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

1. Introduction to the Department:

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

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

2. Introduction to the Program:

The regular Master's degree program (i.e. Master of Science in Disaster Science and Climate Resilience)started from session 2016-2017. Under the Semester System, the *one-year* M.S. Degree in Disaster Science and Climate Resilience (DSCR) at the University of Dhaka is a program comprised of two semesters. Duration of each semester is 26 weeks. Students are required to attend the entire courses equivalent to 41 credit hours in Disaster Science and Climate Resilience (DSCR) Master's program to obtain the degree.

3. Structure of the Curriculum:

There will be two groups in the Master's Program. One group will be termed as **Masters by project work- Project Group** and the other will be termed as **Masters by research work - Thesis Group**. Students of both Groups will have to take a total of 41 credit hours-equivalent courses.

Grading of the Department according to Higher Education Qualification Levels:

Level	Qualification Grade	Grading Credits
9	Master's Mixed Mode	41

Masters by Mixed Mode:

Course Distribution	**Thesis Group**
Compulsory Theory Courses: 5	15 credits
Compulsory Lab Course: 3	9 credits
Comprehensive Oral Exam:1	2 credits
Specialized Course:2	6 credits
Thesis Work	9 credits
Total Credits	41 credits

Course Distribution	**Project Group**
Compulsory Theory Courses: 5	15 credits
Compulsory Lab Course: 3	9 credits
Comprehensive Oral Exam:1	2 credits
Specialized Courses:4	12 credits
Project Work	3 credits
Total Credits	41 credits

3.1 Definition of Credit and Distribution of Courses over the Semester

Each semester shall be 26 weeks

- 14 weeks of class teaching
- 4 weeks for preparation
- 4 weeks for holding the semester final examination
- 4 weeks for result publication

Learning and Teaching Activities Hours:

No.	Teaching-Learning Activities	Notional Hours for 1 Credit
1	Lecture, Seminar and Other Theory Course Activities	40
2	Lab	60

3	Thesis	80

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

Compulsory Theory and Lab Courses for M.S. Program (Thesis and Project Group)

Course ID	Title	Credit
DSCRMT501	**Disaster Impact Assessment**	**3**
DSCRMT502	**Humanitarian Emergency & Crisis Management**	**3**
DSCRMT503	**Urban Resilience: Theory and Practices**	**3**
DSCRMT504	**Climatic Risk Assessment & Extreme Event Modeling**	**3**
DSCRMT505	**Climate Resilient Health System**	**3**
DSCRML506	**Advanced Research Methodology**	**3**
DSCRML507	**Advanced Remote Sensing and GIS**	**3**
DSCRML508	**Numerical Modelling**	**3**

Specialized Theory and other Courses for M.S. Program

Course ID	Title	Credit
DSCRMT509	**Disaster Statistics and Economic Modeling**	**3**
DSCRMT510	**Integrated Water and Agricultural Risk Management**	**3**
DSCRMT511	**Institutional, Organizational and Social System**	**3**
DSCRMT512	**Public Policy and Governance for Disaster Management**	**3**
DSCRMT513	**Climate Policy and Politics**	**3**
DSCRMP514	**Masters Project Work**	**3**
DSCRMT515	**Thesis Work**	**9**
DSCRMV516	***Viva vocé***	**2**

Course Structure: M.S. Programme in Disaster Science and Climate Resilience (Thesis Group)

Course ID	1st Semester	Credit	Course ID	2nd Semester	Credit
DSCRMT501	Disaster Impact Assessment	3	DSCRMT	Specialized course	3
DSCRMT502	Humanitarian Emergency & Crisis Management	3	DSCRMT515	Thesis	9
DSCRMT503	Urban Resilience: Theory and Practices	3	DSCRMV516	*Viva vocé*	2
DSCRMT504	Climatic Risk Assessment & Extreme Event Modeling	3	**Total Credit**		**14**
DSCRMT505	Climate Resilient Health System	3			
DSCRML506	Advanced Research Methodology	3			
DSCRML507	Advanced Remote Sensing and GIS	3			
DSCRML508	Numerical Modelling	3			
DSCRMT	Specialized course	3			
Total Credit		**27**	**Total Program Credit**		**41**

Course Structure: M.S. Programme in Disaster Science and Climate Resilience (Project Group)

Course ID	1st Semester	Credit	Course ID	2nd Semester	Credit
DSCRMT501	Disaster Impact Assessment	3	DSCRMT	Specialized course	3
DSCRMT502	Humanitarian Emergency & Crisis Management	3	DSCRMT	Specialized course	3
DSCRMT503	Urban Resilience: Theory and Practices	3	DSCRMT	Specialized course	3
DSCRMT504	Climatic Risk Assessment & Extreme Event Modeling	3	DSCRMP514	Masters Project Work	3
DSCRMT505	Climate Resilient Health System	3	DSCRMV516	*Viva vocé*	2
DSCRML506	Advanced Research Methodology	3	**Total Credit**		**14**
DSCRML507	Advanced Remote Sensing and GIS	3			
DSCRML508	Numerical Modelling	3			
DSCRMT	Specialized course	3			
Total Credit		**27**	**Total Program Credit**		**41**

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%

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

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

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

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 at least 7 to 15 days before the semester final exam to allow time for exam registration, submitting class assessment, and preparation of students for exam. Only the AC may reduce this time and only under extraneous circumstances.

Duration of Exam

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

Credit	Duration of Examination
3 credit course	3 hours

Duration of practical examinations will be 4 hours irrespective of credit hours.

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 a course taught by one teacher only, the

semester final test scripts must be evaluated by two teachers, one of whom must be the course teacher, and another, a suitable second examiner who may be either from DU or outside DU.

Evaluation by Third Examiner

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

Evaluation of Practical Courses

Evaluation of practical courses will be done by course teacher(s).

Research Conduction and Supervisor Selection

In order to develop skilled personnel in problem identification, work-methodologies, scientific interpretation, producing a standard report; individual students shall carry out a supervised study independently on a specified topic. A topic will be selected by each student with the guidance from their supervisor/co-supervisor which is to be approved by the Academic Committee of the department. Students shall maintain 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 Research, each student shall defend and submit written Report/Thesis on the work undertaken. Students may also carry out internship at an Organization or Industry upon the approval of the Academic Committee.

Evaluation of Research

The written dissertation will be evaluated by two assigned Experts (assigned by the academic committee). For the presentation Exam Committee will evaluate each student's presentation. Other faculty members/supervisors can be present during the presentation. Proposal 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 (did not take an exam)	I	0.00
Withdrawn (did not attend any class and take any exam)	W	0.00

Calculation of GPA and CGPA

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

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

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

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

4.4: Promotion

For final degree a student must have to secure minimum CGPA 2.50.

The minimum CGPA of a student, as mentioned above, is calculated taking into consideration the grade points obtained in all courses.

4.5: Final Degree

For M.S. degree a student needs to complete at least 40 credit hours without F grade in any course, and has to secure a minimum CGPA of 2.50. The program must be completed within the time frame according to the rules of the University of Dhaka.

4.6: Retaking of Examinations and Improvement of Grades

Result of the students with letter grade "F" in any course(s) will remain incomplete (I) and the degree will be awarded after getting appropriate grade(s).

4.7: Class Representatives

Each batch will have two class representatives 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.

4.8: Course Teacher

Course teacher shall be finalized before the beginning of a semester by AC. The AC can make necessary change in course teacher if necessary (going on leave, illness etc.). More than one teacher can take one course if necessary.

Course teacher will take classes of designated courses and arrange field visit if necessary for the courses.The course teacher shall submit class assessment marks (attendance, mid-terms, presentation, and assignment), two copies to the chairman of the examination committee, and one copy to the controller of the examination 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.

4.9: 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, 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. 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.

4.10: Examination committee

The Academic committee of the department shall form an examination committee for each semester. 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.

4.11: 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.

4.12: Plagiarism and Referencing

Plagiarism is use of intellectual material without acknowledging its source. Common examples are copying, paraphrasing (from published, unpublished or web based sources) without acknowledging/referencing the authors.

Plagiarism is a serious academic offence and violation of academic and student conduct rules. It is regarded as theft of intellectual property. **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.

4.13: Semester Break

After completing all examination of Semester final (theory, laboratory, and viva, presentation etc.) a semester break will start. The duration of semester break will be 7-15 days. 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.

