying & Mapping	2
			DSMHF:115	Field Works and Reporting	2
Total Credit		15	**Total Credit**		**18**

Course ID	3rd Semester	Credit	Course ID	4th Semester	Credit
DSMHT:201	Applied Differential Equation	2	DSMHT:210	Seismology & Geodesy	3
DSMHT:202	Geological and Hydro-meteorological Hazards	2	DSMHT:211	Fundamentals of Built Environment	4
DSMHT:203	Climatic Hazards and Climate Change	2	DSMHT:212	Numerical Analysis and Sampling Techniques	3
DSMHT:204	Chemical, Industrial and Technological Hazards	2	DSMHT:213	Principles of Remote Sensing	2
DSMHT:205	Biological Hazards and Public Health	2	DSMHT:214	Geographic Information System and Database Management	3
DSMHT: 206	Introduction to Computer Sciences and Programming	2	DSMHL:215	Remote Sensing Lab.	2
DSMHL:207	Hazard Analysis Lab.	2	DSMHL:216	GIS Lab.	2
DSMHL:208	Environmental Pollution Lab	2	DSMHF:217	Field Works and Reporting	2
DSMHV:209	*Viva vocé*	2			
Total Credit		**18**	**Total Credit**		**21**

Course ID	5th Semester	Credit	Course ID	6th Semester	Credit
DSMHT:301	Mitigation, Prevention and Preparedness	4	DSMHT:309	Disaster and Development: Economic Concept	3
DSMHT:302	Vulnerability and Risk Assessment	3	DSMHT:310	Seismic Risk Reduction Approach	3
DSMHT:303	Geophysical Application: Principal and Practices	2	DSMHT:311	Hydro-meteorological Risk Reduction Approach	3
DSMHT:304	Geotechnical Application: Principal and Practices	2	DSMHT:312	Population, Migration and Shelter Management	2
DSMHT:305	Urban and Regional Planning: Risk Mitigation Concept	4	DSMHT:313	Community based Risk Assessment and Planning: Theory and Practices	3
DSMHL:306	Disaster Statistics Lab	2	DSMHT:314	Inequalities and Disaster	2
DSMHL:307	Risk Sensitive Land use Planning Lab.	2	DSMHL:315	Risk Reduction Lab	3
DSMHV:308	*Viva vocé*	2	DSMHF:316	Field Works and Reporting	2
Total Credit		**21**	**Total Credit**		**21**

Course ID	7th Semester	Credit	Course ID	8th Semester	Credit
DSMHT:401	Response, Recovery and Rehabilitation	4	DSMHT:408	Damage, Loss and Need Assessment	3
DSMHT:402	Disaster Management: Institutions and Instruments	2	DSMHT:409	Main-streaming Disaster Management: National and International Practices	3
DSMHT:403	Climatic Risk Modeling and Adaptation	3	DSMHT: 410	Emergency and Crisis Planning	2
DSMHT:404	Research Methodology and Knowledge Management	4	DSMHT:411	Disaster in Agriculture and Food Security	3
			DSMHT:412	Project Planning, Monitoring and Evaluation	3
DSMHT:405	Prediction and Early Warning	4	DSMHT:413	Bangladesh Studies and Disaster Management Approach	2
DSMHL:406	Geo-informatics and MIS in Disaster Management: Theory &Practices	3	DSMHL:414	Damage and Need Assessment Lab.	2
DSMHV:407	*Viva vocé*	2	DSMHP:415	Research Project	6
Total Credit		22	Total Credit		24

[Note: Of the DSM Majors, each Theory course is denoted by four-letter code DSMHT (i.e., DSM Honors Theory), Practical/Lab course by the DSMHL (i.e., DSM Honors Lab), Field Works course by the DSMHF (i.e., DSM Honors Field), Project work by the DSMHP (i.e., DSM Honors Project) and viva vocé by the DSMHV (i.e., DSM Honors Viva vocé) followed by a three-digit number.]

4. Assessment System:

4.1. Evaluation

Theory courses

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

Practical courses

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

Field Trip

Marks Distribution		
Field Assessment		40%
Final Report	Field Report(s)	40%
	Presentation on Report(s)	20%
Total		100%

Project Works

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

Class Attendance

Five percent of marks in theory courses and twenty percent of marks in practical courses are added from class attendances.

Marks of attendances

Attendance %	**Marks** (Theory)	**Marks** (Practical)
90 and above	05	10
85 to 89	04	8
80 to 84	03	6
75 to 79	02	4
60 to 74	01	2
Less than 60	00	00

In course and/or assignments

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

For practical courses, thirty percent marks shall be allocated for the continuous class assessment.

The course teacher will announce the dates of in-course examinations at the beginning of the course. The in-course assessment will be of one hour duration and the teacher concerned will be responsible to assess the students of his/her course. There will be 1/2 test for each course. In theoretical courses assignment will be selected from the course syllabus or from topics related to course syllabus. Assignment may consist of written report or presentation or both.

4.2: Course Final Examination (Theory and practical 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 Setting 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
4 credit course	4 hours
3 credit course	3 hours
2 credit course	2.5 hours

Duration of practical examinations will be 4 hours irrespective of credit hours. The Class Test(s) for In-course Assessment will be taken usually after covering 40% of the course topics and the Course Final Examination on completion of the entire course. For each semester, the Departmental Academic Committee may fix an "In-course Examination/Class Test Week" for conducting the tests.

Evaluation of Examination Script

In 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 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 marks in any course is more than 20%, the script will be evaluated by a third examiner. The final marks obtained will be averaged of the nearest two marks, or third examiners marks if the difference between his/her marks and the two other examiner's marks are the same.

Evaluation of Practical Courses

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

Evaluation of Field Trip

In field trip/field visit, courses evaluation will be done by field trip coordinator/coordinators. Field Report and Presentation of field reports will be evaluated by field trip coordinator/coordinators and members of exam committee of the semester.

Research Project Conduction and Project Supervisor Selection

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. A project will be developed by each student with the guidance from his supervisor/co-supervisor which is to be approved by the Academic Committee of the department. Students shall contact with 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 dissertation will be evaluated by Project Supervisor, Co-supervisor and an assigned Expert (assigned by the academic committee). For the presentation of project, supervisor, co-supervisor, assigned expert and a representative of the respective Exam Committee will evaluate each student's presentation. Other faculty members/ supervisors can be present during the presentation of a project. 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.

4.3: 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.

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

$$= \frac{Total\ GP\ of\ 1st\ Semester + \cdots + Total\ GP\ of\ 8th\ Semester}{Total\ Credits\ (152)}$$

4.4: 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 have to answer from five topics) each short notes values 3.5 number.
- All theoretical courses' final exam will be held in 70 marks whether it is 2 credits, 3 credits or 4 credits courses. Duration of the exam will only vary with credits (2 credits course's duration of exam is 2.5hours, 3 credits course's duration of exam 3hours and 4 credits course's duration of exam 4hours)
- Question setter will set seven questions.
- Class assessment marks will be 30 in all theoretical courses whether it is 2 credits, 3 credits or 4 credits courses.

Midterm Exam

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

Practical Exam

All final practical exams will be in 60 marks whether it is 2 credits, 3 credits or 4 credits courses. There may be written parts in practical exam based on course curriculum. Number of questions will be selected based on course curriculum. In practical courses 40 marks will be added from class assessments.

Viva voce

All viva voce will be in 100 marks whether it is 2 credits, 3 credits or 4 credits courses. Viva marks will be given by averaging the viva board member's marks.

4.5: Promotion

Promotion will be year wise. Minimum CGPA (Cumulative Grade Point Average) 2 is needed only for promoting from second semester to third semester. Minimum CGPA 2.25 is needed for promoting 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.

4.6: Final Degree

For BS Honors degree a student need to complete 160 credit hours without F grade in any course, have to secure minimum CGPA 2.5, have to complete the program **within six consecutive academic years** including the year of first admission into the program.

4.7: 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 with the available ***immediate next batch*** at his/her own risk. In this particular case, marks of the previous class assessment will be added with the improved (if) final exam marks of final exam.

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

A student with F grade only in any course/courses will be allowed to improve the grade/grades by retaking the examination/examinations of the concerned course/courses for the ***second time with the available following batch*** if he/she gets F in the first improvement test/tests, he/she will get the final chance of improvement but he/she must take his/her improvement with the following batch.

Improvement of midterm exam shall not be allowed.

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 Exams until the date of the publication for the result of 8^{th} Semester.

If a student has CGPA 2.5 in year four (7^{th} and 8^{th} semesters combined) but having F Grade in any of the 7^{th} or 8^{th} semester his/her result will be treated as incomplete. 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 university rules.

The student have to be mentally prepared to take the test of particular course even if it is held on the same day of his/her other examination.

The same rules will be applicable in the case of any student getting absent (I) in any course/courses.

4.8: 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.

4.9: Drop out

A student failing to get a minimum CGPA even readmission for two times to the particular semester of the same year will be dropped out 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 dropped out from the program

4.10: 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.

4.11: 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 courses if necessary.

Course teacher will take classes of designated courses and arrange field visit if necessary for the courses (i. e visiting Bangladesh Meteorological Department).

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.

4.12: Course Coordinator

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

The course 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. Courses coordinator will arrange posting of relevant notices on notice board.

In case of the Course Coordinator falling sick, going on leave, or is unwilling to continue, the academic committee will nominate a substitute.

4.13: Field Trip and Coordinator/Coordinators

Field trip coordinator/coordinators shall be finalized by the beginning of the semester (having field visit) by AC. Coordinator will fix location and timeframe of the fields. All arrangement of field visits shall be carried out by the supervision of Field trip coordinator.

4.14: Examination committee

The Academic committee of the department shall form an examination committee for each semester for three years. The committee will include a chairman and three members. The Academic Committee can make changes in examination committee if necessary. In special case, out of the three members the committee may have an external member 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. If the AC decides, the chairman of examination committee can function as the course coordinator without any monetary benefit for the latter.

In case of any member of committee falling sick, going on leave, or is unwilling to be on the committee, the academic committee will nominate a substitute.

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.

4.15: Tabulation and Tabulator of the Examination Results

Two teachers of the department will act 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 marks in any courses is more than 20%, the script will be evaluated by third examiner. The final marks will be average of nearest two marks, or the third examiner's marks if the difference between his/her marks and two other examiner's marks are the same.

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.

4.16: Credit Transfer

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

4.17: 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 falling 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.

4.18: 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.

4.19: Semester Break

After completing all examination of Semester final (theory, practical, 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.

4.20: 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.

5. Course Structure:

Course Number and Title:
DSMHT: 101 Introduction to Disaster Science and Management

Credit and Credit Hours: 02 (30 Hours)

Introduction to the Course:
Disasters are no longer considered isolated events but are considered as complex phenomena which have 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. Hence, this subject has been developed to study disaster science and management through a comprehensive and holistic approach. This course offers the concept and framework of modern disaster management, its key components and terminologies, the knowledge of which will be essential for the advanced courses.

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. It also emphasizes the content in Bangladesh perspective.

Course Contents:

1. Disaster: Definitions of Terminology; Sciences of Disaster; Meaning and Impact; a Four Phase Approach of Disaster Management; Disaster Trends.
2. Hazards: Natural Hazards (Meteorological, Hydrological hazards, Hydro-meteorological hazards, Climatic Hazards, Geological hazards and Biological hazards), Technological and Man-made hazards); Hazard Identification and Hazard profiling.
3. Risk: Component of Risk (Likelihood, Consequence and Trends); Risk Evaluation; Risk Acceptability and Alternatives.
4. Vulnerability: Physical Profile; Social Profile; Environmental Profile; Economic Profile; risk factors influencing vulnerability; Risk Perceptions.
5. Capacity: Definition, Relation with other disaster terminologies.
6. Fundamental Approach of Disaster Management in Bangladesh: History of Disaster Management, Paradigm shift; Disaster Management framework and Institutions.

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

- The concept of modern disaster science and management.
- The disaster management cycle and its components
- The fundamental components e.g. risk, hazard, vulnerability, exposure, capacity, resilience etc. and tyheir subcomponents
- The evolution of disaster management
- Disaster management in the context of Bangladesh

References:

1. Comprehensive Disaster Management Program (CDMP) (2009) Disaster Dictionary. Dhaka, Bangladesh.
2. Coppola D.P. (2007) Introduction to International Disaster Management. Elsevier. UK.
3. CeesWesten et al (2011) Multi-hazard Risk Assessment. Public Works
4. Paul B.K. (2011) Environmental Hazards and Disasters: Contexts, Perspectives and Management. Wiley-Blackwell. US.
5. Pinkowski J. (2008) Disaster Management Handbook. CRC Press. US.
6. Smith K. &Petley D.N. (2009) Environmental Hazards: Assessing Risk and Reducing Disaster. Routledge. New York.
7. United Nations International Strategy for Disaster Reduction (UNISDR) (2004) Living with Risk: A Global Review of Disaster Reduction Initiatives. Geneva: United Nations.
8. Westen et al (2011) Multi-hazard Risk Assessment Guidebook
9. Wisner B. (2004) At Risk: Natural Hazards, People's Vulnerability and Disasters. Routledge. US.

Number of Classes: 30 (One hour each, totaling 30 lecture hours).

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.

Course Number and Title:
DSMHT: 102 Fundamentals of Earth Sciences

Credit and Credit Hours: 03 (45 Hours)

Introduction to the Course:

To understand the risks of natural disasters, it is essential to understand the earth materials 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. The course comprises of the earth system, fundamentals of different earth realted disciplines, e.g. geology, geography, stratigraphy, pedology etc.

Specific Objectives:

The course aims at studying the earth system as well as earth materials and processes with govern the natural disasters. Also, the course allows the earth materials to be studied from both hazard source as well as elements exposed to hazards. The structural geology, stratigraphy, petrology, surficial processes, pedology etc. are integrated in this course to ensure an clear understanding of those above mentioned scenarios. The course also includes important components of geography that are essential for characterization of different components of disasters.

