Department of Disaster Science and Management
University of Dhaka

Syllabus
for
Master of Science (M.S.) in Disaster Science and Management

Session: 2016-2017 onwards

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Department of Disaster Science and Management
Faculty of Earth and Environmental Sciences
University of Dhaka

(M.S. Syllabus)

Preamble

Department of Disaster Science and Management was established in 2012 and started classes for master degree (MS) from session 2016-2017. Under the Semester System, the one-year M.S. Degree in Disaster Science and Management (DSM) 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 35 credit hours in Disaster Science and Management (DSM) Master's program to obtain the degree.

There will be two groups in Masters Courses in Disaster Science and Management. 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 35 credit hours equivalent courses.

Definition of Credit and Distribution of Courses over the Semester

Each semester shall be 26 weeks

- 17 weeks of class teaching
- 2 weeks for preparation
- 3 weeks for holding the semester final examination
- 4 weeks for result publication

For a 3 credit hour courses there shall be three lecture classes per week i.e., a total of 45 lecture classes of 1-hour duration and for 2 credit hours course, there shall be two lecture classes per week i.e., a total of 30 lecture classes of 1-hour duration.

Structure of the Proposed Syllabus

- **Thesis Group** will have to take five theory courses equaling 15 credits hours, one specialized course equivalent to 3 credit hours, two laboratory course equaling 6 credit hours and one comprehensive oral exam of 2 credit hours totaling 26 credit hours designated as Compulsory Courses. Moreover, they have to pursue research work equivalent to 9 credit hours.
- **Project Group** will have to take 21 credit hours equivalent theory & specialized courses, 9 credit hours equivalent three laboratory courses and one comprehensive oral exam of 2 credit hours totaling 32 credit hours designated as Compulsory Courses. Moreover, they have to pursue project work equivalent to 3 credit hours.
- Students of both groups (Project and Thesis Group) will have to take five compulsory theory courses and two lab courses equaling 21 credit hours in the first semester.
- Project Group students will have to take two theory courses from specialized field equivalent to 6 credit hours in their second semester. And thesis group students, on the other hand, shall have to take one course from the specialized field.

The Tables below summarizes all of the above:

Course Distribution	Thesis Group
Compulsory Theory Courses: 5	15 credit hours
Compulsory Lab Course: 2	6 credit hours
Comprehensive Oral Exam:1	2 credit hours
Specialized Course:1	3 credit hours
Thesis Work	9 credit hours
Total Credits	35 credit hours

Course Distribution	Project Group
Compulsory Theory Courses: 5	15 credit hours
Compulsory Lab Course: 3	9 credit hours
Comprehensive Oral Exam:1	2 credit hours
Specialized Courses:2	6 credit hours
Project Work	3 credit hours
Total Credits	35 credit hours

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

Course ID	Title	Credit
DSMMT:501	**Disaster Impact Assessment**	**3**
DSMMT:502	**Humanitarian Emergency & Crisis Management**	**3**
DSMMT:503	**Urban Resilience: Theory and Practices**	**3**
DSMMT:504	**Climatic Risk Assessment & Extreme Event Modeling**	**3**
DSMMT:505	**Integrated Water and Agricultural Risk Management**	**3**
DSMML:506	**Advanced Research Methodology**	**3**
DSMML: 507	**Advanced Remote Sensing and GIS**	**3**

Specialized Theory and other Courses for M.S. Programme

Course ID	Title	Credit
DSMMT:508	**Institutional, Organizational and Social System**	**3**
DSMMT:509	**Disaster Statistics and Economic Modeling**	**3**
DSMMT:510	**Public Policy and Governance for Disaster Management**	**3**
DSMML:511	**Geo-hazard Modeling and Mapping**	**3**
DSMMP:512	**Masters Project Work**	**3**
DSMMT:513	**Thesis Work**	**9**
DSMMV:514	***Viva vocé***	**2**

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

Course ID	1st Semester	Credit	Course ID	2nd Semester	Credit
DSMMT:501	Disaster Impact Assessment	3	DSMMT: 513	Thesis	9
DSMMT:502	Humanitarian Emergency & Crisis Management	3	DSMMT/ DSMML :	Specialized course	3
DSMMT:503	Urban Resilience: Theory and Practices	3	DSMMV: 514	*Viva vocé*	2
DSMMT:504	Climatic Risk Assessment & Extreme Event Modeling	3	Total Credit		14
DSMMT:505	Integrated Water and Agricultural Risk Management	3			
DSMML: 506	Advanced Research Methodology	3			
DSMML: 507	Advanced Remote Sensing and GIS	3			
Total Credit		**21**	**Total Programme Credit**		**35**

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

Course ID	1st Semester	Credit	Course ID	2nd Semester	Credit
DSMMT:501	Disaster Impact Assessment	3	DSMMT:	Specialized course	3
DSMMT:502	Humanitarian Emergency & Crisis Management	3	DSMMT:	Specialized course	3
DSMMT:503	Urban Resilience: Theory and Practices	3	DSMML : 511	Geo-hazard Modeling and Mapping	3
DSMMT:504	Climatic Risk Assessment & Extreme Event Modeling	3	DSMMP:512	Project Work	3
DSMMT:505	Integrated Water and Agricultural Risk Management	3	DSMMV:514	*Viva vocé*	2
DSMML: 506	Advanced Research Methodology	3	Total Credit		14
DSMML: 507	Advanced Remote Sensing and GIS	3			
Total Credit		**21**	**Total Programme Credit**		**35**

DSMMT 501: Disaster Impact Assessment (3 Credits)

Course Outcomes: Upon completing the course the student will get a comprehensive understanding of Disaster Impact Assessment framework. To reach the goal, emphasize will be given to performing hazard specific and step by step multi-hazard risk assessment practically. In addition, the student will be able to know how to assess the environmental and social impact. Finally, the student will be able to take the decision of proper risk reduction measures based on estimated risk and impact.