Course Structure:

Course Number and Title:
DSCRMT501 Disaster Impact Assessment

Credit :03

Introduction to the Course:
Natural disasters cause human suffering. They also create substantial physical and economic damage, which can spill over outside the disaster area. As a result, disasters may erode a country's overall economic development. There is relationship between natural disasters and economic growth. So proper mitigation and adaption options are required to lessen the impact of disasters on economic and social aspects. This course is, therefore, to exercise the tools and techniques that can be applied/adopted to assess the disaster impact and their mitigation options.

Specific Objective:
To understand how to undertake impact-, hazard-, vulnerability- and risk-assessment; analyze the relationship between various entities exposed to risk and learn about the various tools and techniques available for such assessments.

Course Contents:

1. Scope of Risk & Impact Assessment
2. Hazard Identification Tools, Hazard Analysis, Natural and Technological Hazard Assessment
3. Elements at Risk, Types of Elements at Risk, Exposure Analysis, Vulnerability Assessment, Components and Characteristics of Vulnerability, Conceptual Frameworks of Vulnerability, Vulnerability Assessment Methods: physical, socio-economic, environmental & systemic
4. The purpose of Risk Assessment, Qualitative and Quantitative Approach to Risk Assessment/Risk Estimation
5. Risk Modeling: Concept and Steps, Risk Modeling Tools (e.g. HAZUS, CAPRA, The OpenQuake)
6. Environmental Impact Assessment (EIA), Social Impact Assessment (SIA)
7. Multi-Hazard Risk Assessment Framework, step by step Multi-Hazard Risk Assessment, Risk Evaluation, Risk perception, Risk Transfer

Learning Outcomes:

1. Get a comprehensive understanding of Disaster Impact Assessment framework.
2. Be able to know how to assess the economic, environmental and social impact.
3. Be able to take the decision of proper risk reduction measures based on estimated impact

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

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

References:

1. 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. Ulrich Ranke (2016) Natural Disaster Risk Management: Geoscience and Social Responsibility, Springer, New York
7. Wisner B. (2004) At Risk: Natural Hazards, People's Vulnerability, and Disasters. Routledge. US
8. Westen et al (2011), A Guidebook of Multi-hazard Risk Assessment, Public Works

Course Number and Title:
DSCRMT502 Humanitarian Emergency & Crisis Management

Credit : 03

Introduction to the Course:
Nowadays, the world is facing many humanitarian emergencies and crises all over the world due to disaster and climate change. In this course students will get ideas about humanitarian emergency & crisis, their origin, management and impacts in an elaborate manner.

Specific Objectives:
To get complete ideas about origin of humanitarian emergency and crisis along with management procedures to reduce impacts.

Course Contents:

1**. Introduction:**

Complex Humanitarian Emergency, Origin and evolution of the definition. Related concepts. Difference between man-made and natural disasters: characteristics. Who are the players? A brief description of the network of local, national and international actors.

2. **Practical and conceptual problems with a humanitarian crisis:**

Uncertainty on how and when to intervene (accompanied by a lack of preparedness). The difficulties in linking relief, rehabilitation, and development. Declining resources and disparities in allocation. The roles and management of the organizations involved inter-organizational coordination and competition, as well as the tension between organizational control and local participation.

3. **Root causes of humanitarian crisis: breakdown of societies:**

Vulnerabilities (economic, social, political etc.). Authoritarianism and corruption, Development failures and structural adjustment, Colonialism, War. Resource constraints and impacts of improper planning.

4. **Humanitarian theories:**

Humanitarianism, Theory, and practice of humanitarian intervention, Three Grotian Theories of Humanitarian Intervention, Eight Theories of Humanitarian Intervention

5. **Humanitarian interventions:**

Types of intervention: military (peacekeeping) or civilian. Prevention, Peacemaking, and Rebuilding. How do complex humanitarian emergencies differ from long-term deprivation? When is it "right" and/or "legal" to intervene? When not to intervene? Who should decide? What is the least that should be done to help? Who will oversee the quality of relief?

6. **Humanitarian actors and coordination:**

The military: The emerging and controversial role of the military in "humanitarian interventions." Media, Donor, Country, Governments. NGOs: Theoretical overview: what are they, why have they emerged, whose interests do they serve and why? Distinguishing between public service contractors, solidarity organizations, neutral organizations and impartial organizations. North-South issues. Funding arrangements and the broader issue of donors and their policies. UN System: Roles, responsibilities, and mandates. Roles of states and national sovereignty. Execution of programs & examples of UN-led humanitarian interventions: political rationale, funding levels, assignment for leadership and coordination. Regional Organizations. The aid chain and coordination. The expectations that accompany external aid.

7. **Victims, beneficiaries or participants? The local population, internally displaced people, and refugees:**

Outcomes of actions: conflict resolution, refugee resettlement, social and political reconstruction. What goes right? What goes wrong? Where do we go from here? Coping mechanisms, capacities, capabilities, and vulnerabilities. Participation.

8. **Rebuilding reconsidered: linking relief and development:**

Importance of a long-term development perspective: lives and livelihood. It is important to stress the linkages among political aspects, human rights, and participation. Three areas: security: a transition from war to peace and non-violent ways of conflict resolution; politics: a transition from an authoritarian or totalitarian system to an open, participatory system of governance (including civil society building); and economy: a transition to (re-)building economic capacities, often with a higher degree of equity. Accountability and evaluation. What happens if the spotlight is turned off?

9. **Practical humanitarian actions:**

Water and Sanitation, Livelihoods and Food Security in Humanitarian Crises, Nutrition in Humanitarian Crises, Management of Diseases in Humanitarian Crises, Shelter in a Humanitarian Setting, Protection of Displaced Populations: Human Rights & Humanitarian Law, Emerging Risks, Challenges, and Opportunities for Future Humanitarian Emergencies. Examples from Palestine; Exodus from Middle East, North Africa, South America; and Forcibly Displaced Myanmar Nationals (Rohingya).

10. **Criticisms, alternatives, and solutions:**

Do no harm: aid can support peace or war, the criticism on humanitarianism (De Waal) and the response, Ethics and Humanitarian Standards, SPHERE, HAP, Southern challenges

Learning Outcomes:

1. To learn what is emergency and crisis and their causes.
2. To learn how to manage emergency and crisis
3. To get an overview of world's present emergencies and crises.

Instructional Strategies:

Visual aids like Multimedia alongside whiteboard writings will be used to present lectures. All the materials will be provided as soft copies through common group email account. Teaching methods will be: lectures, group discussion, exercises, case studies, assignments and presentations. Techniques like role play, question and answer sessions, practical research and report writing may be used to increase participation. In addition, problem solving and hands on learning is encouraged.

Assessment:

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

References:

1. Moore, J. (1998) *Hard Choices*, Introduction & Ch. 1, pp. 1-28.
2. Weiss, T. G., Collins, C. (2000) *Humanitarian Challenges and Intervention*, (Ch. 1: Evolution of the Humanitarian Idea) Westview Press, second edition, pp. 13-38.
3. Keen, D. (1998) The Economic Functions of Violence in Civil Wars, *Adelphi Paper*, **320**, The International Institute for Strategic Studies, Oxford University Press, Oxford, 88 pp.
4. Lee, S.P (2010) HUMANITARIAN INTERVENTION—EIGHT THEORIES. In *Diametros № 23 (March 2010): 22-43 22*.
5. Totten, S. & Parsons, W.S. (edited) (2013) Centuries of Genocide: Essays and Eyewitness Accounts (4th Edition). Routledge: New York.
6. Donini, A. (1995) Beyond Neutrality: On the Compatibility of Military Interventions and Humanitarian Assistance, *The Fletcher Forum of World Affairs*, pp. 31-45.
7. Anderson, M.B. (1999) *Do No Harm: How Aid Can Support Peace ¾ Or War*, Lynne Riener Publishers, Boulder.

8. Curtis, D. (2001) Politics and Humanitarian Aid: Debates, Dilemmas, and Dissension, *HPG Report* 10, Humanitarian Policy Group, Overseas Development Institute, London. (http://www.odi.org.uk/hpg/papers/hpgreport10.pdf)
9. Jackson, S., P. Walker (1999) Depolarizing the `Broadened' and `Back-to-Basics' Relief Models, *Disasters*, 1999, 2, 93-114.