Course Contents:

1. Earth System: Origin of the Earth and the Solar System; Interior of the Earth; Rocks and Minerals (their types, texture, structure and composition).
2. Fundamental of Geological Sciences: Introduction to the Science of Geology, Geological Time Scale and Methods of Measurements; Geological Column; Geological Structures (Folds, Faults, Discontinuities), Scope of Geological science for Disaster Management studies.
3. Fundamental of Geography: Basic concepts in Geography (Themes in Geography, World Physical and Human Region), Modes of Explanation in Geography, Scope of Geography for Disaster Management Studies.
4. Earth's Surface Processes: Weathering process, Erosion and Denudations; processes of physical and chemical weathering, product of physical and chemical weathering, zone of weathering, rates of weathering, zone of accumulation.
5. Soil Formation: Soil Forming Factors, Soil Forming process, and Soil Profile characteristics of different soil, Physical, Chemical and Biological Properties of the soil.
6. Stratigraphic Concepts: Stratigraphic Contacts, Unconformities; Vertical and Lateral Successions; Cyclic Successions; Stratigraphic Categories and Classification.

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, geological time scale, plate tectonics
- The ability to identify lithology, and structures which are essential to describe different natural hazards
- The processes that act in earth's surface
- The concept of geography, and its sub disciplines and its scope in disaster science and management
- The strata formation of sedimentary rock and their impacts

- Scope of earth science in disaster management

References:

1. Berry L.G. and Mason B. (1968) Elements of Mineralogy. Greenwood Press. US.
2. Boggs S. (2012) Principles of Sedimentology and Stratigraphy. Prentice Hall. US.
3. Bradshaw M., White G.W. and Chacko E. (2004) Contemporary World Regional Geography, 2nd Edition. McGraw Hill. US.
4. Bradshaw M.J. et al. (1978). The Earth's Changing Surface. Wiley-Blackwell. US.
5. Brady N.C. & Weil R.C. 2008. The Nature of Properties of Soils. 14th Edition. Pearson. US.
6. Leet L.D. et al (1982) Physical Geology. Prentice-Hall. USA.
7. Pettijohn F.J. (1975) Sedimentary Rocks. Harper & Row. US.
8. Plummer C., Carlson D. &Hammersley L. 2014. Physical Geology. 15th Edition. McGraw Hill. US.
9. Robinson H. (1976) Human Geography. M & E Handbooks. Plymonth. US.
10. Turbuck E.J., Lutgens F. K. and Tasa D.S. (2013) An Introduction to Physical Geology. 13th Edition. Prentice Hall. US.
11. Tyrrell G.W. (1952) The Principles of Petrology: An Introduction to the Science of Rocks. Dutton & Company Inc. New York.

Number of Classes: 45 (One hour each, totaling 45 lecture hours).

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.

Course Number and Title:
DSMHT: 103 Introduction to Environment and Ecosystem

Credit and Credit Hours: 02 (30 Hours)

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 Ecosysteminvolves 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 four spheres of the environment, 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.

Course Content:

1. Environment:
   Definition of Environment, Components of Environment: biotic and abiotic, four Sphere of Earth: Lithosphere/ Geosphere, Hydrosphere, Atmosphere, Biosphere; Scope
2. Lithosphere: Definition, Structure of the Earth surface
3. Hydrosphere: Definition, Hydrological Cycle
4. Atmosphere: Definition of Atmosphere, Evolution of Atmosphere (early or primitive atmosphere, secondary atmosphere, living atmosphere), Basic Composition and Structure of Atmosphere, Weather and Climate: elements and factors
5. Biosphere: *Ecosystem,* Definition of Ecology and Ecosystem, Component of Ecosystem, Food Chain and Food Web, Energy Pyramid, Trophic Level, Autotrophs, Heterotrophs, Herbivores, Carnivores, Decomposers etc., *Biomes,* Definition of Biomes, Types and Distribution of Biomes (Terrestrial, Aquatic), *Biodiversity,* Definition, Types (Species Diversity, Genetic Diversity, Ecosystem Diversity, Functional Diversity), Conservation of Biodiversity (In-Situ, Ex-Situ)
6. Major Biogeochemical Cycles: Laws of Thermodynamics, Oxygen Cycle Carbon Cycle, Nitrogen Cycle, Phosphorus Cycle
7. Pollution and Pollutants: Definition, Types of Pollution and Pollutants (Air, Water, Soil, Noise and Thermal Pollution), Point Source Pollution, Non-point Source Pollution.

References:

1. Botkin D. B. & 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 & Distributor. India.
4. Merritts D. et al (1998) Environmental Geology: An Earth System Science Approach. W. H. Freeman & Company. US.
5. Miller G.T. &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 Publication

Learning Outcomes:

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

- Explain environment and its major components and their interactions.
- Understand atmospheric layers and their components with different zones with specific characteristics
- Explain ecosystem and their components and how it works
- Evaluate various kinds of pollution, its causes and remedy technologies

Number of Classes:30 (One hour each, totaling 30 lecture hours).

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.

Course Number and Title:
DSMHT: 104Basic Calculus for Disaster Sciences

Credit and Credit Hours:02 (30 Hours)

Introduction to the Course:

This course is intending to develop basic concept and skill on differential and integral calculus and its application for solving technical problems particularly in disaster sciences.

Specific Objectives: to develop skill of using calculous to solve technical problems in disaster sciences.

Course Contents:

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).
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).
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: Lagranges mean value theorems. Extrema of functions, problems involving maxima and minima.
4. Integrals: Antiderivatives and indefinite integrals. Techniques of integration. Definite integration using anti derivatives.
5. Definite integrals a limit of a sum. The fundamental theorem of calculus. Integration by reduction.
6. Application of Integration: Plane areas. Solids of revolution. Volumes by cylindrical shells. Volumes by cross sections. Arc length and surface of revolution.

Learning Outcomes: student will learn:

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

Number of Classes:30 (One hour each, totaling 30 lecture hours).

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.

References:

1. Anton H. et al. (1988) Calculus with Analytic Geometry. Wiley-Blackwell. US.
2. Bers L. &Karal F. (1976) Calculus. Holt, Rinehart & 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:
DSMHL: 105Basic Cartography and Mapping Techniques

Credit and Credit Hours:02 (30 Hours)

Introduction to the Course:

Cartography is the arts, science and technology of map making. It is an important tool. 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. Student will also learn how to prepare, read, and use maps.

Specific objectives: to learn map making, map reading and map use.

Course Contents:

1. Maps: Definition, History, Basic elements of map (Scale: Definition, Types and Use; Construction of scale- Linear, Comparative and Diagonal.
2. Aesthetics of Map.
3. Maps and Map Projections; Map Scales and their Computations.
4. Map Reading and Interpretations, Map Reproduction-Enlargement and Reduction at different scales; Bearing, Azimuth, Distance, Plotting of Location and Data.
5. Map Design and Symbology: Principles of map design; Cartographic Design; International Color Scheme; Theory, Models and Perception; Typographic Map Production, Thematic map: Definition and Concept: Methods/Techniques of Thematic Mapping- Choropleth, Isopleths, Dot, Flow, Proportional symbol, Isothermal and Diagrammatic method; Cartogram.
6. Contour Maps Construction; Study of Topographic Maps, Classification of Maps and their applications (Weather maps, Geological maps).

Learning Outcomes: students will learn:

- Theory and basic concept of cartography
- How to make maps
- How to read maps
- How to use maps

Number of Classes:30 (One hour each, totaling 30 lecture hours).

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

References:

1. Blyth F.G. H. (1976) Geological Maps and their Interpretation. 2nd Edition. Arnold. UK.
2. Brown L.A. (1960) Map Making: The Art That Became a Science. Little Brown & Co. US.
3. Bygott J. (1967) An Introduction to Map Work and Practical Geography. University Tutorial Press. UK.
4. Kellaway G. P. (1970) Map Projection. 2nd Edition. Methuen & Co. UK.
5. Robinson et al (1953) Elements of Cartography. Wiley Publication

Course Number and Title:
DSMHL: 106 Earth Materials Lab.

Credit Hour: 02 (Two)

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 course DSMHT-105 titled "Introduction to the Earth Sciences".

Specific Objectives: The course offers the visual study of the properties of minerals and rocks; identification these materials in hand specimens using the diagnostic properties, study of soil profiles.

Course Contents:
1. Hand-specimen study of common Igneous, Metamorphic and Sedimentary rocks
2. Hand specimen study of rock forming minerals.
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.

Number of Classes: 15 (2 hours each; totaling 30 hours)

Instructional Strategies: Lecture; Presentation; Hands-on study; Investigation of property and identification of unknown specimens.

References:

1. Berry L.G., Mason B. and Dietrich R. V. (1983) Mineralogy: Concepts, Descriptions and Determinations. W.F. Freeman. US.
2. Pettijohn F.J. (1983) Sedimentary Rocks. 3rd Edition. Harpercollins. UK.
3. Read H.H. (1962) Rutley's Elements of Mineralogy. Thomas Murby and Co. UK.
4. Tyrrell G.W. (1973)The Principles of Petrology. Wiley-Blackwell. US.
5. Plummer C., Carlson D. &Hammersley L. 2014. Physical Geology. 15th Edition. McGraw Hill. US.

Course Number and Title:
DSMHV-107 (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 Module-I of the syllabus titled "Basic Disaster Management 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 management, 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 Exam 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:
DSMHT: 108Basics of Climatology and Meteorology

Credit Hour:03 (45 Hours)

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 learn the basic concept of different atmospheric process.

Course Contents:

1. Climatology and Meteorology: Basic concept, Scales of Weather System.
   Climatology, Meteorology, Weather and Climate, Elements of Weather and Climate, Factors of Weather and Climate
2. Origin, Composition and Structure of Atmosphere
   Origin and Evolution of Atmosphere, Composition of Atmosphere, Structure of Atmosphere
3. Insolation, Energy Balance, Temperature
4. Atmospheric Pressure and Wind, General Circulation of Atmosphere, ITCZ, Jet stream, El Nino-La Nina Phenomenon, Walker Circulation
5. Humidity, Condensation, Precipitation
   Hydrological Cycle, Humidity (absolute humidity, specific humidity, relative humidity), Evaporation, Condensation (cooling of air, condensation nuclei, form of condensation), Stability and Instability of Atmosphere, Fogs, Cloud (formation and classification), monsoon, Precipitation (form, type and theory), and Human Induce Precipitation
6. Air masses, Fronts, and Cyclones
7. Climatic Classification
   Microclimate, Macroclimate, Urban Heat Island, Koppen's Classification, Thornthwite's Classification
8. Atmospheric Extreme Event and Hazards
   Cyclone, Tornado, Thunderstorm, Drought, Flood, Acid Rain, Nor 'wester, Heat Wave, Cold Wave, Monsoon depression etc.
9. Bangladesh: Climate and Climatic Hazard and Signal system.

Learning Outcomes:

Students will learn:

- 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

Number of Classes: 45

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.

References:

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

Course Number and Title:
DSMHT-109 Applied Geomorphology and Tectonics

Credit and Credit Hours: 03 (45 Hours)

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. Also, earths crust can be subdivided into plates which are in motion and, hence, either colliding or moving away from each other. This motion also causes disasters like earthquake, tsunami, volcanism, landslide etc.

Specific Objectives:
The course aims at explaining the morphology of the earth and the agents that control them through certain natural processes. This course explains the major geomorphic units and their

associated hazards. The course also comprises of global tectonics and isostacy and how these trigger or amplify disasters. Moreover, the course also aims at understanding the processes, which have formed this configuration based on the evidences and try to predict possible hazards that may occur. Lastly, the course also incorporates the subdivisions of geomorphological units, tectonic units, geological units and the soils types of Bangladesh.

Course Contents:

1. Basic concepts of Geomorphology, Natural agents (Glaciers, Running water and Wind) sculpturing the Earth's surface and their origin, Earth surface processes- Fluvial, Glacial, Aeolian and Coastal processes and their morphology. Major geomorphic features of the earth (Mountains, Rivers, Floodplains etc).
2. Global Tectonic: Continental drift, Seafloor spreading, Plate tectonics,
3. Isostasy
4. Deformation of Earth Surface and Structural Landforms: folds and faults, landform controlled by folds, landform controlled by faults, criteria for faulting, landforms of major structural units.
5. Geomorphic Markers: Planar geomorphic markers (lacustrine shorelines, deltas, river terraces, alluvial fans, erosional surface), linear geomorphic markers (rivers, ridges, glacial moraines, lava flows, debris flow, landslide).
6. Stream Types and their relation to tectonics as well as lithology.
7. Geomorphic and tectonic units of Bangladesh; Geology of Bangladesh.

Learning Outcomes:

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

- 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
- Geomorphic markers to identify changes in the landform which can be an evidence of certain disasters
- The classification of different units of Bangladesh, i.e. geological, pedological, tectonic etc.

References:

1. Billings M.P. (1972) Structural Geology. 3rd Edition. Prentice Hall. US.
2. Brierley G. &Fryirs K. (2005) Geomorphology and River Management: Applications of the River Styles Framework. Blackwell publishing. UK.
3. Boggs S. (2012) Principles of Sedimentology and Stratigraphy. Prentice Hall. US.
4. Carlson D., Plummer C. et al. (2012) Physical Geology. McGraw-Hill Companies. US.
5. Douglas W.B. and Anderson R.S. (2011) Tectonic Geomorphology. 2nd Edition. Wiley-Blackwell. US.

6. Hugget R.J. (2007) Fundamentals of Geomorphology. Routledge Publication
7. Imam B. (2005) Energy Resources of Bangladesh. University Grants Commission. Dhaka. Bangladesh.
8. Khan F.L. (1991) Geology of Bangladesh. The University Press Limited. Dhaka. Bangladesh.
9. Selby M.J. (1985) Earth's Changing Surface. Clarendon Press. Oxford. UK.
10. Tarbuck E.J., Lutgens F.J., et al. (2010) An Introduction to Physical Geology. Prentice Hall. US.
11. Thornbury W.D. 1961. Principles of Geomorphology. Wiley-Blackwell. US.
12. Philip Kearey et al (2009) Global Tectonics, Wiley-Blackwell Publication

Number of Classes: 45 (One hour each, totaling 45 lecture hours).

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.

Course Number and Title:
DSMHT: 110 Introduction to Hydrology and Water Resources

Credit and Credit Hours: 02 (30 Hours)

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.

Course Contents:

1. Introduction; Scope; Hydrologic Cycle; Precipitation, Runoff, Evaporation, Evapotranspiration and Infiltration Processes and their Measurements; Hydrograph; Unit Hydrograph; terminology of Drainage Basin-Quantitative Evaluation; Stream flow type and Velocity; River-Stage and Discharge
2. Introduction; 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.
3. Chemistry of Groundwater; Isotope Hydrology. Groundwater contamination and Pollution—Sea-water Intrusion in Coastal Aquifers, Arsenic contamination, Industrial pollution.
4. Groundwater and Surface water Resources of Bangladesh: IWRM for DRR aspects.