Course Number and Title:
DSCRMT503 Urban Resilience: Theory and Practices

Credit :03

Introduction to the Course:
Cities grow faster and every day the urban areas are being increased, which creates pressure on exiting infrastructures/facilities, economy and standard of living. Again, the growth of urban areas is not as much as the growth of population. As a result, the urban population density is hiking always that increases the exposure to the human lives to the urban disaster like earthquake, flood, and fire and build collapse etc. This leads to make urban setting vulnerable day by day. So to make urban areas more resilient is a great concern for city / disaster management authority and urban dwellers. To avoid losses from disasters, and to prevent affected citizens from falling into poverty, improved urban resilience can safeguard for its generations. Hence this course is designed to highlight the theories, techniques and best practices for attaining urban resilience in a sustainable way.

Specific Objectives:
To understand what makes urban areas vulnerable and how to achieve resilience in such environments.

Course Contents:
1. Principles of Urban Resilience: Urban Disaster Resilience, Risk, Uncertainty, and Complexity, Disaster Risk Management and Opportunities for Resilience Social Resilience, Land Use Planning, Urban Ecosystems, Urban Upgrading, Incorporating Resilience into the Project Cycle,
2. Tools for Building Urban Resilience: Risk Assessment, Risk-Based Land Use Planning, Urban Ecosystem Management, Urban Upgrading, Community and Stakeholder Participation, Disaster Management Systems, Data Gathering, Analysis, and Application, Risk Financing and Transfer Approaches
3. Climate Resilient Cities: Understanding the Impacts of Climate Change and Disaster Risk Management, Explaining Climate Change Impacts and Disaster Risk Management, Assessment Exercise: Discovery of a “Hot Spot”, Information Exercise: Creating a City Information Base, Sound Practice Examples of Adaptation and Mitigation
4. Pillars of Urban Risk Assessment: Hazard Impact Assessment, Institutional Assessment, and Socioeconomic Assessment
5. Techniques for Urban Disaster Mitigation: focus on Earthquake, Fire and Water Logging

6. The Practice of Urban Resilience: Water Supply and Wastewater Systems, Energy and Communication Systems, Transportation Systems
7. Work place safety and public health issues in urban settings
8. Learning from Cities: Delta Cities, Coastal Cities, and Densely Populated Cities
9. Resilient Cities and Climate Adaptation Strategies
10. Risk Assessment of Action Planning and Implementation

Learning Outcomes:

1. Understand urban setting, risk and resilience.
2. Identify the urban risk resulting from natural hazards and climate change.
3. Apply urban vulnerability and risk assessment methods, including social techniques towards resilient city.
4. Know the best practices for tackling disaster and climate-related impact.
5. Know how to incorporate this risk information into action plans.

Instructional Strategies:

Visual aids like Multimedia alongside whiteboard writings will be used to present lectures. All the materials will be provided as soft copies through common group email account. Teaching methods will be: lectures, group discussion, exercises, case studies, assignments and presentations. Techniques like role play, question and answer sessions, practical research and report writing may be used to increase participation. In addition, problem solving and hands on learning is encouraged.

Assessment:

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

References:

1. Abhas K. Jha et al (2013) Building Urban Resilience: Principles, Tools, and Practices, a World Bank Publication
2. Eric Dickson and et al (2012) Urban Risk Assessments: Understanding Disaster and Climate Risk in Cities
3. Seth Stein and Jerome Stein (2014) Playing Against Nature: Integrating Science and Economics to Mitigate Natural Hazards in an Uncertain World, AGU, WILEY
4. Ulrich Ranke (2016) Natural Disaster Risk Management: Geoscience and Social Responsibility, Springer, New York
5. Neeraj Prasad, Federica Ranghieri, Fatima Shah, Zoe Trohanis, Earl Kessler, Ravi Sinha. 2009. Climate Resilient Cities: A Primer on Reducing Vulnerabilities to Disasters. Washington, DC: World Bank. doi: 10.1596/978-0-8213-7766-6.
6. Pasteur, K. 2011. From Vulnerability to Resilience: A Framework for Analysis and Action to Build Community Resilience. Bourton on Dunsmore, U.K. Practical Action Publishing, Ltd.

7. Pelling, M. 2010. Review and Systematization of Disaster Preparedness Experiences in Urban Areas in the Caribbean Region. Oxford, U.K.: Oxfam.
8. Pelling, M., and B. Wisner. 2009. Disaster Risk Reduction: Case Studies from Urban Africa. London: Earthscan Publications Ltd.
9. Tools for Building Urban Resilience: Integrating Risk Information into Investment Decisions. Pilot Cities Report—Jakarta and Can Tho (World Bank 2012).
10. UNISDR. 2015. Sendai Framework for Disaster Risk Reduction 2015-2030. The United Nations Office for Disaster Risk Reduction (UNISDR), United Nations - Headquarters (UN), Geneva Switzerland, 32 p.

Course Number and Title:
DSCRMT504 Climatic Risk Assessment and Extreme Event Modeling

Credit : 03

Introduction to the Course:
Day by day extreme atmospheric events are increasing due to climate change. In this course students will learn about the climatic risk assessment techniques use model to predict extreme climatic events.

Specific Objectives:
Learning climatic risk assessment technique and using climatic models to predict extreme climatic events.

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

2. **Physical Processes in the Climate System:** Conservation of moment, Equation of (Application- height-pressure-temperature relation, thermal circulation, sea level rise due to oceanic thermal expansion, temperature equation (Application: the dry adiabatic lapse rate near the surface, decay of a sea surface temperature anomaly), Continuity equation (Application: coastal upwelling, equatorial upwelling, conservation of warm water mass in an idealized layer above the thermocline), Moisture equation and salinity equation, Moist processes, Wave processes in the atmosphere and ocean (e.g. Gravity waves, Kelvin waves, Rossby waves).

3. **Climate Model:** Constructing a Climate Model (An Atmospheric model, Treatment of sub-grid scale processes, Resolution and computational cost, An ocean model and ocean-

atmosphere coupling, Land surface, snow, ice and vegetation, Summary of principal climate model equations, Climate system modeling), Numerical representation of atmospheric and oceanic equations (Finite-difference versus spectral models, Time-stepping and numerical stability, Staggered grids and other grids, Parallel computer architecture), Parameterization of small-scale processes (Mixing and surface fluxes, Dry convection, Moist convection, Sea ice and snow, The hierarchy of climate models, Climate simulations and climate drift, Evaluation of climate model simulations for present-day climate (Global Climate Models e.g. GCM, Regional Climate Models e.g. PRECIS, Atmospheric model climatology from specified SST, Climate model simulation of climatology, Simulation of ENSO response), Evaluation of climate models.

4. **Climate Model Scenarios for Global Warming:** Greenhouse gases, aerosols and other climate forcing, Global-average response to greenhouse warming scenarios, Spatial patterns of warming for time-dependent scenarios, Climate response time in transient climate change, Ice, sea level, extreme event, Climate change observed to date, Emissions paths and their impacts.

5. **Year-to-Year Climate Prediction:** El Niño prediction, Other inter-annual climate phenomena and prospects for seasonal-to- inter-annual climate prediction (e.g. Hurricane season forecasts, Sahel drought, North Atlantic oscillation and annular modes)

Learning Outcomes:

1. Learn to assess climatic risk
2. Learn to run climate model
3. Learn to evaluate results provided by climate model etc.

Instructional Strategies:

Visual aids like Multimedia alongside whiteboard writings will be used to present lectures. All the materials will be provided as soft copies through common group email account. Teaching methods will be: lectures, group discussion, exercises, case studies, assignments and presentations. Techniques like role play, question and answer sessions, practical research and report writing may be used to increase participation. In addition, problem solving and hands on learning is encouraged.