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

References:

1. Chow V.T. (1964) Handbook of Applied Hydrology. McGraw Hill. US.
2. Kazmann R.G. (1972) Modern Hydrology. Joana Cotler Books. New York. US.
3. Matthess G. (1982) The Properties of Groundwater. Wiley-Blackwell. US.
4. Raghunath H.M. (1990) Groundwater Hydrology. Wiley Eastern Ltd. India.
5. Todd D.K. (1980) Groundwater Hydrology. 2nd Edition. Wiley-Blackwell. US.
6. United Nations Development Program (UNDP) (1982) Ground Water Survey: The Hydrogeological Conditions of Bangladesh. UNDP Technical Report. US.
7. Ward and Robinson (1975) Principals of Hydrology, Mcgraw Hill Publication

Number of Classes: 30 (One hour each, totaling 30 lecture hours).

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.

Course Number and Title:
DSMHT: 111 Society and Disasters

Credit and Credit Hours: 02 (30 Hours)

Introduction to the Course:

Globally, disasters are on the increase, 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 disaster management in a comprehensive and holistic manner from the societal perspectives. In the first half of the course students will examine different theories and frameworks for understanding the link between society and disasters. 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 from Bangladesh and all around the world.

Specific Objectives:

This course, Society and Disasters tends to:

1. Provide students with critical perspectives to examine this natural disasters/society interface.
2. Focus on natural and manmade disasters being better understood as social disasters with natural triggers.
3. Develop an understanding how forms of social vulnerability to hazards emerge and shape subsequent disaster impacts.
4. Examine how disasters are disrupting events that can critically jolt and shape future social, economic and political outcomes in the context of governance and politics.

Course Contents:

1. Evolution of Human Society, Civilization and Disaster, Agricultural Revolution, Industrial Revolution
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.
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.
4. Demographic Issues and Disaster: Demographic Variables, Population Growth, Composition, Distribution, Migration, Population Management and their Significance in Disaster.
5. Socio-Political Victims and Resources of Disasters: Disaster Effects on Poor, Women, Children, Elderly, Disabled, Marginal, Minority Groups and Socially Excluded Population. Interventions of Family, Neighbors, Kin, Community and Religion. Local Government, Voluntarism, Social Security and Safety Net Programs; Disaster issues in Academic Curricula and Media. Resource Mobilization and Resilience.
6. Psycho-Social Interventions in Disaster: Psycho-social Crisis and Conflict, Crisis Management. Support to Displace Population, Population with Special Needs and Victim Support Groups. Pro-active Disaster Management Approaches.
7. Bangladesh Studies: Evolution of Bangladeshi Society, Natural & Human Resources of Bangladesh, Government and Politics, Settlements (Urban and Rural)

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 disaster management.
- 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 the different societal perspectives.
- Explore and critically evaluate different approaches, in order to distil ‘best practice’ in terms of possible response/s to different kind of emergencies.

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. & 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.

Number of Classes: Total of 30 lecture classes of 1 hour duration.

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.

Course Number and Title:
DSMHT: 112 Basic Statistics and Probability for Disaster Sciences

Credit and Credit Hours: 02 (30 Hours)

Introduction to the Course:
This course provides an elementary introduction to probability and statistics with applications. Topics include: descriptive statistics, random variables, correlation and regression, probability distributions, Bayesian inference, hypothesis testing.

Specific Objectives:
Students completing the course will be able to:

Statistics:

- Create and interpret scatter plots and histograms.
- Understand the difference between probability and likelihood functions, and find the maximum likelihood estimate for a model parameter.

- Do Bayesian updating with discrete priors to compute posterior distributions and posterior odds.
- Do Bayesian updating with continuous priors.
- Construct estimates and predictions using the posterior distribution.
- Find credible intervals for parameter estimates.
- Use null hypothesis significance testing (NHST) to test the significance of results, and understand and compute the p-value for these tests.
- Use specicific significance tests including, z-test t-test (one and two sample), chi-squared test.
- Find confidence intervals for parameter estimates.
- Compute and interpret simple linear regression between two variables.
- Set up a least squares fit of data to a model.

Probability:

- Use basic counting techniques (multiplication rule, combinations, permutations) to compute probability and odds.
- Compute conditional probabilities directly and using Bayes' theorem, and check for independence of events.
- Set up and work with discrete random variables. In particular, understand the Bernoulli, binomial, geometric and Poisson distributions.
- Work with continuous random variables. In particular, know the properties of uniform, normal and exponential distributions.
- Know what expectation and variance mean and be able to compute them.
- Understand the law of large numbers and the central limit theorem.
- Compute the covariance and correlation between jointly distributed variables.

Course Contents:

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.
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.
3. Characteristics of Statistical Data: measures of location, central tendency and their types, dispersion, skewness, kurtosis and their properties, moments, box-and-whiskers plots.
4. 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.

5. 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.
6. 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.

Learning Outcomes: Upon successful completion of this course, students will:

- Understand descriptive and probabilistic statistics
- Organize data and can describe its features.
- Able to select appropriate statistical methods for a given problem

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.

Number of Classes: 20

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.

Course Number and Title:
DSMHT: 113 Applied Linear Algebra

Credit Hours: 02 (30 Hours)

Introduction to the Course:
This course studies will provide the knowledge of linear domain, nature of liner problem, different method of solving linear problems.

Course Objectives:

1. To use mathematically correct language and notation for Linear Algebra.
2. To become computational proficiency involving procedures in Linear Algebra.
3. To understand the axiomatic structure of a modern mathematical subject and learn to construct simple proofs.
4. To solve problems that apply Linear Algebra to Physics, Economics and Engineering including Disaster Science and Management.

The topics that will enable this course to meet its objectives are:

1. the basic arithmetic operations on vectors and matrices, including inversion and determinants, using technology where appropriate;
2. solving systems of linear equations, using technology to facilitate row reduction;
3. the basic terminology of linear algebra in Euclidean spaces, including linear independence, spanning, basis, rank, nullity, subspace, and linear transformation;
4. finding eigenvalues and eigenvectors of a matrix or a linear transformation, and using them to diagonalize a matrix;
5. the common applications of Linear Algebra, possibly including Markov chains, areas and volumes, Cramer's rule, the adjoint, and the method of least squares;
6. the nature of a modern mathematics course: how abstract definitions are motivated by concrete examples, how results follow from the axiomatic definitions and are specialized back to the concrete examples, and how applications are woven in throughout. This course will present various "characterization" theorems (eg. characterizing isomorphic finite-dimensional vector spaces by their dimension and characterizing invertible matrices by various criteria);
7. basic proof and disproof techniques, including mathematical induction, verifying that axioms are satisfied, standard "uniqueness" proofs, proof by contradiction, and disproof by counterexample.

Course Contents:

1. Matrices and Determinants:Notion of matrix. Types of matrices. Matrix operations, laws of matrix Algebra. Determinant function. Properties of determinants. Minors, Cofactors, expansion and evaluation of determinants. Elementary row and column operations and row-reduced echelon matrices.
2. System of Linear Equations:Linear Equations. System of linear equations (homogeneous and non-homogeneous), Solution of System of Linear Equations using Different Methods, Application of system of linear equations.
3. Vector Spaces:Vectors in R^n and C^n : Inner product. Norm and distance in $R\pi$ and $C\pi$. Abstract vector space over R^n and C^n. Subspace. Sum and direct sum of sub spaces. Linear dependence/independence of vectors; basis and dimension of vector spaces. Row and column space of matrix; rank of matrices. Solution spaces of systems of linear equation.
4. Linear Transformations. Kernel and image of a linear transformation and their properties. Matrix representation of linear transformations.
5. Eigenvalues and Eigenvectors. Diagonalization. CayleyHamiton theorem. Applications.

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.
- One advantage linear algebra has over some other subjects for introducing abstract thinking, is that much of the material has a geometric interpretation. In low dimensions, one can "visualize" algebraic results, and happily, the converse is also true: linear algebra helps develop your geometric instinct. The geometric intuition you already have will be complemented by an "algebraic picture", one that will allow you, with practice, to "see" in higher dimensions that are inaccessible to our normal senses.

References:

1. Anton H. and Rorres C. (2000) Linear Algebra with Applications. 10th Edition. Wiley-Blackwell. US.
2. Greub W.H. (1967) Linear Algebra. Springer. Netherlands.
3. Lipschutz S. & Lipson M. (2012) Linear Algebra. 5th Edition. McGraw-Hill. US.

Number of Classes: 20

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.

Course Number and Title:
DSMHL: 114 Geodetic Surveying and Mapping

Credit: 02 (Two)

Introduction to the Course:

Nowadays mapping and surveying are one of the important lab techniques to reconnaissance field condition to design a project. This course introduces surveying methods and techniques required to apply theoretical knowledge acquired in DSMHT 102, 109 (Theory) courses.

Specific Objectives:

This course enables students to how to carry out different types of survey and mapping techniques. This will familiarize them with various types of survey equipment, their setups, and principal of operational procedures.

Course Contents:

1. Definition of Surveying: Type of Survey: (Geodetic, Plane)

2. Surveying as the Basis of Large Scale Maps: The Framework of Topographical Maps; Principles of Triangulation; Types of Triangulation (Topographical, Principal, Major and Minor)

3. Methods of Surveying: Chain and Tape: Equipments; 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; Equipments, Method of Preparation; Open and Closed , Traverse Surveying; Advantages and Disadvantages of Plane Table Survey, Prismatic Compass; Equipments, Data Recording and Plotting; Advantages and Disadvantages of the Survey

4. Introduction to Total Station Survey: Introduction to the machine; Setting up the machine; Methods of Angle Measurement; Methods of Coordinate Measurement; Principles of Operation.

5. Cross section and map (topographic, geologic and geomorphic) reading.

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

1. Work with total station in the field with setting up the machine.
2. Survey with topographical, geologic and geomorphic maps
3. Understand the framework of Topographical Maps; Principles of Triangulation; Types of Triangulation.
4. Perform methods of surveying such as traversing, chain and tape, plane table, plotting etc.
5. Able to perform angle measurement, coordinate measurement and do the cross sections of maps.

Number of Classes: 30

Instructional Strategies: Lecture, Presentation, Hands-on Exercise with Total station and Maps, Assignment, Field Work.

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. & 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.

Course Number and Title:
DSMHF: 115 Field Works and Reporting

Credit: 02 (30 credit hours; 100 marks)

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:

The course builds on theory and practical courses taught in the 1st semester. The theory part of the course focuses on the conceptualization of a fieldwork; how to conduct the research work collecting and analyzing the data recorded and registered in the a field. It also encompasses detailed lectures on sedimentary depositional environment, interpretation of different lithology and attitude of the beds to identify the stratigraphy and regional structures.

During the fieldwork, the student is to measure the attitudes (Dip and Strike) of sedimentary beds, identify the lithology and relevant geological environment. The students are to interpret the data to identify structure(s) create a geological map and develop the local stratigraphy based on the collected information. The student will also identify the general geomorphology, natural drainage system, populations, and overall settlement pattern as well as general socio-economic conditions of the dwellers. The field also incorporates identification of the hazards within the study area as well as assesses different social parameters using tools learnt in the semester.

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:
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 2nd Semester 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. Black J.A. & 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. & Williams M. (1996) An Introduction to the Philosophy of Social Research. UCL Press. UK.
5. Moser C.A. &Kalton G. (1971) Survey Methods in Social Investigation. 2nd Edition. Heinemann Educational. UK.

Course Number and Title:
DSMHT 201: Applied Differential Equation

Credit and Credit Hours: 02 (30 Hours)

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's 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 Course 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.

Course Contents:

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).
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 1^{st} order differential equations
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).
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.

References:

1. Brauer F. and Nohel J.A. 1986. Introduction to Differential Equations with Applications. Harper and Row. US.
2. Boyce W.E. Elementary Differential Equations and Boundary Value Problems, 9^{th} Edition, Willey and Sons
3. S.L. Ross. (1974) Differential Equation. Wiley-Blackwell. US.
4. Zill D.G. (2009) A First Course in Differential Equations with Applications. 9^{th} Edition. Cengage Learning. India.

Number of Classes: 20

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.

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

Credit and Credit Hours: 02 (30 Hours)

Introduction to the Course:

Among the different types of disaster, the geological and hydrometeorological 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.

Course Contents:

1. Introduction to Geological and Hydro-meteorological Hazards.
2. Geological Hazards
   Earthquakes (Causes, types and effects of Earthquakes) Tsunami &Seiches(Naming Tsunami Generation, Velocity and height, coastal effects and vulnerability) Volcanoes(Origin & types of volcanic hazards, volcanic eruptions and products)Mass Movement Dry (Factors controlling downslope movement; causes, classification and effects of mass movements), Land subsidence and sinkholes
3. Hydro-meteorological Hazard
   Riverbank Erosion (Causes and effects, early warning), Coastal Erosions (Coastal geomorphic features, beach erosion and replenishment), Flood: Definition, Causes, Types, Flood Mitigation Measures (structural, non-structural), Flood Action Plan (FAP), Mass movement (wet): **(**Landslide, Avalanche and subsidence: causes, classification, measurement and effects), Salinity Intrusion, Arsenic Contamination
4. Geological & 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
- Existing policies to address these hazards

References:

1. Bell F.G. (1999) Geological Hazards. CRC Press. US.
2. Bird E. (2008) Coastal Geomorphology. 2nd Edition. Wiley-Blackwell. US.
3. Hyndman D. and Hyndman D. 2010. Natural Hazards and Disasters. 3rd Edition. Cengage Learning. India.
4. Kusky T.M. (2005) Encyclopedia of Earth Sciences. Infobase Publishing. New York. US.
5. Lutgens F.K. &Tarbuck E.J. (2013) Earth: An Introduction to Physical Geology. 11th Edition. Pearson. USA.
6. Plummer C., Carlson D. &Hammersley L. (2014) Physical Geology. 15th Edition. McGraw Hill. US.
7. Westen et al (2011), A Guidebook of Multi-hazard Risk Assessment, Public Works

Number of Classes: 30 (One hour each, totaling 30 lecture hours).

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.

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

Credit and Credit Hours: 02 (30 Hours)

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.

Course Contents:

1. Climatic and Meteorological Hazards: origin, life cycle, types, effects and measurement:
   Extreme temperature, Drought, Fog, Polar Vortex, Wildfire (forest fire & land fire), Tropical Cyclone, Extra-tropical Cyclone, Local Severe Storms: Thunderstorms, Nor 'westers, Tornadoes.
2. Climatic and Meteorological Data Source (National and International): Bangladesh Meteorological Department (BMD) and Bangladesh Space Research and Remote Sensing Organization (SPARRSO), WMO, etc.
3. Climate Change
   a. Introduction to Climate Change: Definition, Scope, Multidisciplinary Approaches
   b. Science of Climate Change: Milankovitch Cycle, Natural and Anthropogenic Factors, Greenhouse Gases (GHG) and Greenhouse Effects
   c. Evidence of Climate Change: Past (Proxy Data), Present (Human Perception, Marker Species, Instrumental Data), Future (Climate Modeling)
   d. Global Atmospheric & Oceanic Circulation: General Circulation Model, El-Nino and La-Nina and Climate Change
   e. 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.)
   f. Response to Climate Change: Adaptation and Mitigation Measures, Loss and Damage Issue in Global Climate Change Dialogue
   g. National, Regional and International Response to Climate Change: International Treaties, Protocols, IPCC, and UNFCCC (COP: historical development, success and failure),
   h. 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
   i. 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: student will learn

- 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

Number of Classes: 30

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.

References:

1. Asian Development Bank (ADB) (1994) Climate Change in Asia: Bangladesh Country Report. Manila. Philippines.
2. Bankoff G., Frerks G.&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., SchubertW.&Somerville 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. & Cook J. (2013). Climate Change Science: A Modern Synthesis. Volume - 1. Springer. Netherlands.
8. Hyndman D. and Hyndman D. (2010). Natural Hazards and Disasters. 3rd Edition. Cengage Learning. India.
9. Knight C.G. &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. PrayagPustakBhawan, Allahabad, India
13. Willium James Burroughs (2007) Climate Change-A Multi-disciplinary Approach, Cambridge University Press

Course Number and Title:
DSMHT 204: Chemical, Industrial and Technological Hazards

Credit and Credit Hours: 02 (30 Hours)

Introductionto the Course:
Human induce 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.

Course Contents:

1. Introduction to manmade hazards.
2. Types: engineering failure, fire hazard, nuclear hazard, chemical explosion, water logging, civil unrest & war, transportation accident, mine hazards, blow out, terrorism; Causes and their effects.
3. Flammable chemicals; Ignition and propagation of a flame front, Control measures, Fire extinguishment, Fire precautions.
4. Reactive chemicals; Water-sensitive chemicals, Toxic hazards from mixtures, Reactive hazards from mixtures, Oxidizing agents, Explosive chemicals, General principles for storage, Hazards arising in chemicals processing.
5. Radioactive chemicals; Hazards, Types of radiation, Control measures
6. Environmental Pollution, Hazardous Wastes
7. Reuse, Recycling, Resource Recovery
8. Industrial hazards, Work place, Work place health and safety
9. World's Worst Manmade & Technological Hazards: 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…
10. Manmade Hazards: Bangladesh Context, Addressed Part in National Policies

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. Ruth F. Weiner (2003) Environmental Engineering. Elsevier Publication

Leaning 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.

Total of 30 lecture classes of 1 hour duration.

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.

Course Number and Title:
DSMHT 205: Biological Hazards and Public Health

Credit and Credit Hours: 02 (30 Hours)

Introduction to the Course:

This course encompasses biological hazards, epidemic and pandemics. Identification, personal protective equipment, symptoms of exposure and abatement of these 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 the disaster management 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, environmental issues, emergency preparedness, global issues, and public health research.

Specific Objectives:
This course, Biological Hazards and Public Health tends to:

1. Provide Describe the basic concepts, types and causes behind biological hazards.
2. Apply the concepts of bio/medical-safety and risk assessment to analyze some practical problems of human epidemics, livestock or animal epidemics, plants and agricultural epidemics.
3. Select relevant knowledge elements obtain solutions for some common problems towards control and monitor of bio-related hazards, which is relevant in Disaster Management.
4. Demonstrate reflective practice in the areas of Public Health.

Course Contents:

1. Introduction, types and causes behind biological hazards.
2. Human epidemics, livestock or animal epidemics, plants and agricultural epidemics.
3. Biological agents- Bacteria, Virus, Fungi, Zoonoses etc.
4. Psychosocial hazards-disaster trauma, occupational stress, workplace violence.
5. Public Health and its role in Disaster Management: Public health systems, Health promotion and disaster prevention, integrated approach.
6. Areas of Public Health: Community and Family Health, Global Health, Environmental and Occupational Health, Epidemics.
7. Identifying Socio-Psychological Needs in Mass Emergency: Global assessment of Needs and Priorities, Area specific requirements, Psychological Characteristics of Disaster Management, Different psychological considerations in natural and manmade disasters.
8. Environmental Impacts on Reproductive Health and Fertility
9. Health Policy and Management: Public Health Practices, Public Health Emergencies in large populations

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 associated with hazardous biological agents.
- Describe how to carry out a biological agents risk assessment in the public health and disaster management context.
- Analyze the measures used to safeguard Public Health Practices during Emergencies in large populations.

References:

1. Adamowski K. (1998) Creating Excellence in Crisis Care. Wiley-Blackwell. US.
2. Coppola D.P. (2007) Introduction to International Disaster Management. Elsevier. UK
3. Fallon L.F. &Zgodzinski E. (2011) Essentials of Public Health Management. 3rd Edition. Jones & Bartlett Learning. US.
4. Hodgkinson P.E. & Stewart M. (1998) Copying With Catastrophe: A Handbook of Post Disaster Psychological After Care. Routledge. UK.
5. Miller J. (2012) Psychosocial Capacity Building in Response to Disasters. Columbia University Press. US.
6. Noji E.K. (1996) The Public Health Consequences of Disasters. Oxford University press. UK.
7. Tracery J. Woodruff (2010) Environmental Impacts on Reproductive Health and Fertility, Cambridge Press.

Number of Classes: Total of 30 lecture classes of 1 hour duration.

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.

Course Number and Title:
DSMHT: 206 Introduction to Computer Sciences and Programming

Credit and Credit Hours: 02 (30 Hours)

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.

Course Content:
Introduction to programming concept: Algorithms, flowchart and pscudocods, 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.

Python concept: data strictures, Scripting, Math and computation, algorithm development, data acquisition, data analysis, exploration, and visualization

Learning Outcomes:
Upon successful completion of this course, the student will have reliably demonstrated the ability to:

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

References:

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

Addition -MathLab , 2005.

Number of Classes: 20

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.

Course Number and Title:
DSMHL: 207 Hazard Analysis Lab

Credit: 02 (Two)

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.

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.

Course Contents:
Frequency analysis, Intensity and Magnitude Determination, Hazard Profiling, Analysis of Physical Hazard Parameters, F-N Curve, Technological Hazard 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.

References:

1. Bankoff G., Frerks G.&Hilhorst D. (2004) Mapping Vulnerability: Disasters, Development, and People. Earthscan. UK.
2. Barrie Pittock (2009) Climate Change: the science, impacts and solutions, CSIRO Publishing.
3. Cook, K.H. (2013) Climate Dynamics. Princeton University Press.
4. Donner L., Schubert W.&Somerville R. 2011. The Development of Atmospheric General Circulation Models: Complexity, Synthesis and Computation. Cambridge University Press. UK.
5. Bell F.G. (1999) Geological Hazards. CRC Press. US.
6. Bird E. (2008) Coastal Geomorphology. 2nd Edition. Wiley-Blackwell. US.
7. Hyndman D. and Hyndman D. 2010. Natural Hazards and Disasters. 3rd Edition. Cengage Learning. India. Pettijohn F.J. (1983) Sedimentary Rocks. 3rd Edition. Harpercollins. UK.
8. Read H.H. (1962) Rutley's Elements of Mineralogy. Thomas Murby and Co. UK.
9. Westen et al (2011), A Guidebook of Multi-hazard Risk Assessment, Public Works, ITC

Number of Classes: 15 (Two hour each, totaling 30 lecture hours).

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

Course Number and Title:
DSMHL 208: Environmental Pollution Lab

Credit:02 (Two)

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 DSMHT 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.

Course Contents:

1. Definition of Pollution: Type of pollutions: (Air, Water and Sound)

2. Pollution Measurement Techniques (Water): The basics of AAS measurements, hand held field equipment. Sample collection in the field, preservation and preparation for lab measurements.

2. Pollution Measurement Techniques (Air): The basics of Particulate matter, aerosol etc. measurements, hand held field equipment for sampling. Sample collection in the field, sample preservation and preparation for lab measurements.

3. Pollution Measurement Techniques (Sound/Noise): The basics of Sound/Noise pollution, their measurements, hand held field equipment. Data collection in the field, and processing for lab measurements/ analysis

Learning Outcomes:

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

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

Number of Classes: 30

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

References:

1. Richard Helmer, IvanildoHespanhol, Water Pollution Control: A Guide to the Use of Water Quality Management Principles,

2. Botkin D. B. & Keller E. A. (2000) Environmental Science: Earth as a Living Planet. 3rd Edition. Wiley-Blackwell. US,
3. Park C. C. (2001) The Environment: Principles and Application. Routledge. US.,
4. Enger E. and Smith B. (2008) Environmental Science: A Study of Interrelationship. McGraw Hill. US.
5.Richard Helmer, IvanildoHespanhol, Water Pollution Control: A Guide to the Use of Water Quality Management Principles,

Course Number and Title:
DSMHT-209 (Viva vocé)

Credit: 02 (Two)

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 Module-III of the syllabus titled "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 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 3rd Semester Exam 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:
DSMHT: 210 Seismology and Geodesy

Credit and Credit Hours: 03 (45 Hours)

Introduction to the Course:
Earthquake is the most frequently occurring and most devastating hazard till date. Seismology deals with the scientific approach towards the study of earthquakes; the propagating elastic waves and their characteristics. Coupled with geodesy, seismology helps us better understand the earthquakes, their characteristics and possible associated hazards.

Specific Objectives:
This course has the following deliverables:

1. Understanding seismicity and earthquakes
2. Learning the characteristics of earthquakes
3. Earthquake measurements and prediction
4. Synchronization with geodesy to understand the earthquakes

Course Contents:

1. Seismicity and Earthquake; Brief History of Seismology; Historical & Instrumental Seismicity; Seismic Waves
2. Wave Propagation: waves in unbounded area, waves in a semi-infinite body, waves in layered body
3. Seismogram & Seismographs; Earthquake Magnitude and Intensity; Earthquake Magnitude, Depth & Location Calculation; Magnitude Saturation
4. Seismic Sources: Isotropic, Double Couple and CLVD

5. Focal Mechanism; Moment Tensor and Moment Tensor Inversion
6. Attenuation: Geometrical Spreading, Scattering, Multi-pathing, anelasticity; Green Function; Anisotropy
7. Earthquake Prediction; Electromagnetic Fields generated by Earthquakes; Paleoseismicity; Earthquake-related Hydrological and Geochemical Changes; Seismicity In and Around Bangladesh
8. Seismic Sensors: Seismometers, Accelerometers; Sensor Calibration; Seismic Networks and Data Formats
9. 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
10. Integration of Datasets: Seismology & 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

References:

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

Number of Classes: 30 (15 One hour classes and 15 two hour classes, totaling 45 lecture hours).

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.

Course Number and Title:
DSMHT: 211 Fundamentals of Built Environment

Credit and Credit Hours:04 (45 Hours)

Introduction to the Course:

This course highlights the overall concept of the built environment and impacts of natural and man-made disasters on it. The contents of the course includes 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.

Course Contents:

1. Built Environment: Introduction and its components.
2. Structural forms and systems for buildings, bridges, communication and transmission structures.
3. Types of construction materials - steel, reinforced and prestressed concrete etc.
4. Physical and chemical properties of built materials.
5. Loads on structures; types of foundation, concept of bearing capacity, settlement.
6. Impact of Built Environment on Health, sustainable design, towards environment friendly built environment.
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.
8. Building Construction Considering Energy Efficiency and Safety

Learning Outcomes:

On successful completion of the course students will be able to:

6. Understand the build environment and its components.
7. Know the properties of engineering materials
8. Evaluate different type of loads imposed on a structures.

9. Apply the BNBC in designing and building the infrastructures to make it resilient
10. Incorporate the safety and security issues in the built environment and how to apply build back better concept.

Number of Classes: 45

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. Question and answer sessions, 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.

References:

1. Bangladesh Housing and Building Research Institute. 1993. Bangladesh National Building Code.
2. Chan A.P.C. & Cheung E. 2014. Public Private Partnership in International Construction. Taylor & 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. &Jain 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 & Risk reduction. 2nd Edition. Wiley-Blackwell. US.

Course Number and Title:
DSMHT: 212 Numerical Analysis and Sampling Techniques

Credit and Credit Hours: 03 (45 Hours)

Introduction to the Course:

This course will introduce the statistical aspects associated with the design and analysis of sample surveys, and the principles and methods to design survey sampling schemes. Basic theory underpinning survey inference will be introduced, focusing on methodology for survey-based estimation for population totals and related quantities for some standard sample designs

The course will develop numerical methods aided by technology to solve algebraic, transcendental, and differential equations, and to calculate derivatives and integrals. The course will also develop an understanding of the elements of error analysis for numerical methods and certain proofs. The course will further develop problem solving skills.

Specific Objectives:

Sampling Techniques:

1. Understand the importance of sampling and how results from samples can be used to provide estimates of population characteristics such as the population mean, the population standard deviation and / or the population proportion.
2. Know what simple random sampling is and how simple random samples are selected.
3. Understand the concept of a sampling distribution.
4. Understand the central limit theorem and the important role it plays in sampling.
5. Specifically know the characteristics of the sampling distribution of the sample mean and the sampling distribution of the sample proportion.
6. Learn about a variety of sampling methods including stratified random sampling, cluster sampling, systematic sampling, convenience sampling and judgment sampling.

Numerical Analysis:

1. solve an algebraic or transcendental equation using an appropriate numerical method
2. approximate a function using an appropriate numerical method
3. solve a differential equation using an appropriate numerical method
4. evaluate a derivative at a value using an appropriate numerical method
5. solve a linear system of equations using an appropriate numerical method
6. perform an error analysis for a given numerical method
7. prove results for numerical root finding methods
8. calculate a definite integral using an appropriate numerical method
9. code a numerical method in a modern computer language

Course Contents:

Sampling Techniques

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.
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.
3. Systematic sampling: estimating population characteristics, systematic sampling in some special populations.
4. Stratified Sampling: Definition and basic ideas, theory of stratified sampling, allocating observations to strata, defining strata.