Assessment:

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

References:

1. Neelin J.D., 2011. Climate Change and Climate Modeling, Cambridge University Press, London
2. Dr. Philip J. Rasch , Philip J. Rasch, 2012. Climate Change Modeling Methodology: Selected Entries from the Encyclopedia of Sustainability Science and

Technology, Springer-Verlag New York
3. Saeid Eslamian, 2014. Handbook of engineering hydrology: Modeling, climate change, and variability, CRC Press/Taylor & Francis Group, Boca Raton
4. Yongyut Trisurat, Rajendra P. Shrestha, Rob Alkemade Land Use, 2011. Climate Change and Biodiversity Modeling: Perspectives and Applications, Information Science Reference, Hershey
5. N. Gobron, F. Mélin, B. Pinty (auth.), Martin Beniston, Michel M. Verstraete (eds.), 2001. Remote Sensing and Climate Modeling: Synergies and Limitations, Springer Netherlands
6. Azadeh Ramesh, 2013. Response of Flood Events to Land Use and Climate Change: Analyzed by Hydrological and Statistical Modeling in Barcelonnette, Springer Netherlands
7. Leila Maria Véspoli de Carvalho, Charles Jones (eds.), 2016. The Monsoons and Climate Change: Observations and Modeling, Springer International Publishing, Switzerland
8. Dr. Philip J. Rasch (auth.), Philip J. Rasch (eds.), 2012. Climate Change Modeling Methodology: Selected Entries from the Encyclopedia of Sustainability Science and Technology, Springer-Verlag New York
9. John B. Drake, 2014. Climate modeling for engineers and scientists, SIAM-Society for Industrial and Applied Mathematics, Philadelphia

Course Number and Title:
DSCRMT505 Climate Resilient Health System

Credit: 03

Introduction to the Course:
Public health is an essential component to achieve resilience and this course explores its relationship with Disasters and Climate Change. How diseases spread, its impacts and control are all studied here. At the same time students will learn what is necessary in order to have a Climate Resilient Heath System.

Specific Objectives:
Understand how diseases can impact the world and what is necessary for a Climate Resilient Heath System

Course Contents:
1. Introduction to Climate Change and Climate Resilience in Disaster Science.
2. Impact of Climate Change on Public Health.
3. Impact of Climate Change on Food Security and Agriculture.
4. Climate Change Adaptation and Food Security.
5. Water and Environmental Pollution : Risk, Prevention and Control.

6. Climate Resilient Water- Environment Driven Crop System and Food Security.
7. Climate Resilience and Social Determinants of Health.
8. Public Health Surveillance and Disease Outbreak: Investigation in Emergencies.
9. Extreme Weather Events and Public Health Management (Flood, Cyclone, Drought, Water Surge, Landslide etc.).
10. Preparedness and Responses through Adaptation and Mitigation for Climate Resilience.
11. Climate Resilient Health System: National and International Responses.

Learning Outcomes:

1. Learn about diseases and how they spread
2. Learn how diseases are connected to Disasters and Climate Change
3. Learn about the vulnerabilities in health systems
4. Understand the necessities of a resilient health system

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

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

References:

- Aschengrau, A., & Seage, G. (2018). *Essentials of Epidemiology in Public Health.* Jones & Bartlett Learning.
- Fallon, L., Fleming, J. F., & Zgodzinski, E. (2012). *Essentials of Public Health Management.* Jones & Bartlett Learning.
- Filho, W. L., Azeiteiro, U., & Alves, F. (2016). *Climate Change and Health.* Springer International Publishing.
- Levy , B., & Patz, J. (2015). *Climate Change and Public Health.* Oxford University Press.
- Schneider, M. J. (2020). *Introduction to Public Health.* Jones & Bartlett Learning.
- Seabert, D., McKenzie, J., & Pinger, R. (2021). *McKenzie's An Introduction to Community & Public Health.* Jones & Bartlett Learning.

Course Number and Title:

DSCRML506: Advanced Research Methodology

Credit : 03

Introduction to the Course:
This course will provide an opportunity for students to establish or advance their understanding of research through critical exploration of research language, ethics, and approaches. The course introduces the language of research, ethical principles and challenges, and the elements of the research process within quantitative, qualitative, and mixed methods approaches. Students will use these theoretical underpinnings to begin to critically review literature relevant to their field or interests and determine how research findings are useful in forming their understanding of their work, social, local and global environment. Based on the learning, the students will prepare their thesis/project proposal in this course. In addition, the ideal format for submitting a project proposal to achieve research grant will also be addressed in this course. Finally, students should able to know how to present the expected project outcomes to the professional audience.

Specific Objectives:
1. Understand concepts and definitions of research;
2. Select a tentative research problem that will be subsequently developed into a research proposal;
3. Identify various paradigms for conducting research;
4. Understand the process of developing a research project;
5. Know and use library reference sources and services;
6. Understand the organizational skill necessary for good research;
7. Demonstrate the ability to think and interact critically with primary and secondary materials as well as with fellow students and the instructor;
8. Learn how to write with clarity and grace.

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. Causal research design: Conditions of causality, concomitant variation, time order of occurrence of variables, experiment and experimental design, internal and external validity, history, maturation, testing and instrumentation effects, statistical regression effects, selection bias, mortality effect, randomization, matching, experimental designs (pre-experimental, true experimental, quasi-experimental and statistical).
9. Critical Reading and Technical Writing, Argumentation
10. Ethics and Professionalism in Science
11. 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); Factor analysis: Factor analysis model, key statistics, conducting factor analysis, principal component analysis, determination of variables and number of factors, interpretation

12. 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.
13. Research Presentation and Publication: Scientific Articles, Publication of Report, Grey Literature, Conference Paper, Presentation of Research, Poster.
14. Research Proposal: Research or Project proposal preparation and defense.
15. Project proposal preparation for a research grant.

Learning Outcomes:

Upon completing the course students will be able to:

1. Identify the main characteristic of scientific research.
2. Develop the capability to find, evaluate and summarize pertinent scientific literature to find the scope and to formulate their research problem.
3. Develop the skills how to read any research output critically and write technically.
4. Construct the framework to be followed in the thesis/project work.
5. Know how to store, manage, and use the bibliographic data in scientific writing.
6. Critically evaluate & choose the methods & techniques they have learned so far.
7. Emphasize research ethics and professionalism.

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

Assessment:
Formative (40%): Attendance, Laboratory work
Summative (60%): Practical Examination

References:

1. B.D. Phillips. 2014. *Qualitative Disaster Research: Understanding Qualitative Research*, Oxford: Oxford University Press.
2. D.G. Rossiter (2011) Research Skills and Methods, An ITC Publication
3. Damodar N. Gujarati and Dawn C. Porter. 2009, *Basic Econometrics*, 5th Edition, McGraw-Hill Irwin, international edition.
4. Paul J. Gertler, Sebastian Martinez, Patrick Premand, Laura B. Rawlings, and Christel M. J. Vermeersch. 2011. *Impact Evaluation in Practice*, Washington DC: World Bank.
5. Shahidur R. Khandker, Gayatri B. Koolwal, Hussain A. Samad. 2010. *Handbook on Impact Evaluation: Quantitative Methods and Practices*, Washington DC: World Bank.

6. N.K. Malhotra and D.F. Birks. *Marketing Research*, Second European Edition, Prentice Hall.

Course Number and Title:
DSCRML507 Advanced Remote Sensing and GIS

Credit:03

Introduction to the Course:
Remote Sensing (RS) dataset is widely being used, nowadays, in Disaster Management Cycle. Effective disaster management needs information before, during and after the event for risk reduction, response and crisis management. So real time data or data of temporal nature is essential for proper disaster management (DM). DM also needs data of remote and inaccessible areas. These needs of DM make Remote Sensing data is a must. On the other hand, GIS is a tool to accommodate data from various sources like, RS, GPS (Global Positioning System), field survey (spatial and non-spatial info) and data from other sources or thematic areas to perform analysis for suggesting options for taking appropriate decision for DM. Also GIS is a strong platform for data visualization for individual thematic area and a mashup of different themes.

Course Contents:
1. Advanced Concepts and Principles of Remote Sensing: Air- and Space-borne
2. Advanced Concept of Geo-information Science: Time Series Analysis, Network Analysis, Terrain Analysis, Process Modeling, Data Quality and Accuracy Assessment, Concept and Application of Geo-health, Web-GIS and Crowdsourcing, Customization, Scripting and programming, Geo-database, spatial database, Model builder.
3. Advanced Image Classification: Support Vector Machine, Super Resolution Mapping, Markov Random Field, Sub-Pixel Analysis of Optical Imagery, Object-based image classification, Radar Image Analysis: Interferometry & Polarimetry, Lidar Image Analysis
4. Damage Mapping using Optical, UAV and Radar Image.
5. Remote sensing application in Disaster risk reduction. Cyclone and flood inundation modeling and mapping, Landslide hazard mapping, drought and salinity mapping and modeling, chemical and technological hazard modeling

Learning Outcomes:
Upon completion of this course:
1. The student should able to learn the advanced concept of Geo-information Science and Earth Observation.
2. The student should be able to apply this knowledge using state-of-the-art GIS tools.
3. Thus, the student should enable themselves to solve real-life problems in the context of Disaster Science and Climate Resilience based on spatial knowledge.

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

Assessment:
Formative (40%): Attendance, Laboratory work
Summative (60%): Practical Examination

References:

1. Lillesand T.M., Kiefer R.W. and Chipman J.W. (2004) Remote Sensing and Image Interpretation. 5th edition. Wiley-Blackwell. US.
2. ITC (2010) A Core Book of Geo-information Science and Earth Observation: A System based Approach.
3. Richards J.A. (2013) Remote Sensing Digital Image Analysis, Springer, New York
4. Weng Q. (2009) Remote Sensing & GIS Integration: Theories, Methods, and Applications. McGraw Hill. US.

Course Number and Title:
DSCRML508 Numerical Modelling

Credit:03

Introduction to the Course:
This lab course will address various numerical methods and build on previously lessons, for example, AEM, FEM, FVM, FDM, BEM, and DEM. In addition, Game theory, agent-based modeling and simulation and different type's optimization technique will also be covered.

Specific Objective:
The objective of this lab is to present the application of various numerical simulation (AEM, FEM, FVM, FDM, BEM, and DEM) tools in the field of disaster science and climate resilience.

Course Contents:
1. Finite element method (FEM)
2. Finite volume method (FVM)
3. Finite difference method (FDM)
4. Boundary element method (BEM)
5. Discrete element method (DEM)
6. Applied element method (AEM)

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

Learning Outcomes:
Upon completion of this course students will be able to apply numerical method in the field of disaster risk reduction, for example, FEM based 2D seismic site response analysis, numerical simulation of direct shear test by DEM, 2D/3D Flood Modelling, Post-disaster resources allocation etc.

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

Assessment:
Formative (40%): Attendance, Laboratory work
Summative (60%): Practical Examination

References:

1. Bishop, Christopher. Neural Networks for Pattern Recognition. New York, NY: Oxford University Press, 1995. ISBN: 9780198538646.
2. Duda, Richard, Peter Hart, and David Stork. Pattern Classification. 2nd ed. New York, NY: Wiley-Interscience, 2000. ISBN: 9780471056690.
3. Hastie, T., R. Tibshirani, and J. H. Friedman. The Elements of Statistical Learning: Data Mining, Inference and Prediction. New York, NY: Springer, 2001. ISBN: 9780387952840.
4. MacKay, David. Information Theory, Inference, and Learning Algorithms. Cambridge, UK: Cambridge University Press, 2003. ISBN: 9780521642989. Available on-line here.
5. Mitchell, Tom. Machine Learning. New York, NY: McGraw-Hill, 1997. ISBN: 9780070428072.
6. Cover, Thomas M., and Joy A. Thomas. Elements of Information Theory. New York, NY: Wiley-Interscience, 1991. ISBN: 9780471062592.
7. P.E. Lewis and J.P Ward, The finite element method; Principles and Application, AddisonWesley, 1991.
8. Zienkiewicz and K. Morgan, Finite Elements and approximations, John Wiley and Sons.
9. C.F. Gerald and P.O. Wheatley, Applied Numerical Analysis, Addison-Wesley, 1998.

10. M.A. Celia and W.G. Gray, Numerical Methods for Differential Equations, Prentice-Hall Int. Inc.
11. G.D. Smith, Numerical solution of Partial differential equations, Clarendon press, Oxford, 1978
12. Stephen C. Chapra, McGraw Hill, 2010. Applied Numerical Methods with MATLAB for Engineers and Scientists, 2nd Edition.
13. Cleve Moler, Numerical Computing with MATLAB, Electronic edition: The MathWorks, Inc.,
14. Natick, MA, 2004, http://www.mathworks.com/moler. Print edition: SIAM, Philadelphia, 2004.http://ec-securehost.com/SIAM/ot87.html
15. L. V. Fausett, Applied Numerical Analysis Using MATLAB® 2/E, Prentice Hall, ISBN: 0132397285
16. S. Nakamura, Numerical Analysis and Graphic Visualization with MATLAB®, 2/e, Prentice Hall, 2002, ISBN:01306548921

    A. Gilat and V. Subramaniam, Numerical Methods for Engineers and Scientists, John Wiley Sons, Inc., 2008, ISBN: 9780471734406
17. J. H. Mathews and K. D. Fink, Numerical Methods Using MATLAB®, 3rd ed, Upper Saddle River, NJ: Prentice Hall, 2004, ISBN: 0130652482
18. J. Kiusalaas, Numerical Methods in Engineering with MATLAB® , Cambridge University Press, 2005, ISBN: 0521852889

Course Number and Title:
DSCRMT509 Disaster Statistics and Economic Modeling

Credit : 03

Introduction to the Course:
Disaster affects economy in numerous ways. Understanding of the real scenario of disaster impact and knowledge of how to perform proper economic modelling is required. This advance course will focus on analysis of dynamic behavior of economic shift and changes due to disaster and possible solutions.

Specific Objectives:
This course will prepare students for doing advance research in quantitative fields of disaster and economic, Damage and Los Assessment, Impact Assessment.

Course Contents:

1. **Introduction:** Economic dimensions of disasters, effects on expenditure and income sides of the economy, consumption, investment, markets, economic growth and business cycles, money supply, inflation, credit, the fiscal policy including revenue and subsidy, insurance, and market and government failures.
2. **Economic modeling:** Circular flow of the economy, household, labor market, firm, industry, macro modeling and national income accounting.

3. **Econometric modeling:** Multivariate regression; Logit, Probit and Tobit models, ARIMA, hedonic pricing model, forecasting models, an econometric model with panel data.
4. **Economic systems analysis:** Single and Multi-Region Input-Output Tables, Environmentally Extended Social Accounting Matrix (EESAM), SAM-based assessment of disasters, and computable general equilibrium modeling.
5. **Advances in national accounting:** Experimental ecosystem accounting, System of Environmental-Economic Accounting, valuation, catastrophic loss, and physical and monetary balance in national accounting.
6. **Economic modeling of climate change:** Integrated assessment models — DICE, RICE and PAGE models, G-Cubed model, and Stern Review.
7. **Macroeconomic modeling for climate change:** Welfare maximization, intergenerational choice and time discount, production function, factor inputs, estimating capital stock, effects on nominal and real sectors.

Learning Outcomes:

Upon completing the student will get the advanced concept of disaster economics.

1. They should be able to figure out the trend of disaster statistics and realize the necessity of disaster database.
2. They should know how to apply economic modeling utilizing these data to perform economic system analysis.
3. Learn how to incorporate the information derived from Damage and Need Assessment in development plan and policies.

Instructional Strategies:

Visual aids like Multimedia alongside whiteboard writings will be used to present lectures. All the materials will be provided as soft copies through common group email account. Teaching methods will be: lectures, group discussion, exercises, case studies, assignments and presentations. Techniques like role play, question and answer sessions, practical research and report writing may be used to increase participation. In addition, problem solving and hands on learning is encouraged.

Assessment:

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

References:

1. Alabala-Bertrand, J.M. 1993: *Political Economy of Large Natural Disasters; With Special Reference to Developing Countries*. Oxford: Clarendon Press.
2. Andersen, T. 2004. International Risk Transfer and Financing Solutions for Catastrophic Exposures. *Financial Market Trends* 87: 91-120.
3. Butler, J. and Doessel, D. 1980. Who Bears the Costs of Natural Disasters? An Australian Case Study. *Disasters* 4(2): 187-204.