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

Numerical Analysis

1. Concept of Numerical Mathematics: Difference table, finite difference operators, interpolation and extrapolation.
2. Interpolation and inverse interpolation: uses of Newton's forward and backward interpolation formula; Lagrange's formula, subdivision of intervals, divided differences.
3. Numerical integration: Simpson's rule, Weddle's rule, trapezoidal rule, Gauss's quadratic formulae.
4. Solution of transcendental equations: method of interpolation or of false position, Newton-Raphson method, method of iteration.

Learning Outcomes:

Upon successful completion of this course, the student will have reliably demonstrated the ability to:

Sampling Techniques:

- Understand the importance of sampling and how results from samples can be used to provide estimates of population characteristics such as the population mean, the population standard deviation and / or the population proportion.
- Know what simple random sampling is and how simple random samples are selected.
- Understand the concept of a sampling distribution.
- Understand the central limit theorem and the important role it plays in sampling.
- Specifically know the characteristics of the sampling distribution of the sample mean and the sampling distribution of the sample proportion.
- Learn about a variety of sampling methods including stratified random sampling, cluster sampling, systematic sampling, convenience sampling and judgment sampling.

Numerical Analysis:

- solve an algebraic or transcendental equation using an appropriate numerical method
- approximate a function using an appropriate numerical method
- solve a differential equation using an appropriate numerical method
- evaluate a derivative at a value using an appropriate numerical method
- solve a linear system of equations using an appropriate numerical method
- perform an error analysis for a given numerical method
- prove results for numerical root finding methods
- calculate a definite integral using an appropriate numerical method

- code a numerical method in a modern computer language.

References:

Texts (Sampling Techniques)

1. Cochran W.G. (1977) Sampling Techniques. 3rd Edition. Wileyl. US.
2. Levy P.S. and Lemeshow S. (2008) Sampling of Populations: Methods and Applications. 4th Edition. Wiley-Blackwell. US.

Texts (Numerical Analysis)

1. Scarborough J.B. (1955) Numerical Mathematical Analysis. Johns Hopkins Press. USA.
2. Hildebrand F.B. (1987) Introduction to Numerical Analysis. Dover Publications. USA.

Number of Classes: 30

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.

Course Number and Title:
DSMHT: 213 Principles of Remote Sensing

Credit and Credit Hours: 02 (30 Hours)

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

Course Contents:

1. Introduction; Scope; Concepts and Principles of Remote Sensing; Air- and Space-borne.
2. Electromagnetic Radiation and Its Interaction with Atmosphere and Earth Surface
3. Sensors, Sensor Types and Sensor Characteristics
4. Pre-processing: Visualization and Radiometric Operation; Image Enhancement, Correction Data for Imperfection of Sensor, Atmospheric Correction
5. Visual Image Interpretation; Digital Image Classification
6. Rectification and Terrain Analysis; Georeferencing, Geocoding , DEM & DSM
7. Remote sensing application in Disaster Science & Management

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

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.

Number of Classes: 30 (One hour classes, totaling 30 lecture hours).

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.

Course Number and Title:
DSMHT: 214Geographic Information Systems (GIS) and Database Management

Credit and Credit Hours: 03 (30 Hours)

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. Now a days GIS is playing a big role in the field of Disaster Risk Reduction 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. This course also is a beginning of learning of spatial and non-spatial database concept.

Course Contents:

1. Introduction to GIS
   Development of GIS, Scope
2. Data and Information
   Data Type, Typology: Spatial Relationship
3. Map Projection and Coordinate System
   Reference Surface for Mapping, Map Projections, Coordinate Transformations
4. Data Entry and Preparation
   Data Acquisition, Digitizing from Existing Documents, Data Preparation
5. Data Retrieval and Database Management
   Tupple Selection, Attribute Projection, Query Definition: SQL & JSP
6. Network and Network Analysis
7. Vector Analysis
   Overlay: Intersect, Clip & Overwrite; Neighborhood Operation: Buffer and Thiessen Polygon
8. Raster Analysis

Measurement: Location, Distance, Area Size, Classification, Overlay: Arithmatic Operation, Comparison Operators, Logical Operators, Conditional Expressions, Decision Tables

9. Data Quality: Accuracy & Precision
10. Visualization and Presentation
11. Application of GIS in Disaster Management

Learning Outcomes:

After the completion of the course students will be able to:

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

Number of Classes: 45

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. Question and answer sessions, 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.

References:

1. Bonham-Carter G.F. (1991) Geographic Information Systems for Geoscientists: Modeling with GIS. Elsevier. UK.

2. Brimicombe A. (2009) GIS, Environmental Modeling and Engineering. 2nd Edition. CRC press. US.
3. Campagna M. (Ed.) 2006. GIS for Sustainable Development. CRC press. US.
4. Decker D. 2001. GIS Data Sources. Wiley-Blackwell. US.
5. Healey R.G. (1991) Database Management Systems. In Manguire D.J. et al (ed.). Geographical Information Systems: Principles and Technical Issues. Wiley-Blackwell. US.
6. ITC (2010) A Core Book of Geo-information Science and Earth Observation: A System based Approach.

Course Number and Title:
DSMHL: 215 Remote Sensing Lab

Credit: 02 (Two)

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.

Course Contents:
- Data acquisition
- Pre-processing: Visualization and Radiometric Operation; Image Enhancement, Correction Data for Imperfection of Sensor, Atmospheric Correction
- Visual Image Interpretation; Digital Image Classification
- Rectification and Terrain Analysis; Georeferencing, Geocoding, DEM & DSM
- Data Analysis
- Data Interpretation
- Data Visualization
- Remote sensing application in Disaster Science & Management

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

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.

Number of Classes: 15 (Two hour each, totaling 30 lecture hours).

Instructional Strategies: Lecture; Presentation; Hands-on study; online learning, software learning

Course Number and Title:
DSMHL: 216 GIS Lab.

Credit: 02 (Two)

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 DSMHT 214 (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).

Course Contents:

1. Introduction to Desktop and Online GIS Application (ArcGIS, QGIS, Google Earth, OSM)
2. Projection and Coordinate System
3. Georeferencing
4. Working with Attribute Data
5. Creating Spatial Data (Digitization, GPS Survey, Google Earth / OSM)
6. Data Editing
7. Geoprocessing
8. Spatial Analysis
9. Map Presentation
10. Database and Table
11. GIS Application in Disaster Management

Learning Outcomes:

Accomplishing hands-on exercise in the GIS Lab, students will be conversant to –

- 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.

Number of Classes: 30

Instructional Strategies: Lecture, Presentation, Hands-on Exercise with GIS Software, Assignment, Field Work.

References:

1. ArcMap Tutorial – ESRI
2. ArcGIS Help - ESRI
3. QGIS User Guide – Open Source
4. Spatial Analyst Tutorial - ESRI
5. …

Course Number and Title:
DSMHF: 217 Field Works and Reporting

Credit: 02 (30 credit hours; 100 marks)

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, usually in Gaibandha district, a flood prone as well as riverbank erosion prone area 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.

Course Contents:

The course builds on theory and practical courses taught upto the 4th Semester with an emphasis on different hazard assessment, remote sensing, field investigation and GIS tools for disaster 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
- 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:

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 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 2nd Semester 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.

Course Number and Title:

DSMHT: 301 Mitigation, Prevention and Preparedness

Credit and Credit Hours: 04 (45 Hours)

Introduction to the Course:

This course is for introducing student with the concept of disaster mitigation, prevention and preparedness aspects for building a resilient community. This includes hazard specific mitigation, preparedness measures; structural and non-structural mitigation options.

Specific objectives:

This course is to make students familiar with disaster mitigation, prevention and preparedness options and methods for different hazards.

Course Contents:

1. Mitigation and Preparedness for Resilient Communities, Mitigation Strategies, the Value of Mitigation and Preparedness.
2. Preparedness Activities: the role of preparedness in the Disaster Management Cycle, resource relevant to preparedness, obstacles to preparedness, government preparedness (planning, exercise, training, equipment etc), public preparedness (emergency awareness and education, early warning, media as a public educator)
3. Mitigation Measures; resources relevant to mitigation, types of mitigation (structural and non-structural), guiding principles of mitigation, assessing and selecting mitigation options, problem areas of mitigation, requirement of effective mitigation, incorporating mitigation into development and relief projects.
4. Hazard Specific Mitigation and Preparedness Measures.

Learning Outcomes:

On successful completion of the course students will be able to:

- Understand the mitigation, prevention, preparedness, and adaptation.
- Apply structural and non-structural mitigation options for mitigating different disaster impact.

- Analyze the hazard specific situation to select appropriate preparedness and mitigation measures.
- Evaluate the post-disaster performance of applied preparedness and mitigation initiatives.

Number of Classes: 45

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. Question and answer sessions, 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.

References:

1. Carter W.N. 1991. Disaster Management: A Disaster Managers Hand Book. Asian Development Bank. Manila.
2. Coppola D.P. & Maloney E.K. (2009) Communicating Emergency Preparedness: Strategies for Creating a Disaster Resilient Public. Auerbach Publications. US.
3. Coppola D.P. (2007) Introduction to International Disaster Management. Elsevier. UK.
4. Schwab A.K., Eschelbach K. & Brower D.J. (2006) Hazard Mitigation and Preparedness. Wiley-Blackwell. US.

Course Number and Title:
DSMHT: 302 Vulnerability and Risk Assessment

Credit and Credit Hours: 03 (45 Hours)

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

Course Contents:

1. cope of Vulnerability and Risk Assessment
2. Hazard Identification Tools, Hazard Assessment, Natural and Technological Hazard Assessment
3. Vulnerability Assessment, Components and Characteristics of Vulnerability, Conceptual Frameworks of Vulnerability, Vulnerability Assessment Methods.
4. Elements at Risk, Types of Elements at Risk, Exposure Analysis
5. Risk Evaluation, Risk perception, Risk Transfer
6. The purpose of Risk Assessment, Qualitative and Quantitative Approach of Risk Assessment/Risk Estimation
7. Risk Modeling : Concept and Steps, Risk Modeling Tools (e.g. HAZUS, CAPRA, OpenQuake).
8. Environmental Impact Assessment (EIA), Social Impact Assessment (SIA) and Hazard Impact Assessment (HIA) Framework and Methodology
9. 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.

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

Number of Classes: 45 (15 One hour and 15 two hour classes, totaling 45 lecture hours).

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.

Course Number and Title:
DSMHT: 303 Geophysical Application: Principal and Practices

Credit and Credit Hours: 02 (30 Hours)

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 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:
1. Understanding the principles of geophysical tools
2. Behavior of earth materials under these investigations; range of different materials
3. Comparisons and complementing different tools and techniques

4. Learning different investigation tools and interpretation techniques.

Course Contents:

1. Introduction, Scope and Objectives of Geophysics, Disciplines of Geophysics: Active and Passive Methods.
2. Physical properties of earth materials: stress and strain; Young's modulus, shear and bulk modules; Poisson's ratio; P and S waves; surface waves; seismic velocity; acoustic impedance, ground acceleration etc.
3. Basic Concepts of the Seismic Method: Snell's law; wave fronts; ray paths; reflection and transmition coefficients; elastic constants.
   Seismic Refraction –Basic Theory
   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.
   Seismic Reflection-Basic Theory
   Geometry of reflection; travel-time equation; normal moveout; reflection records; seismic sections.
4. Introduction, Principles and Scope of Gravity, Magnetic, Electrical and Resistivity methods.
5. Theory and Applications of Shallow Seismic Investigation Tools: 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 management
- Principles, scope and application of different geophysical tools
- Basics of investigation tools; mobilization, mechanism, data collection, data processing and data interpretation

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.

Number of Classes: 30 (One hour each, totaling 30 lecture hours).

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.

Course Number and Title:
DSMHT 304: Geotechnical Application: Principles and Practices

Credit and Credit Hours:Credit 02 (30 Hours)

Introduction to the Course:

This Course will provide different theory and available tools in this area to deal with hazards related with earth- natural foundations for buildings, bridges, dams, reservoirs, power plants, pipelines, highways, canals, sewers, tunnels, mine adits etc.

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.

Course Contents:

1. Introduction &Scope.

2. Dynamic Soil Properties, Soil & Rock Mechanics, Measurement of Dynamic Soil Properties (Field tests & Laboratory tests), Index Properties (porosity, moisture content, Atterberg limits, Specific Gravity, Density, Unit Weight)

3. Strength of Natural Materials: Normal, Shear and Tensile Strength; Strength Measurement (Unconfined, Point Load, Tensile Strength Tests); Mohr Circles

4. Deformation and Deformation Types (elastic, plastic, brittle)

5. Soil Improvements: Densification Techniques, Reinforcement Techniques, Grouting and Mixing Techniques, Drainage Techniques, Verification of Soil Improvement, Retaining Walls

6. Geotechnical Hazards: Liquefaction, Subsidence etc.

7. Site Characterization: In situ Geotechnical Tests; Geotechnical Soil Classification

Leaning Outcomes:

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

- Measure dynamic soil properties (Both Field and Laboratory Tests), index properties.
- 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.

References:

1. Chen W.F. &Lui E.M. (2006) Earthquake Engineering for Structural Design. CRC Press. US.
2. Coduto D.P., Yeung M.C. &Kitch W.A. (2011) Geotechnical Engineering. 18th Edition. Pearson. US.

3. Kramer S.L. (1996) Geotechnical Earthquake Engineering. Prentice Hall. US.

4. Kumar K. (2008) Basic Geotechnical Earthquake Engineering. New age International Publishers. India.

5. McDowell P.W., Barker R.D., et al. (2002) Geophysics in Engineering Investigations. Geological Society of London and CIRIA. UK.

6. Paul D.K. & Sharma M.L. (2006) Earthquake Engineering. Elite Publishing House. India.

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.

Course Number and Title:
DSMHT: 305Urban and Regional Planning: Risk Mitigation Concept

Credit and Credit Hours:04 (45 Hours)

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.

Course Contents:

1. Definition, objective and scope of urban planning. Urban functions, activities and land use components. Modern principles of planning—town center, 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.

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

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.

4. Risk Components in Urban and Rural Planning

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

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?

Number of Classes: 45

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.

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:
DSMHL: 306 Disaster Statistics Lab.