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5. Guimaraes, P., Hefner, F., and Woodward, D. 1993. Wealth and Income Effects of Natural Disasters: An Econometric Analysis. *Review of Regional Studies* 23: 97-114.
6. Horwich, G. 2000. Economic Lessons from the Kobe Earthquake. *Economic Development and Cultural Change* 48(3): 521-522.
7. Kabir, M. 2005. Managing Flood in Bangladesh: Facts and Caveats. *Bangladesh Journal of Political Economy* 22(1&2): 143-156.
8. Kellenberg, K. and Mobarak, A.M. 2011. The Economics of Natural Disasters. *Annual Review of Resource Economics* 3:297–312.
9. Nordhaus, W.D. 2007. A Review of the Stern Review on the Economics of Climate Change. *Journal of Economic Literature* 45: 686–702.
10. Nordhaus, W.D. 2014. Estimates of the social cost of carbon: concepts and results from the DICE-2013R model and alternative approaches. *Journal of the Association of Environmental and Resource Economists* 1(1/2): 273-312.
11. Nordhaus, W.D. 2016. Projections and uncertainties about climate change in an era of minimal climate policies. *Cowles Foundation Discussion Paper No. 2057*, Connecticut: Yale University.
12. Pelling, M., Özerdem, A. and Barakat, S. 2002. The Macro-Economic Impact of Disasters. *Progress in Development Studies* 2(4): 283-305.
13. Rezai, A., Taylorb, L. and Mechler, R. 2013. Ecological macroeconomics: An application to climate change. *Ecological Economics* 85: 69-76.
14. Rose, A. 2004. Defining and Measuring Economic Resilience to Disasters. *Disaster Prevention and Management* 13(4): 307-314.
15. Rose, A. 2004. Economic Principles, Issues, and Research Priorities in Hazard Loss Estimation. In: Y. Okuyama and S.E. Chang (eds), *Modeling Spatial and Economic Impacts of Disasters*, New York: Springer, pp. 13-36
16. UNDP. 1994. *Disaster Economics*, 2nd Edition, New York: UNDP.
17. Yezer, A. 2002. The Economics of Natural Disasters. In: R. Stallings (ed), *Methods of Disaster Research*. Philadelphia: Xlibris, pp. 213-235.

Course Number and Title:
DSCRMT510 Integrated Water and Agricultural Risk Management

Credit: 03

Introduction to the Course:
This Course will provide insight on different theory and available tools in this area to deal with water and agricultural risk managements. This course covers wide ranges of risk and possible solutions on water and agricultural aspects.

Specific Objectives:
Students would be able to identify and apply appropriate methods of assessing these risks and to demonstrate an understanding of the decision process behind the management of such water and agricultural risks and to explain the possible consequences in a given situation where these risks will occur and their likely impacts on the water, agriculture and finally the populations.

Course Contents:

1. **Environmental, Water and Agricultural Risk and Perception.** Integration of water, agriculture, and environment – the need and its study approach. Various types of water, agricultural and environmental risks, the perception of risk and how it varies with context, attitudes towards risk based on psychological, cultural and other dimensions. The role of various societal groups (the media, NGOs, etc) in risk issues.

2. **Water and Environmental Pollution Prevention and Remediation Technologies.** Water treatment process train, Ultra- and Microfiltration – Basic principles. Membrane materials, pore size, and fouling mechanisms. Overview of ultra- and micro-filtration elements and systems. Fouling in MF/UF systems, fouling control and pre-treatment. Reverse osmosis and Nano-filtration – Basic principles. Overview of RO and NF membranes and elements. Summarizing process design of RO systems. Conventional pre-treatment techniques for RO and NF. Particulate fouling and pre-treatment– Fouling due to suspended and colloidal matter, parameters to predict fouling, Biofouling and pre-treatment– Pre-treatment for bio-fouling, principles, parameters AOC and BDOC, membrane fouling simulator. Fouling due to Oil compounds spills. Advanced oxidation processes – Fundamentals of AOPs including ozone, H2O2, UV, and combinations; application. Air quality monitoring- Common and Criteria pollutants, solid waste management- site selection and leachate management, Aquifer vulnerability assessment.

3. **Modelling of Environmental Processes/Contaminants:** Examples of models applied in Environment, soil, and water. Overview of the types of models applied, strengths and weaknesses of various models. Illustrating the impact of models and model outputs on climate change to local flooding risk.

4. **Agricultural systems and its historical development underworld and Bangladesh context**: The future direction of production and productivity of Bangladesh agriculture: Vision, mission, and road-map. Agricultural environments of Bangladesh with the specific role of water.

5. **Environmental constraints: Land, water, and climate**.

6. **Qualitative and Quantitative analysis of water-environment-based agriculture**: ‘Agroecosystems’ approach. Formal modeling approach.

7. **Improved productivity of water-environment-driven agriculture:** Application of qualitative and quantitative approach for Crop, Livestock and Fish system

8. **Scientific writing and presentation of agricultural systems analysis**.

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

1. Understand the wide range of water and agricultural hazards and risks within Bangladesh.
2. Aim at improving environmental quality by using different types of pollution prevention technologies.
3 Have a clear idea of the environmental processes through Modelling which are feasible for a short time period analysis.

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

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

References:
1. PARK, Chris (2001) The Environment: Principles and Applications. 2nd Edition, Routledge, UK.
2. Cramer, G.M., Ford, R.A. & Hall, R.L. 1978, "Estimation of toxic hazard - a decision tree approach", Food and cosmetics toxicology, vol. 16, no. 3, pp. 255-276.
3. Griem H., Synder R. Toxicology, and Risk Assessment: A Comprehensive Introduction Wiley, UK, ISBN: 978-0-470-86893-5
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5. BARC. 2012. Agricultural Research Vision 2030. Project Coordination Unit (PCU) National Agricultural Technology Project (NATP): Phase-1, Bangladesh Agricultural Research Council (BARC), Farmgate, Dhaka-1215, Bangladesh.
6. Conway G.R. 1986. Agroecosystem analysis. Agricultural Administration. 20: 31-55. 14
7. Groom B. 2012. Climate Change Adaptation: The Bangladesh Experience. World Wide Fund for Nature – Pakistan.
8. Penning de Vries F.W.T., D.M. Jansen, H.F.M. ten Berge and A. Bakema. 1989. Simulation of Ecophysiological Processes of Several Annual Crops. Pudoc, Wageningen, Netherlands.
9. Ruane A.C. 2013. Multi-factor impact analysis of agricultural production in Bangladesh with climate change. Global Environmental Change. 23: 338–350.
10. Van Keulen H. and J. Wolf (Eds). 1986. Modelling of Agricultural Production: Weather, Soils, and Crops. Pudoc, Wageningen, Netherlands.

Course Number and Title:
DSCRMT511 Institutional, Organizational & Social System

Credit : 03

Introduction to the Course:
This course introduces students about the objective of linking broad organizational and institutional social forces in the field of disaster management. Through this course Students will develop understanding of the disaster management perspective through study of content and the processes used by disaster managers to discover, describe, explain, and/or predict the institutional, organizational and social systems. Students must understand the diversities and complexities of the organizational and social world, past and present, from a critical analytical perspective, and methodologies, and come to an informed sense of contemporary disaster management approaches. This course will give students a grounded experience of how disasters impact on people and their societies, their political cultures and institutions. This course is designed to emphasize: The ability to see how individual lives are connected with wider social and cultural processes and forces; and the ability to work both independently and cooperatively in the application of sociological or anthropological ideas.

Specific Objectives:

To provide students with a relatively detailed understanding of some of the major theoretical perspectives and recent development of Institutional, Organizational & Social System regarding disaster management. To illustrate how these perspectives are tested. To develop an ability to critique, improve upon, and/or extend the execution of an organizational and institutional research program in disaster science and climate resilience, and to present and discuss research ideas.

Course Contents:

1. **The Organization and its Environment:** Internal Organizational Design, The population ecology approach, the resource dependence approach & the institutionalist approach.
2. **Social Movements & Social Networks:** Social movements in organizational theory perspective.
3. **Institutional Systems:** Functional systems, independence of systems, Cognitive systems, cultural systems
4. **Institutional Organizational Analysis:** Change and transformation
5. **Institutional Arrangements for Disaster Management:** institutional mechanism and their functions.
6. **Bangladesh Disaster Management Authority:** Powers and functions of the National, State and District Disaster Management Authority, District Crisis Management Group/Incident Command System & Emergency Operation Centre
7. **The Role of International Organizations in Disaster Response:** Functioning, Actors, and Problems.

Learning Outcomes:

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

1. Develop and communicate hypothetical explanations for intuitional and organizational behavior within the field of disaster management or social context.
2. Recognize the prevailing global priorities and frameworks for intuitional, organizational and social systems.
3. Draw on the social and behavioral sciences to evaluate contemporary problems using social science research methodology.

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

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

References:

1. Meyer & Rowan (1977), "Institutional organizations: formal structure as myth and ceremony"
2. DiMaggio & Powell (1983), "The Iron Cage Revisited: Institutional Isomorphism and Collective Rationality in Organizational Fields
3. Meyer, R. (2008), New sociology of knowledge: Historical legacy and current strands
4. Powell (1991): Expanding the Scope of Institutional Analyses
5. Mazza&Strandgaard (2004). 'From Press to E-media? The Change of an Organizational Field'
6. Strandgaard, Raffaelli& Glynn (2012). "Towards a General Theory of the Institutional Field"
7. Lampel& Meyer (2008). 'Field-configuring events as structuring mechanisms: how conferences, ceremonies, and trade shows constitute new technologies, industries, and markets'
8. Friedland& Alford (1991). 'Bringing Society Back in: Symbols, Practices and Institutional Contradictions' (chapter 10 in Powell & DiMaggio)
9. Lounsbury&Boxenbaum (2013). Introduction to 'Institutional Logics in Action'
10. Thornton, Ocasio&Lounsbury (2012). Chp. 4 'Microfoundations of Institutional Logics'
11. Boxenbaum, E. &Jonsson, S. (2008). 'Isomorphism, diffusion and decoupling'
12. Strang, D., & Soule, S. A. (1998). 'Diffusion in organizations and social movements: From hybrid corn to poison pills'
13. Westphal, J. D., &Zajac, E. J. (2001). 'Decoupling policy from practice: The case of stock repurchase programs'
14. Strandgaard Pedersen, J. and Dobbin, F. (2006). In Search of Identity and Legitimation – Bridging Organizational Culture and Neoinstitutionalism.
15. Boxenbaum, E. &Jonsson, S. (2008). Isomorphism, diffusion and decoupling.

16. Lounsbury, M. (2001). Institutional sources of practice variation: Staffing College and university recycling programs.
17. Suddaby& Greenwood (2009), Methodological Issues in Researching Institutional Change
18. Schneiberg& Clemens (2006), The typical tools for the job. Research strategies in institutional analyses
19. Battilana, J., Leca, B., &Boxenbaum, E. (2009). How actors change institutions: Toward a theory of institutional entrepreneurship.
20. DiMaggio, P.J. (1988). Interest and agency in institutional theory
21. Lawrence &Suddaby (2006) Institutions and Institutional Work
22. Lounsbury&Boxenbaum: Institutional Logics in Action (2013). In: Michael Lounsbury; Eva Boxenbaum (ed.): Institutional Logics in Action, Research in the Sociology of Organization, Part A. Emerald Group Publishing Limited, pp. 3-22
23. Meyer &Höllerer (2010): Meaning structures in a contested issue field: A topographic map of shareholder value in Austria. Academy of Management Journal 53/6, 1241–1262
24. Suddaby, (forthcoming) "Historical Institutionalism"
25. Czarniawska&Joerges (1996), Travel of Ideas
26. Strang& Meyer (1994) 'Institutional Conditions for Diffusion'
27. Ansari, Fiss, &Zajac (2010). 'Made to fit: How practices vary as they diffuse'
28. Suddaby (2010). Challenges for Institutional Theory
29. Lawrence, Leca and Zilber (2013). Institutional Work: Current Research, New Directions and Overlooked Issues
30. Meyer, Hollerer, Jancsary& van Leeuwen (2013). The Visual Dimension in Organizing, Organization, and Organization Research: Core Ideas, Current Developments, and Promising Avenues
31. Westenholz (2014). Conventions and Institutional Logics – Invitation to a dialogue between two theoretical approaches

Course Number and Title:
DSCRMT512 Public Policy and Governance for Disaster Management

Credit: 03

Introduction to the Course:
This course discusses disaster governance and global policy perspectives for Disaster Management. The course will describe in detail the necessary steps for the measurement of indicators, including the information to be compiled, the assessment process, recommendations for public policy and examples based on the application conducted on governance related to disaster management in different regions as well as in Bangladesh. The course will take the student into the intersecting research communities of development, disasters, public policy, governance and poverty alleviation in studying how disasters impact on human, social and political behavior, and how disaster impacted populations respond to these crisis events in the context of disaster management approach.

Specific Objectives:

This course, Public Policy and Governance for Disaster Management tends to:

1. Provide students with critical perspectives of disaster governance and global policy perspectives for Disaster Risk Reduction.
2. Explore the issues of participatory disaster governance, the role of decentralization of disaster resources and responsibilities, and best policy practice principles and governance in preparedness, mitigation, response and recovery and reconstruction
3. Analyze the roles of the various phases of disaster management and issues concerning planning and policies in different phases.
4. Understand the role of federal, state, and local governments in disaster planning and policies.

Course Contents:

1. **The general framework of governance for disaster risk management:** Risk Identification (RI), Risk Reduction (RR), Disaster Preparedness (DP), Recovery Planning (RC) & Financial Protection (FP).
2. **Assessment of Risk Awareness and Emergency Response Capability:** planning, prevention, and preparedness
3. **Disaster Risk Reduction, Governance & Mainstreaming:** DRR and Governance, UNDP Role, Conducting DRR Analysis & Analysis of the UNDP Global Disaster Risk Governance Portfolio.
4. **Disaster Management and Theories of Public Policy:** Normative Political Theories, Public Management Models, Role of Theory in Emergency Management, Bureaucratic Politics Theories and Emergency Management, Public Management Theory,
5. **Public policy & disaster risk management:** Institutional Context, Policymaking process, Assessing Disaster Risk Management Arrangements, Community Engagement, Cooperative Funding & Shared Policy Vision
6. **Disaster Governance in Bangladesh**
7. **National Disaster Management Policy of Bangladesh:** Policy Statement, Policy Implementation Agencies, and Structures Implementing Structures, Operational Mechanism, Financing Options for the Policy & Policy Review, Monitoring and Evaluation.

Learning Outcomes:

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

1. Understand the comprehensive emergency management and related plans and policies;
2. Analyze the factors affecting short and long-term recovery and rebuilding and the role of planners and policy-makers;
3. Identify the fundamental changes in governance of disaster management that have led to the increasing usage of intergovernmental, interagency, and intersectoral networks;
4. Practice and apply various techniques and tools for improving the disaster management policies;
5. Suggest courses of action for improving performance of disaster management governance networks.

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

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

References:

1. Australian Public Service Commission [APSC]. (2007). Tackling Wicked Problems: A public policy perspective. Australian Government: Canberra.
2. Alam, K. (2013). Report on Independent Evaluation of the Capacity for Disaster
3. Reduction Initiative (CADRI) 2007-2012. Commissioned by UNDP. New York.
4. Armstrong, E. (2005). Integrity, Transparency, and Accountability in Public Administration: Recent Trends, Regional and International Developments and Emerging Issues. UNESA.
5. Aysan, Y. and Lavell, A. (2014). Disaster Risk Governance during the HFA Implementation
6. Period: Global Thematic Review. Background Paper prepared for GAR15, commissioned by UNDP. New York
7. Beck, U. (1992). Risk Society: Towards a new modernity. Sage: London.
8. Bell, S. (2002). "'Appropriate' policy knowledge, and institutional and governance implications." Australian Journal of Public Administration.
9. Colebatch, H. (2005). "Policy analysis, policy practice and political science." Australian Journal of Public Administration.
10. Handmer, J. & S. Dovers. (2008). "Policy development and design for fire and emergency management." Australian Journal of Emergency Management.
11. Handmer, J. & S. Dovers. (2007). Handbook of Disaster and Emergency Policies and Institutions. Earthscan: London.
12. Head, B. (2008). "Wicked problems in public policy." Public Policy.
13. Heazle, M. (2010). Uncertainty in Policy Making: Values and evidence in complex decisions.
14. Earthscan: London.
15. Howes, M. (2005). Politics and the Environment: Risk and the role of government and industry. Allen & Unwin: Sydney/ Earthscan: London.
16. Neiman, M. & S. Stambough. (1998). "Rational choice theory and the evaluation of public policy." Policy Studies Journal.

Course Number and Title:
DSCRMT513 Climate Policy and Politics

Credit: 03

Introduction to the Course:
Discussion of climate change science: Basic findings; models, scenarios, and targets (IPCC report, case studies); Climates of the past; Societal (social, political, economic, cultural and ethical) agents and structures that contribute to environmental and climate change; Political resistance to the findings of mainstream climate science; Energy supply; Energy use and demand; Decolonization, equity and decarbonization; Economic consequences of climate change; Political consequences of climate change.