Credit: 02 (30 hours)

Introduction to the Course:
In this course the student will apply their theoretical knowledge gained from DSMHT-112 and DSMHT-212 courses through computer software and programming language to gets hands on training.

Specific Objectives:

- Collect, analyze and generate statistical reports from field data.

Course Contents:

This Course will cover theory learned from DSMHT-112 and DSHMT-212 with application in disaster management. Statistical Tools like SPSS, R, etc. will be used.

Learning Outcomes:

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

- Can independently design questioners for a field survey
- Data preprocessing and filtering
- Statistical analysis on disaster dataset and interpretation.
- Visual report generation.

References:

1. John McInnes "*An Introduction to Secondary Data Analysis with IBM SPSS Statistics"* (2017)

2. Stephen A. **Sweet**, and Karen **Grace-Martin** "Data Analysis with SPSS: A First Course in Applied Statistics"
3. Garrett Grolemund, "Hands-On Programming with R: Write Your Own Functions and Simulations Paperback" 2014

Number of Classes: 20

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.

Course Number and Title:
DSMHL: 307Risk Sensitive Land Use Planning Lab

Credit: 02 (Two)

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.

Course Contents:

1. Disaster Risk Reduction Enhanced Land Use Planning (LUP),
2. Importance of Disaster Risk Information in LUP,
3. 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,
4. mainstreaming disaster risk assessment result in LUP,
5. Land use planning options, enabling environment for incorporating disaster risk information in LUP,
6. Application of GIS and RS in LUP mapping.
7. Preparation of land use maps
8. Preparation of risk sensitive land use maps

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

Number of Classes: 30

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

References:

6. Blyth F.G. H. (1976) Geological Maps and their Interpretation. 2nd Edition. Arnold. UK.
7. Brown L.A. (1960) Map Making: The Art That Became a Science. Little Brown & Co. US.
8. Bygott J. (1967) An Introduction to Map Work and Practical Geography. University Tutorial Press. UK.
9. Kellaway G. P. (1970) Map Projection. 2nd Edition. Methuen & Co. UK.
10. Robinson et al (1953) Elements of Cartography. Wiley Publication

Course Number and Title:
DSMHT: 308 (Viva vocé)

Credit: 02 (Two)

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 Module-III of the syllabus titled "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 5th 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 5th Semester Exam 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:
DSMHT309 - Disaster & Development: Economic Concept

Credit and Credit Hours: 03 (45 Hours)

Introduction to the Course:
Disasters and development are linked closely in that disasters can both destroy development initiatives and create development opportunities, and that development schemes can both increase and decrease vulnerability. This course views responsibility in reducing disaster occurrence as a shared undertaking that goes far beyond improved disaster or emergency response. It gives explicit priority to assessing and building on household and community capabilities in at-risk communities, so that our vulnerability reduction efforts are sustainable. The course takes a developmental approach to the sustainable reduction of disaster risk, in both the individual country disaster management frameworks, as well as with respect to the priorities of the basic concepts of Economics.

Specific Objectives:
- Understanding the concepts development.
- Exploring the themes of Microeconomics and Macroeconomics.
- Analyzing the core concepts of disaster management and development strategies.

Course Contents:
1. Introduction; Basic understanding of development; Evolution of development theories, sustainable development, human development; Vulnerability and underdevelopment; Relationship between development and disaster.

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.
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).
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.
5. Human development index; Basic concept of Human development; Calculation of the individual and gross index; Evolution of the index.
6. Disaster & development industry in Bangladesh; Impact of disaster on microeconomic and macroeconomic indicators of Bangladesh; Cost-benefit analysis of disasters.
7. Global development strategies and disaster management, SDGs, SFDRR; International development and humanitarian industry.
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:

- Outline the appreciation of the theoretical and empirical links between natural disasters and national/international economy and development.
- Develop a critical awareness of the role of development activities in global patterns of human vulnerability and disaster risk and this will encourage them to have a critical reflection on the management of disasters through humanitarian action and disaster risk reduction approaches.
- Recognize the prevailing global priorities and frameworks for policy, planning and developmental practice.
- Synthesize specific conceptual and/or policy-related area of disaster risk reduction along with the basic concepts and implications of Economics.

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.

Number of Classes: Total of 45 lecture classes of 1 hour duration.

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.

Course Number and Title:
DSMHT: 310 Seismic Risk Reduction Approach

Credit and Credit Hours: 03 (45 Hours)

Introduction to the Course:

Earthquake accounts for the highest damage and loss caused by disasters. It is essential that the policy and the infrastructures developed considering earthquake risks. 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:

1. Understanding different aspects of earthquake vulnerability and risk
2. Seismic response of soils and structures
3. Seismic risk sensitive structure design
4. Earthquake risk modeling and risk management

Course Contents:

1. Earthquake Vulnerability: qualitative measures of vulnerability and quantitative measures of vulnerability; vulnerability of different classes of building, vulnerability of contents of buildings, damage models as functions of ground motion measures, microzoning effects on vulnerability functions, upper and lower bounds on vulnerability, earthquake risk reduction potential, human vulnerability to casualties, inter-earthquake effects.
2. Seismic Response of Soils and Structure
3. The design and construction process- choice of form and materials, seismic design of foundations and soil-retaining structures, design and detailing of new structures for earthquake ground shaking, earthquake resistance of services, architectural detailing for earthquake resistance, Retrofitting.
4. Earthquake Risk Modeling and Management: earthquake risk modeling, business interruption, reduction of business interruption, Planning for Earthquakes, earthquake insurance, earthquake risk management in developing countries, impediments to earthquake risk reduction.
5. Seismic Hazard Analysis, Seismic Slope Stability Analysis, Liquefaction Susceptibility analysis.

Learning Outcomes:

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

- The different aspects of earthquake vulnerability and risks
- Assessing Seismic response of soils and structures
- Different components of seismic hazard analysis, i.e. analysis of slop 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 managenment

References:

1. Balassanian S., Cisternas A. &Melkumyan M. (2000) Earthquake Hazard and Seismic Risk Reduction, Series: Advances in Natural and Technological Hazards Research. Springer. Netherlands.
2. Bozorgnia and Bertero. Earthquake Engineering: From Engineering Seismology to Performance based Engineering, CRC Press
3. Dowrick D. (2009) Earthquake Resistant Design and Risk Reduction. 2nd Edition. Wiley-Blackwell. US.
4. Kramer S.L. (1996) Geotechnical Earthquake Engineering. Prentice Hall. US.
5. Westen et al (2011) Multi-hazard Risk Assessment Guidebook.

Number of Classes: 30 (15 One hour classes and 15 two hour classes, totaling 45 lecture hours).

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.

Course Number and Title:
DSMHT: 311 Hydro-meteorological Risk Reduction Approach

Credit and Credit Hours: 03 (45 Hours)

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.

Course Contents:

1. Hydrometeorological Hazard modeling & Risk Assessment: An introduction
2. Physical, Social, Economic and Environmental Vulnerability of flood, drought, cyclone and river bank erosion
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
4. Riverbank Erosion: Causes, Contributing factors, types of failures, Riverbank Protection Measures, Riverbank erosions in Bangladesh: Scenario and practices
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.
6. Introduction to Mountainous Hazards, Overview of Mountainous Vulnerability Assessment and Risk Reduction.
   Estimating the probability of landslides, Estimating the Consequences, Landslide Vulnerability assessment, evaluation & quantifying landslide risks. Mountainous Risk Reduction Methods (Structural and Non structural: 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
7. Arsenic Contamination in Groundwater of Bangladesh and Mitigation options

Learning Outcomes:

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

- 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

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.

Number of Classes: 45 (15 One hour and 15 hour sessions, totaling 45 lecture hours).

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 hangs on field learning\ will be highly appreciated.

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

Credit and Credit Hours: 02 (30 Hours)

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 sociological, 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 international 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:

- Understanding the fundamental concepts regarding the key components of demography.
- Exploring basic concepts of migration and influence of migration process on migrants.
- Having depth of knowledge of the main foundations, principles, processes, and complexity of humanitarian shelter coordination in natural disasters.
- Analyzing how forced migrants—including refugees and IDPs—and so called voluntary migrants are conceptualized, as well as of the different policy and legal responses in both, the international and the domestic spheres.

Course Contents:

1. Demographic Factors and Processes

Fertility, Mortality, Migration, Marriage and Nuptiality, Life Expectancy, Birth Rate, Death Rate etc.

2. Population Distribution and Density

Population Distribution, Population Density, Factors Affecting Population Density and Distribution (Physical, Economic, Political and Social)

3. Population Growth, Demographic Theories and Model

Population Growth, Malthus Theory, Demographic Transition Model, Optimum Population Theory etc.

4. Population and Resources: Population Resource or Burden, Optimum Population, Over Population, Under Population
5. Migration

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

6. Urban and Rural Population, Population Policies, Population and Disaster.

7. Environmental Migration: definitions, types & patterns.
8. Environment induced Internal Migration: disaster and migration, the characteristics of migrants, changing livelihoods, IDPs- Asian & African cases and effects of migration on urbanization: Examples of Bangladesh.
9. Environment & climate induced International Migration: Asian & African cases
10. Climate Change induced Environmental Migration: population response to cyclones, floods, and river bank erosion: Examples of Bangladesh
11. Gender Dimension of Environmental Migration: The impacts of climate change on women.
12. Introduction: Definition, Causes behind Refugee, Environmental Refugees.
13. Managing Migration- Role of different Organizations (UNHCR, IOM, ILO, BMET, BOESL)
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.

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.

Number of Classes: Total of 30 lecture classes of 1 hour duration.

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.

Course Number and Title:
DSMHT: 313 Community based Risk Assessment and Planning: Theory and Practices

Credit and Credit Hour:03 (45 Hours)

Introduction to the Course:

Bottom-up approach of planning in case of disaster management is considered as better option for building community resilient. 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 filed level risk assessment session with community people.

Course Contents:

1. Most Vulnerable People in Disaster: Issues and Concerns, Social Exclusion and Vulnerabilities.
2. Social Exclusion Analysis framework, Guidelines for Gender Sensitive Risk reduction Measures.
3. Tools of Community Based Risk Assessment (CBRA): Hazard Mapping, Social Mapping, Community Rural Appraisal, Transect Walk, Seasonal Calendars, Historical time line, Focus Group Discussion, Venn diagram, Vulnerability Matrix.
4. Introduction and Purpose of Urban Risk Reduction (URA). Difference between URA & CRA.
5. Participants of URA, Steps of URA & Framework for URA
6. Participation of Stakeholders in CBRA, Role of Local authority in Community based Disaster Risk Management.
7. Bottom Up Inclusive Participatory Approach, Stakeholder Participation, PGIS, Volunteered Geographic Information (VGI).
8. Application of GIS and RS techniques in Citizen Science
9. Case Studies of CRA: 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 session in the field.
- Analyze community risk reduction options and implementation plan
- Apply RS and GIS in a participatory way to prepare community risk map.

Number of Classes: 45

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.

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 Inclusion in Disaster Risk Reduction.
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:
DSMHT 314: Inequality and Disasters

Credit and Credit Hours: 02 (30 Hours)

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:

- To develop the ability to understand the ways in which individuals and communities are vulnerable to natural hazards and disasters.
- To compare the ways in which social groups differ in experiencing natural hazards and disasters.
- To apply a critical perspective to the ways in which social inequality related to disaster vulnerability.
- To employ social science inquiry, particularly sociological and anthropological theory and methods of research, to analyze the effects of disasters on socially marginalized populations.
- To contrast the ways in which leading social theories of vulnerability construct "vulnerability" and vulnerable populations.
  To understand how the principles of social justice can be used to reduce vulnerability among socially marginalized populations.

Course Contents:

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)
2. Social Stratification: Definition, Causes and Consequences, Theory: Marxist, Weber's Model
3. Disasters & Gender:
   Concepts & Definitions,
   Gender-disaster relationship: Spatial, Social, and Economic
   Causes of Gender Vulnerability, Women in Culture and Society, Assessing Women's Disaster Resilience, Women organizing to reduce Risk
   Gender Vulnerability to natural hazards: Social vulnerability, Economic vulnerability
   Impact of different disasters: Natural disasters: floods, cyclones, river bank erosion, draughts and earthquakes, urban disasters: Fire hazards
   Disaster and Health (Reproductive & Communicable): During Disaster, After Disaster

Disaster and Security: Personal security (During & After), Food security (During & After), Economic security (During & After)

Gender Resilience & Coping: Immediate strategy, Long term strategy

4. Disabilities (Mental and Physical) and Disaster
5. Socially Exclusive Groups and Disaster
6. Class and Caste System (Race/Ethnicity, Religion, Minority) and Disaster.
7. Age Inequality and Disasters
8. Inequalities and Health Issues in Disaster (Mental and Physical)
9. Social Inequalities and Responses, Relief and Rehabilitation in Disaster
10. Inequalities and Disaster Risk Reduction Measures: Pre, During and Post Disaster Phase; Mainstreaming Inequality Issues in Disaster Risk Reduction;
11. Social Safety Net/Socio-Economic Safety Net Program
12. Policy, Planning and Legal Aspects of Inequality Issues in Disaster
13. Inequalities inclusive Disaster Risk Reduction
14. Theoretical Interpretations of Inequality: From Classical to Post Modern Approach
15. Measurement of Inequality in Societies
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 in equality 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.

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.

Number of Classes: Total of 30 lecture classes of 1 hour duration.

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.

Course Number and Title:
DSMHL: 315 (Risk Reduction Lab)

Credit: 02 (Two)

Introduction to the Course:
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 risk assessment for specific hazards as well as for multihazards; identify potential risk reduction measures; conduct cost benefit analysis and determine their suitability.

Course Contents:
- Vulnerability assessment and exposure analysis
- Risk Assessment
- Risk Reduction Measures
- Cost Benefit Analysis

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

- To assess vulnerability and conduct exposure analysis for specific hazards
- Assess risk for specific hazards as well as, multihazards
- Risk visualization
- Identify Suitable risk reduction measures
- Cost benefit analysis of the measures

References:

1. Birkmann J. (2013) Measuring Vulnerability to Natural Hazards: Towards Disaster Resilient Societies. United Nations University Press. Japan.
2. Ostrom L.T. &Wilhelmsen C.A. (2012) Risk Assessment: Tools, Techniques and Their Application. Wiley-Blackwell. US.
3. Westen et al (2011), A Guidebook of Multi-hazard Risk Assessment, Public Works
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. Dowrick D. (2009) Earthquake Resistant Design and Risk Reduction. 2nd Edition. Wiley-Blackwell. US.
6. Kramer S.L. (1996) Geotechnical Earthquake Engineering. Prentice Hall. US.
7. Lee E.M. & Jones D.K.C. (2004) Landslide Risk Assessment. Thomas Telford Publication. UK.
8. Ministry of Water Resources, Government of the People's Republic of Bangladesh. (2005) Bangladesh Coastal Zone Policy. Bangladesh Secretariat. Dhaka.
9. Sassa K. &Canuti P. (2008) Landslides-Disaster Risk reduction. Springer. Netherlands.
10. 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.
11. United Nations Environment Programme (UNEP). (2005) Assessing Coastal Vulnerability: Developing a Global Index for Measuring Risk.
12. WMO (2008). Guide to Hydrological Practices, WMO.

Number of Classes: 15 (Two hour each, totaling 30 lecture hours).

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

Course Number and Title:
DSMHF: 316 Field Works and Reporting

Credit: 02 (30 credit hours; 100 marks)

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, preferably in a coastal district that face 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 on in-depth vulnerability and exposure analysis and, consequent risk assessment through different social surveying tools complemented by field observation for multi hazard scenario. The course helps the students identify possible risk reduction measures and evaluate them.

Specific Objectives:
The main objective of this course is to strengthen the students' knowledge on different dimensions of vulnerability, exposure analysis and risk assessment through different social investigation tools e.g. questionnaire survey, FGD, KII etc. The course allows the processing, analysis and interpretation of the data using different software by each student as well as identification of the risk reduction measures.

Course Contents:
The course 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 and evaluate
- 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:

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 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 2nd Semester 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:
DSMHT: 401 Response, Recovery and Rehabilitation

Credit and Credit Hours:04 (45 Hours)

Introduction to the Course:

Disaster Management is a twofold approach - Risk Management and Crisis Management. The crisis management includes response, recovery and rehabilitation activities. So this course is basically deals with crisis management and discusses the framework, approaches and best practices of crisis management (response, recovery and rehabilitation)

Specific Objectives:

This course is designed to make the students learn how to manage crisis through response, recovery and rehabilitation.

Course Contents:

1. Framework and Approaches of Response and Recovery
2. Recognition of Pre-disaster Actions; warning and evacuation, pre-positioning of resources and supplies, last-minute mitigation and preparedness measures.
3. Recognition of Post Disaster Actions; search and rescue, First Aid medical treatment, Evacuation, Disaster Assessments, treating the hazards, provision of water, food and shelter, health, sanitation, safety and security, critical infrastructure resumption, emergency social services, donations management, media's role in evacuation in urban and rural settings.
4. Disaster Response and Recovery Planning: Response planning, recovery planning, Short term recovery planning, long-term recovery planning
5. Coordination; the Incident Command System, the Disaster Declaration Process.
6. Emergency plan and its Activation: process of planning, disseminating the plan, testing and revising the plan, integration of plan in theory and practice.
7. Specialized Planning: emergency medical planning, veterinary plan, planning for educational institutions, planning for industries, planning for tourism, planning for libraries and archives, planning for terrorism & crowd emergencies, plan for the mass media, psychiatric help, integration of plans.
8. Reconstruction Planning: temporary measures, restoration of services, reconstruction of damaged structures, development & mitigation.
9. Emergency Management Training: the cause and effect model, the concept based approach, scenario based methods.

10. Dimension of Disaster Recovery: Debris Management, Environmental Recovery, Historical and Cultural Resources, Housing, Business, Infrastructure, Social Psychological and Public Sector Recovery.

Learning Outcomes: After completion of the course students will be able to:

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

Number of Classes: 45

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.

References:

1. Alexander D. (2002) Principles of Emergency Planning and Management. Oxford University Press. UK.
2. Coppola D.P. (2007) Introduction to International Disaster Management. Elsevier. UK.
3. Gustin J.F. (2010) Disaster and Recovery Planning: A Guide for Facility Managers. 5th Edition. Fairmont Press. US.
4. Gustin J.F. (2013) Disaster and Recovery Planning: A Guide for Facility Managers. 6th Edition. Fairmont Press. US.
5. Haddow D., Bullock J. & Coppola D.P. (2013) Introduction to Emergency Management. 5thEdition.Butterworth-Heinemann. UK.
6. Klaene B.J. & Sanders R.E. (2007) Structural Fire Fighting: Strategy and Tactics. 2nd Edition. Jones & Bartlett Learning. US.
7. Miller J. (2012) Psychosocial Capacity Building in Response to Disasters. Columbia University Press. US.
8. Phillips B.D. (2009) Disaster Recovery. CRC Press. US.

Course Number and Title:
DSMHT 402: Disaster Management: Institutions and Instruments

Credit and Credit Hours: 02 (30 Hours)

Introduction to the Course:
Demographic changes, human settlement patterns, land-use decisions, and political and social policy dynamics have increased vulnerability to natural and man-made disasters. Planning and policy processes and interventions can help reduce disaster vulnerabilities and increase resilience at every stage of the disaster management cycle: disaster mitigation, preparation, response, and recovery.

Specific Objectives:

This course proposes to provide students with the following:

- Understanding of the roles of the various phases of disaster management and issues concerning planning and policies in those phases.
- Understanding of comprehensive emergency management from a planning and policy perspective
- Understanding of the role of federal, state, and local governments in disaster planning and policies.
- Knowledge of mitigation planning and policy strategies.
- Understanding of comprehensive emergency management and related plans
- Understanding of factors affecting short and long-term recovery and rebuilding and the role of planners and policy-makers.
- Understanding of the factors that give rise to disaster vulnerabilities (e.g. natural, physical, social, economic, policies, and governance).
- Understanding of the factors that give rise to differential vulnerabilities and levels of community resilience
- Knowledge and capabilities to assess and manage these vulnerabilities through disaster planning and policy-making.

Course Contents:

1. 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.
2. Bilateral Disaster Management Assistance: How governments provide bilateral assistance, monetary assistance, Equipment and supplies, Expertise.
3. Government Agencies Involved in Bilateral Assistance: Overseas diplomatic missions, International development agencies, National disaster management agencies, Other government agencies, Military resources
4. Nongovernmental Organizations: Types of nongovernmental organizations involved in emergency management, The emergency management role of nongovernmental organizations, The private sector, Academia

5. Nongovernmental Emergency Management Operations: Funding, Coordination, NGO / Military Cooperation, Standards of conduct, Case Study (The International Federation of Red Cross / Red Crescent Societies)
6. Multilateral Organizations :Multilateral organizations explained, Regional international organizations, The emergency management role of multilateral organizations
7. The United Nations: The United Nations system, United Nations agencies and programs, The United Nations role in emergency management, The Consolidated Appeals Process
8. Disaster Management Act, Law, Plan and Policy: their guidelines.
9. 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 this course, the student will be able to:

1. Describe the authorities that govern institutional assistance and discuss their underlying philosophies.
2. Compare the roles and responsibilities of key personnel and stakeholders in dealing with localized emergency incidents vs. declared disasters.
3. Describe the reporting requirements and institutional structure related to damage assessments conducted at various stages of a disaster.
4. Describe the different hazard mitigation measures that can be incorporated into the disaster recovery planning process.
5. Describe the institutional procedures for requesting disaster management assistance.
6. Describe a typical sequence of events following a Disaster Declaration, outlining government and non-government roles and responsibilities.
7. Describe the special needs of disaster victims and relief workers and identify appropriate sources of assistance.
8. Explain how effective media relations may be maintained before, during, and after a disaster.
9. Describe the role of international organizations in disaster management.

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

Number of Classes: Total of 30 lecture classes of 1 hour duration.

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.

Course Number and Title:
DSMHT: 403Climate Modelling and Adaptation

Credit and Credit Hours:03 (45 Hours)

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 adaptation strategies of climate change.

Course Contents:

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.

2. Processes of Climatic Model Development, Sensitivity of Climate Model & Model Evaluation.

3. Types of adaptation to climate change: anticipatory and reactive.

4. Adaptation characteristics and processes: Components and Forms of adaptation, Climate Stimuli for Adaptation, Adaptation Types and Forms, Systems, Scales, and Actor, Processes and Evaluation of Adaptation

5. Technologies & Options for Adaptation: adaptation in coastal zones, adaptation technologies for water supplies, adaptation options for agriculture, adaptation options for health, infrastructure technologies for adaptation

6. Adaptive Capacity and its Determinants: Economic Resources, Technologies, Information and skills, Infrastructure, Institution, Equity. Enhancing Adaptive Capacity.

7. Climate Change Adaptation Options in Bangladesh, NAPA, Endowed Knowledge Inclusion in Adaptation.

Learning Outcomes: student will learn:

- What are the climate models?
- How climate models used?
- How climate models are useful in climate change study?
- What are the adaptation strategies of climate change?

Number of Classes: 45

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.

References:

1. Asia Pacific Water Forum. 2012. Framework Document on Water and Climate Change Adaptation: For Leaders and Policy-makers in the Asia-Pacific Region. Philippines.
2. Erda L. 2009. Climate Change Vulnerability and Adaptation in Asia and the Pacific. Kluwer. Netherlands.
3. Guill S. 1996. Vulnerability and Adaptation Assessments: An International Handbook. Kluwer. Netherlands.
4. McGuffie K. & Henderson-Sellers A. 2013. A Climate Modelling Primer. 3rd Edition. Wiley-Blackwell. US.
5. Ministry of Environment and Forest, Government of the People's Republic of Bangladesh. 2005. National Adaptation Program of Action. Dhaka. Bangladesh.
6. Patt A.G. 2008. Assessing Vulnerability to Global Environmental Change: Making Research Useful for Adaptation, Decision Making and Policy. Earthscan. UK.

7. Schellnhuber H.J. &Cramer W.P. 2006. Avoiding Dangerous Climate Change. Cambridge University Press. UK.
8. United Nations Framework Convention on Climate Change. 2006. Technologies for Adaptation to Climate Change. Bonn. Germany.

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

Credit and Credit Hours: 04 (45 Hours)

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:
- Understand research terminology.
- Be aware of the ethical principles of research, ethical challenges and approval processes.
- Describe quantitative, qualitative and mixed methods approaches to research.
- Identify the components of a literature review process.
- Critically analyze published research.

Course Contents:
1. Science, Research and Scientific Enterprise
2. Concept Measurements, Challenges & Constraints in Conducting Research
3. Literature Review
4. Formulating Problems, Objectives and Questions; Assumption and Hypothesis
5. Frameworks: Conceptual, Process, Analytical and Research Framework
6. Research Methods: Pre-field work, Field Work & without Field Work
7. Citation and Reference List; Bibliographic Engines e.g. Mandalay.
8. Critical Reading and Technical Writing, Argumentation
9. Ethics and Professionalism in Science
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)

11. Research Proposal; Proposal to Thesis
12. Research Presentation and Publication

Scientific Articles, Publication of Report, Grey Literature, Conference Paper, Presentation of Research, Poster**.**

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.

References:

1. Dawson C. (2007) Practical 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.

Number of Classes: Total of 45 lecture classes of 1 hour duration.

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.

Course Number and Title:
DSMHT: 405 Prediction and Early Warning

Credit and Credit Hours:04 (45 Hours)

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.

Course Contents:

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.**
2. Application of **technologies for monitoring and warning of hazards.**
3. **Modeling Techniques for early warning (flood, landslide, tsunami, flash flood, drought)**
4. Key Elements of Early Warning Systems; Risk Knowledge, Monitoring and Warning, Dissemination and Communication, Response Capabilities
5. Essentials of EWS; Effectiveness, Efficiency, Equity, Legitimacy
6. Cross Cutting Issues; Effective Governance and Institutional Arrangements, A Multi Hazard Approach, Cultural Diversity and Gender Perspectives, Involvement of Local communities
7. Role of Government, Media & NGOs in Early Warning System.
8. Electronic Warning System: Sensors, Alarms & Information Networks; Role of communications system in early warning system of impending disasters; wire lines and wireless communication application.

9. Awareness Development through Education, Seminar, conference, Olympiad, Poster, Media etc.
10. 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.

Number of Classes: 45

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.

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. NemecJr.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:
DSMHL: 406 Geoinformatics and MIS in Disaster Management: Theory & Practices

Credit and Credit Hours:03 (45 Hours)

Introduction to the Course:

Geographic Information System (GIS) is a cross-cutting tools for planning by incorporating various other technologies and information from different fields/sectors. Disaster Management, in fact, needs sectoral data for its mitigation, early warning, response, recovery and damage & loss assessment. This is an intermediate level course design for both classroom learning as well as lab exercises. This includes some latest technologies/platform in Remote Sensing and GIS field like Web GIS, LiDAR, RADAR, UAV, 3-D Analysis, Network Analysis etc. Apart from those, the students from this course can receive hands-on experiences on how to estimate Damage and Loss, Rapid Response Mapping, Risk Mapping etc.

Specific objectives:

This course is designed to make students familiar with latest development in the field of RS, GIS and GPS. Side by side the students will do hands-on exercise on how to apply the knowledge of RS, GIS and GPS technology in layers of Disaster Management Cycle.

Course Contents:

1. Introduction to Geoinformatics and Its Scope
2. Spatial Data Infrastructure (SDI), Web GIS, QGIS
3. Remote sensing for disaster management: Multispectral and Hyperspectral remote sensing concepts.
4. Pre-processing and Information Extraction from LiDAR, RADAR, UAV Image (drone, nano satellite)
5. Spatial modeling: Spatial analysis and modeling (knowledge driven and data driven methods); Geostatistical analysis; 3-D analysis; interpolation; topographic analysis using TIN; DEM and surfacing; Network Analysis
6. Application of Geoinformation for Disaster Management: Microzonation mapping, early warning, Vulnerability analysis, Real–time mapping, Hazard Monitoring, Decision making, Relief operation and Response Mapping, Food Security Analysis
7. Disaster database creation and management.

Learning Outcomes: After completion of the course students will be able to:

- Understand latest development in the field of Geoinformatics.
- Create spatial and non-spatial database and their linking.
- Analyze the geospatial data for damage/loss estimation, rapid response mapping, evacuation route identification, prepositioning options etc.
- Create Web GIS application for analysis and geospatial information dissemination.

Number of Classes: 45

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. Question and answer sessions, and report writing will be used to increase participation.

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.