Specific Objectives:
Students will learn about the policies and politics regarding Climate Change

Course Contents:
1. **Global institutions and policies on climate change**: Climate negotiations history; International governance systems; International organizations: United Nations (UN), the European Union (EU), United Nations Environmental Programme (UNEP), the United Nations Framework Convention on Climate Change (UNFCCC), and the Intergovernmental Panel on Climate Change (IPCC); Nation states and global climate governance; Non-state actors in climate negotiation; Environmental NGOs; Global-level climate policy within the UNFCCC; Conference of the Parties (COP); Common But Differentiated Responsibility; Kyoto protocol; The Paris Agreement; Nationally Determined Contributions; US withdrawal from the Paris Agreement, Adaptation vs. mitigation issues in the climate negotiation; Market-based solutions: Payments for Ecosystem Services; Carbon markets and economic tools; Green finance; Critics and complications of climate legislation; National interests and coalition in climate negotiation; Advocacy Coalitions.
2. **Public opinion on environmental issues & climate change:** Impacts of climate change on developed and developing countries; The grass root climate movements; Media and climate change; Public opinion.
3. **Environmental justice**: Environmental justice; Indigenous energy justice and the climate crisis; Racism and climate change.
4. **Climate justice**: Justice implications of climate change; Definition of climate justice; Climate change as a social justice issue; Carbon footprint; Equity and responsibility in the UNFCCC; The climate game and the world's poor; Climate refugees; climate justice and communities of color; Climate change and health
5. **Climate change politics**: Political dynamics and diverse interests that make climate change such a difficult problem to solve politically; Conflicting issues in cross country climate policy and interest; Political trade-offs involved in using emerging technologies to address climate change; Mitigation vs Adaptation; Damage and Loss finance; US Presidential Candidates and Climate Change; The politics of carbon pricing and policy durability; Why

are solutions so hard; different forms of climate science "denial"; Global climate politics : comparative EU-US perspectives;

6. **Conclusion and way forward**: Practical example of the complexities of effective policy responses to climate change; The ethical dimension: What would a just response to climate change
   Look Like, What does a low-carbon lifestyle look like;
   How should we tackle climate change; Climate change and the implications for future global environmental politics; Technological solutions at the global scale

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

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

References:

1. Acemoglu, D. and Robinson; J. 2012. "Theories that don't work" and "The making of prosperity and poverty". Why Nations Fail: The origins of power, prosperity and poverty. UK: Profile Books.
2. Agarwal, Anil and Sunita Narain. 2015. "Environmental Colonialism: The Perverse Politics of Climate Change." Except reproduced in Global Environmental Politics: From Person to Planet. Simon Nicholson and Paul Wapner (eds.) Boulder, London: Paradigm Publishers. Pages 233-237.
3. Gardiner, S.M. 2006. A Perfect Moral Storm: Climate Change, Intergenerational Ethics and the Problem of Moral Corruption. Environmental Values 15 (2006): 397–413
4. Haque. 2019. (How) Climate Change is a Hangover of Colonialism, Exploitation, and Slavery. Eudaimonia and Co.
5. Hassan, S.M.K., Khan, N.A., Khanam, N. 2022. Reflections of the Climate Justice Framework in Public Policies: The Bangladesh Perspective. In: Madhanagopal, D., Beer, C.T., Nikku, B.R., Pelser, A.J. (eds) Environment, Climate, and Social Justice. Springer, Singapore. https://doi.org/10.1007/978-981-19-1987-9_8
6. Intergovernmental Panel on Climate Change. 2021. Summary for Policymakers. In: Climate Change 2021: The Physical Science Basis. Contribution of Working Group I to the Sixth Assessment Report of the Intergovernmental Panel on Climate Change [Masson- Delmotte,

V., P. Zhai, A. Pirani, S.L. Connors, C. Péan, S. Berger, N. Caud, Y. Chen, L. Goldfarb, M.I. Gomis, M. Huang, K. Leitzell, E. Lonnoy, J.B.R. Matthews, T.K. Maycock, T. Waterfield, O. Yelekçi, R. Yu, and B. Zhou (eds.)]. Cambridge University Press. https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_SPM_final.pdf

7. Intergovernmental Panel on Climate Change. 2021. Climate change 2021: The physical science basis [Contribution of working group I to the sixth assessment report of the Intergovernmental Panel on Climate Change]. https://www.ipcc.ch/report/ar6/wg1/downloads/report/IPCC_AR6_WGI_Full_Report.df
8. Intergovernmental Science-Policy Platform on Biodiversity and Ecosystem Services. 2019. Nature's Dangerous Decline 'Unprecedented'; Species Extinction Rates 'Accelerating'. https://www.un.org/sustainabledevelopment/blog/2019/05/nature-decline-unprecedented-report/
9. Jacques, P., Dunlap, R.E., & Freeman, M. 2008. The Organization of Denial: Conservative think tanks and environmental skepticism. Environmental Politics, 17 (2008): 349-385
10. Khan, M., Robinson, S., Weikmans, R., Ciplet, D., & Roberts, J. T. 2020. Twenty-five years of adaptation finance through a climate justice lens. Climatic Change, 161(2), 251–269. https://doi.org/10.1007/s10584-019-02563-x
11. Mace, M.J. and Verheyden, R. 2016. Loss, Damage and Responsibility after COP21: All Options Open for the Paris Agreement. *Review of European Community & International Environmental Law.* 25(2): 197- 214
12. Okereke, C., & Coventry, P. 2016. Climate justice and the international regime: Before, during, and after Paris. Wires Climate Change, 7(6), 834–851. https://doi.org/10.1002/wcc.419
13. Page, E. A., & Heyward, C. 2017. Compensating for climate change loss and damage. Political Studies, 65(2), 356–372. https://doi.org/10.1177/0032321716647401
14. Patrick J Egan, David M Konisky, Megan Mullin. 2022. Ascendant Public Opinion: The Rising Influence of Climate Change on Americans' Attitudes about the Environment, *Public Opinion Quarterly*, Volume 86, Issue 1, Spring 2022, Pages 134–148, https://doi.org/10.1093/poq/nfab071
15. Schlosberg, D., & Collins, L. B. 2014. From environmental to climate justice: Climate change and the discourse of environmental justice. Wires Climate Change, 5(3), 359–374. https://doi.org/10.1002/wcc.275
16. Thompson, Claire. 2020. Why Racial Justice is Climate Justice. *Grist*. 4 June 2020.
17. United Nations. 1992. United nations framework convention on climate change. https://unfccc.int/resource/docs/convkp/conveng.pdf
18. United Nations. 2015. Paris agreement. https://unfccc.int/sites/default/files/english_paris_agreement.pdf

Course Number and Title:
DSCRMP 514 Masters Project Work

Credit:03

Introduction to the Course:
In this course students will select a research topic. Then they will conduct research under supervision of faculty member(s) and present their outcomes as verbal presentation as well as in a written format as a project report.

Specific Objectives:
To learn how to conduct research independently as well in group under supervisor of faculty members.

Course Contents: Project Work

Learning Outcomes:
- They will learn to conduct research independently as well under supervisor of faculty members in group.
- Learning data collection methods
- Learning data analysis and presentation methods etc.

Instructional Strategies: Student will get supervision from faculty members from the department and from professionals in the industry. They must present and defend their project proposal (presentation). During final examination they must defend (presentation) their research project findings and must submit project report for evaluation.

Course Number and Title:
DSCRMT515 Thesis Work

Credit:09

Introduction to the Course:
In this course, students will select a research topic. Then conduct research under supervision of faculty member(s) and present their outcomes as verbal presentation as well as in a written form.

Specific Objectives:
To learn how to conduct research independently as well in group under supervisor of faculty members.

Course Contents: Thesis Work
Learning Outcomes:
1. They will learn to conduct research independently as well under supervisor of faculty members in group.
2. Learning data collection methods
3. Learning data analysis and presentation methods etc.

Instructional Strategies: Instructional Strategies: Student will get supervision from faculty members from the department and from professionals in the industry. They must present and defend their research proposal (presentation). During final examination they must defend (through presentation) their research thesis and must submit written copy for evaluation.

Course Number and Title:
DSCRMV516 ***Viva vocé***

Credit: 02

Introduction and Objective:
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. 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.

Content:
The course contents include the courses taught up to 2nd Semester.

Learning Outcomes:

- Develop and demonstrate oral communication ability;
- Provide experience with the communications identified as most challenging in the workplace, i.e., interaction with a superior;
- Demonstrate communication behaviors appropriate for effective comprehensive and supportive listening;

I**nstructional Strategies:**
Discussions, Questions and Answers.

Assessment:
The oral exam is to be conducted by the 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 courses.