Course Number and Title:
DSMHV-407 (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 Module-IV of the syllabus titled "Vulnerability Assessment and Risk Reduction" and Module-V titled "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 7^{th} 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 exam is to be conducted by the 7th Semester Exam 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:
DSMHT: 408 Damage, Loss and Need Assessment.

Credit and Credit Hours:03 (45 Hours)

Introduction to the Course:

Post disaster Damage and Loss Assessment (DaLA) plays a vital role in crisis management phase of disaster management cycle. The DaLA method of ECLAC (UN Economic Commission for Latin America and the Caribbean) is to assess damage – disaster effects on assets and losses – disaster effects on economic flows. DaLA is needed to quantify the financial needs for economic recovery and reconstruction and to define government priorities for intervention in different geographical areas, sectors and population groups based on estimated gaps in production, growth and development.

Specific Objectives: This course is for giving overall idea about Sector wise DaLA methodology of UN ECLAC to assess Post Disaster Damage and Loss Assessment.

Course Contents:

1. Introduction: Concept of disaster damage and losses; Factors causing increase in damage and losses;
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).
3. Assessment Methodology: ECLAC, DaLa, PDNA.
4. Steps in the Application of ECLAC (Economic Commission for Latin American and Caribbean region) Methodology.
5. Conducting Damage and Loss Assessments by Sector: Economic Sector, Social Sector, and Infrastructure and Cross Cutting sectors.
6. Post Disaster Need Assessment (PDNA): From Losses to economic Recovery Plan, From Damage to reconstruction Needs.
7. Link between Risk Assessment and Damage Assessment

8. Latest Loss Estimation Modeling and Disaster Impact Analysis for Effective Policy Form ation: 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: After completion of the course students will be able to:

- Understand DaLA method of UN ECLAC to assess Damage and Loss
- Conduct Baseline and Post Disaster Survey to get sector wise information.
- Analyze Sector wise information to assess overall Damage Scenario.
- Apply DaLA method to estimate changes in economic flow (Loss)
- Estimate post disaster need assessment (PDNA)

Number of Classes: 45

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.

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:
DSMHT 409: Main-streaming Disaster Management: National and International Practices

Credit and Credit Hours: 03 (45 Hours)

Introduction to the Course:
This course explores disaster risk management concepts and practices using practical examples at international up to national level. It will provide students not only a solid theoretical and conceptual understanding of Disaster Risk Management (DRM), but also will take them through the practical application of the concept and practices in different settings.

Specific Objectives:

- To improve understanding of disaster risk management concept, framework and approaches from the context of national to local level.
- To understand characteristics and identify causes of disaster risks in Bangladesh and linkages with development.
- To identify and apply suitable disaster risk reduction measures.
- To understand the cross-cutting issues in disaster management and able to take appropriate measures to address them.

Course Contents:

1. Mainstreaming Disaster Management Framework: Fundamental Concepts.
2. Comparison of DRM and DRR.
3. Disaster Risk Assessment: Hazard Characterization and Frequency Analysis, Consequence Analysis, Risk Estimation, Risk Prioritization.
4. 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.
5. Mainstreaming gender issues in Disaster Management (From Bangladesh Perspective): GAD Approach.
6. Mainstreaming Disaster Risk Reduction in Land use planning, Education, Environment and Natural resources and housing.
7. Mainstreaming Climate Change Adaption into Development Planning.
8. 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.
9. Main Streaming Disaster Management: DDM and CDMP Approach
10. 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:

- Demonstrate a critical understanding of key concepts in disaster risk reduction and humanitarian response
- Understand and appreciate the specific practice and conceptual understanding of disaster management and humanitarian response and their significance in the current national and international context.
- Recognize issues, debates and challenges arising from the nexus between paradigm of development and disasters.
- Critically evaluate disaster management policy and practice from multiple perspectives.
- Develop an understanding of mainstreaming humanitarian response and practical relevance in specific types of disasters and conflict situations.
- Critically analyze the strengths and weaknesses of disaster management approaches, planning and programming in different countries, particularly in Bangladesh.
- Respond to disaster risk reduction initiatives and disasters in an effective, humane and sustainable manner.

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.

Number of Classes: Total of 45 lecture classes of 1 hour duration.

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.

Course Number and Title:
DSMHT: 410 Emergency and Crisis Planning

Credit and Credit Hour:02 (30 Hours)

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.

Specific Objectives: This course is designed to make students confident to chalk out a realistic planning for successful emergency operations.

Course Contents:

1. Introduction: definitions, principles, scenarios, structure of a plan, Standards in emergency planning.
2. Aims, Purpose and Scope of Emergency Planning
3. Emergency Plan and its Activation: Process of planning, dissemination of Plan, Integration of Plan in Theory and Practice.
4. Specialized Planning: Contingency planning- Generic and Scenario based, Contingency Plan for Major Responding Organization
5. Incident Command System (ICS) and Standing Operation Procedure (SOP)
6. Sustainability of emergency preparedness, · Critical infrastructure planning
7. Emergency Communications, Emergency Operations Center (EOC) and Procedures
8. Understanding Crisis: Proliferation and Recognizing a Crisis, Characteristics of Crisis, Classifying a Crisis.
9. Crisis Communication: Essentials of Crisis Communication, Guidelines for Crisis Communication.
10. Role play exercise for national to community level
11. Crisis Management Essentials (Bangladesh Perspective)

Learning Outcomes: After completion of the course students will be able to:

- 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.
- Prepare emergency communication content for emergency management
- Conduct planning exercises.

Number of Classes: 30

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.

References:

1. Alexender, David (2002) Principles of Emergency Planning and Management. Tera Publishing. UK
2. Nudell M. &Antokol N. (1988) Handbook for Effective Emergency and Crisis Management. Lexington Books. US.
3. Lerbinger, Otto. (2012) The Crisis Manager: Facing Disasters, Conflicts and Failures. Routlrdge. New York.
4. Moore, Tony; Lakha, Raj(ed.). (2002) Tolley's Handbook of Disaster and Emergency Management: Principles and Practice. Elsevier. London.
5. Haddow, George D; Bullock, Jane A. (2006) Introduction to Emergency Management. Elsevier. London.

Course Number and Title:
DSMHT: 411 Disaster in Agriculture and Food Security

Credit and Credit Hours: 03 (45 Hours)

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, its development and food security.
- Exploring climate change issues and its 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.

Course Contents:

1. Evolution of Agriculture (Domestication of Plants and Animals; Civilization, Agriculture and Disasters).
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).
3. Green Revolution
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).
5. Agriculture of Bangladesh, Agro-ecological Zone of Bangladesh.
6. Agriculture and Disaster (Natural and Human Induced)
7. Food Security
8. Climate Change, Food Security and Agricultural Risk Reduction in Bangladesh
9. Disaster Risk Reduction Measures in Agriculture
10. 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 enhance knowledge of the students on government's agricultural policies, plans and development objectives to promote agricultural sector to meet the UN-sustainable development goal.

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. Earthscan. UK.
10. FAO (2015). The Impact of Disaster on Agriculture and Food Security, Italy, Rome.

Number of Classes: 30

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, video shows, 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.

Course Number and Title:
DSMHT: 412 Project Planning, Monitoring and Evaluation

Credit and Credit Hours: 03 (45 Hours)

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 works demand formulation of projects and their regular monitoring and evaluation. The course focuses on project life cycle approach to development, 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:

- Understanding the concept of project and programme management
- Knowing the steps-by-step methods of project planning, development of project proposal and its appraisal processes
- Building competence in designing Monitoring and Evaluation Frameworks and Plans
- Exploring the core concept of Environmental and Social Impact Assessments

Course Contents:

1. Basic Concepts: definition & characteristics of a project & program, difference between project and program, project and programme managers role; project classification & their differences, understanding project objective.
2. Project life cycle, aspects and activities of different phases, project generation and screening.
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.
4. Project Appraisal: different aspect 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.
5. Logical framework approach in project management: definitions and use, nine different steps in LFA, building a logframe matrix, Elements of Project Management.
6. Project Monitoring & Evaluation: definitions, purpose and objectives, elements and components of a good M&E System, M&E Plan and results framework. Characteristics of a good indicator, Monitoring report, methods and types of evaluation.
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.
8.

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 makingbetter 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.

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. Harvey Mayor (2005), Project Management, Third Edition, India
5. International Labor Organization. (2000) Project Preparation, Implementation, Monitoring, Evaluation: User's Hand Book. Dhaka.
6. NORAD. (1999) The Logical Framework Approach. Oslo.
7. Young T. (2003) The Project Management Manual. Penguin books. New Delhi.
8. UNDP (2009), Handbook on Planning, Monitoring and Evaluating for Development Results, New York
9. Development Project Proforma/Proposal (DPP) Manual Part I and II, General Economic Division, Govt. of Bangladesh, March 2014, Dhaka.
10. Development of Project Proposal, Processing, Approval and Revision Methods (in Bangla), Planning Commission, Govt. of Bangladesh, October 2016, Dhaka.
11. Project Management Handbook, Version 1.1, July 2006, DANS, The Hague, 2006
12. Kabir Z. (2013), "Fifteen Years of Environmental Impact Assessment System in Bangladesh: Current Practice, Challenges and Future Directions", Journal of Environmental Assessment Policy and Management, Vol. 15, No. 4, Imperial College Press,

Number of Classes: 30

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.

Course Number and Title:
DSMHT: 413 Bangladesh Studies &Disaster Management Approach

Credit and Credit Hours: 02 (30 Hours)

Introduction to the Course:
Bangladesh is one of the world's most vulnerable countries to natural hazards and disasters. Its geographical location makes it subject to annual monsoon floods and cyclones, but there are also a number of other risks the country has to cope with. As it is considered to be the country most affected by climate change, the risk is increasing for major hydro meteorological disasters to occur. Widespread poverty and an extremely high population density add to the country's vulnerability to disasters. The course will orient students about the paradigm of response/relief-oriented to comprehensive approach and risk reduction culture of disaster management in Bangladesh. The course proposes to expand evaluations and lessons learning of disaster management approaches of Bangladesh.

Specific Objectives:

- To understand every category of disaster management in Bangladesh including early warning systems, risk assessment, DRR policy, and preparedness for effective response.
- To identify various national plans through the institution of the necessary legal framework to support disaster risk reduction and climate change adaptation in Bangladesh.
- To analyze the mitigation and preparedness measures along with the role the government of Bangladesh.

Course Contents:
1. Linkage of Disasters with Physiographic Units of Bangladesh: Linking Different Hazards with physical units of Bangladesh (following the %)
2. Evolution of Disaster Management Approach in Bangladesh: Relation of Disaster Management with historical evolution of Bangladesh (from specific focus on 1970s Cyclone
3. 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
4. Disaster Management Approach in 5^{th} and 6^{th} Five Years Plan of Bangladesh
5. Details of Comprehensive Disaster Management Programme (CDMP) I & II
6. Detailed Discussion on Cyclone Preparedness Programme of Bangladesh: Focused on its Organogram
7. Components of Flood Action Plan (FAP) in Bangladesh

Learning Outcomes:

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

- Understand disaster and climate change issues in different sectors of Bangladesh including short term versus long term investments, benefits, preparedness, planning and strategy.
- Recognize strength and attributes include community resilience, volunteerism, the Early Warning System, community based decision making process, government commitment, a vibrant NGO sector and an appreciable legal and institutional framework of Bangladesh.
- Critically evaluate different provisions of the DM Act, especially the Disaster Management Fund, Volunteer Platform, Research and Training Institute.

References:

1. Ahmad Q.K. (1994) Bangladesh: Past two Decades and the Current Decade. Dhaka: Bangladesh unnayanparishad. Bangladesh.
2. 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.
3. Brammer H. (1997) Agricultural Development Possibilities in Bangladesh. University Press Limited. Dhaka.
4. Brammer H. (2000) Agroecological Aspects of Agricultural Research in Bangladesh. University Press Limited. Dhaka.
5. Brammer H. (2002) Land Use and Land Use Planning in Bangladesh. University Press Limited. Dhaka.
6. Choudhury G. W. (1993) The Last Days of United Pakistan. University Press Limited. Dhaka.
7. Faaland J. and Parkinson J.R. (1976) Bangladesh: The Test Case for Development. University Press Limited. Dhaka.
8. Gritzner C.F. Bangladesh: Modern World Nations. Chelsea House Publishers.US.
9. Novak J.J. (1993) Bangladesh: Reflection on the Water. University Press Limited. Dhaka.
10. Rasheed K.B.S. (2008) Bangladesh: Resource and Environmental Profile. A. H. Development Publishing House. Dhaka.

Number of Classes: Total of 30 lecture classes of 1 hour duration.

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.

Course Number and Title:
DSMHL: 414 Damage and Need Assessment Lab

Credit:02 (Two)

Introduction to the Course:

Post disaster Damage and Loss Assessment (DaLA) plays a vital role in crisis management phase of disaster management cycle. The DaLA method of ECLAC (UN Economic Commission for Latin America and the Caribbean) is to assess damage – disaster effects on assets and losses – disaster effects on economic flows. DaLA is needed to quantify the financial needs for economic recovery and reconstruction and to define government priorities for intervention in different geographical areas, sectors and population groups based on estimated gaps in production, growth and development.

Specific Objectives: This lab work is for hands-on exercise on theory course taught under DSMHT408 for estimating sector wise Damage and Loss using DaLA methodology of UN ECLAC.

Course Contents:

Laboratory studies based on course DSMHT408

Learning Outcomes: After completion of the labs students will be able to:

- Understand DaLA method of UN ECLAC to assess Damage and Loss
- Analyze sector wise stocks and economic flows
- Apply DaLA method to estimate Stocks (Damage)
- Apply DaLA method to estimate changes in economic flow (Loss)
- Estimate post disaster need assessment (PDNA)

Number of Classes: 30

Instructional Strategies:

Lecture, Presentation, Hands-on Exercises on DaLa, Assignment, Field Work.

References:

7. GFDRR. (2013) Post Disaster Need Assessment Guidelines: Volume A.
8. GFDRR. (2008) Disaster Damage, Loss and Need Assessment: Training Guidelines. Dhaka. Bangladesh.
9. Handbook for Disaster Assessment, UN ECLAC
10. Handbook for estimating the socio-economic and environmental effects of disasters, UN ECLAC

Course Number and Title:

DSMHP: 415Research Project

Credit:06 (Six)

Introduction to the Course:

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.

Number of Classes: No class. Student will meet their supervisor and co-supervisor regularly.

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.