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

Suggested Readings:

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.fa
8. Westen et al (2011), A Guidebook of Multi-hazard Risk Assessment, Public Works

DSMMT 502: Humanitarian Emergency & Crisis Management (3 Credits)

Course Outcomes: In this course, the student will get the in-depth concept of the humanitarian emergency and crisis management. This includes root causes of the crisis and how to intervene to come back to the normal situation. This course will highlight the national and international actors, norms and regulations on humanitarian assistance. This will able the students to grasp the overall aspects of crowdsourcing emergency database (Victims, Extent etc), analysis technique for emergency and crisis management.

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, in particular, 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 and Prevention. Causes: Exclusion (economic, social, political). Authoritarianism and corruption, Development failures and structural adjustment, Colonialism, War economies. Resource constraints: population pressures and environmental deterioration.

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.

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

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.

Suggested Readings:

1. Gourevitch, P. (1998) *We wish to inform you that tomorrow we will be killed with our families: Stories from Rwanda*, Picador USA, New York.
2. Moore, J. (1998) *Hard Choices*, Introduction & Ch. 1, pp. 1-28.
3. Weiss, T. G., Collins, C. (2000) *Humanitarian Challenges and Intervention*, (Ch. 1: Evolution of the Humanitarian Idea) Westview Press, second edition, pp. 13-38.
4. Crocker, Hampson, Aall (1996) pp. 1-170.
5. 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.
6. Hatzfeld, J. *(Translated by Linda Coverdale)* (2006) Life Laid Bare: The Survivors in Rwanda Speak. Other Press, New York. 2006.
7. Lee, S.P (2010) HUMANITARIAN INTERVENTION—EIGHT THEORIES. In *Diametros № 23 (March 2010): 22-43 22*.
8. Totten, S. & Parsons, W.S. (edited) (2013) Centuries of Genocide: Essays and Eyewitness Accounts (4th Edition). Routledge: New York.
9. Crocker, Hampson, Aall (1996) pp. 173-273, 287-341, 379-417.

10. Task Force on Ethical and Legal Issues in Humanitarian Assistance (1994) *The Mohonk Criteria for Humanitarian Assistance in Complex Emergencies*, World Conference on Religion and Peace, New York.
11. Donini, A. (1995) Beyond Neutrality: On the Compatibility of Military Interventions and Humanitarian Assistance, *The Fletcher Forum of World Affairs*, pp. 31-45.
12. Moore, J. (1998) *Hard Choices*, Ch. 4, 5, pp. 71-98.
13. Moore, J. (1998) *Hard Choices*, Ch. 8, 10, pp. 137-156, and pp.177-193.
14. Moore, J. (1998) *Hard Choices*, Ch. 16, pp. 287-302.
15. Moeler, S.D. (1999) *Compassion Fatigue: How the Media sell Disease, Famine, War and Death*, Routledge, New York and London, Ch. 2, pp. 97-155.
16. Dijkzeul, D. (1999) 'UNOPS in Guatemala: From Relief to Development', in Mathiason, J. (Forthcoming) *Managing the World*, New York University, 64 pp. (available on the course web-site).
17. Maynard K.A. (1999) Ch. 5 Communities in Conflict pp. 107-122 and Ch. 6 Rebuilding Social Cohesion pp. 125-143, in *Healing Communities in Conflict: International Assistance in Complex Emergencies*, Columbia University Press, New York.
18. Harrel-Bond, B. (1999) The Experience of Refugees as Recipients of Aid, pp.136-168 in Ager, A. (ed.) (1999*) Refugees: Perspectives on the Experience of Forced Migration*, Cassel, London and New York.
19. Moore, J. (1998) *Hard Choices*, Ch. 7, pp. 119-135.
20. Crocker, Hampson, Aall (1996) Ch. 36 and Ch. 41, pp. 533-550 and 607-622.
21. Anderson, M.B. (1999) *Do No Harm: How Aid Can Support Peace ¾ Or War*, Lynne Riener Publishers, Boulder.
22. Curtis, D. (2001) Politics and Humanitarian Aid: Debates, Dilemmas, and Dissension, *HPG Report* **10**, Humanitarian Policy Group, Overseas Development Institute, London, 19 p. (See course website or http://www.odi.org.uk/hpg/papers/hpgreport10.pdf)
23. Jackson, S., P. Walker (1999) Depolarising the `Broadened' and `Back-to-Basics' Relief Models, *Disasters*, 1999, 2, 93-114.

DSMMT 503: Urban Resilience: Theory and Practices (3 Credits)

Course Outcomes: Students should be able to identify the urban risk resulting from natural hazards and climate change. They should able to apply urban vulnerability and risk assessment methods, including social techniques, towards urban resilience. They will familiarize themselves with cities tackling disaster and climate-related impact. Finally, the student should able to know how to incorporate this risk information into action plans.

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**

Suggested Readings:

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. 10 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.

DSMMT 504: Climatic Risk Assessment and Extreme Event Modeling (3 Credits)

Course Outcomes: The course will allow the students to avail a clear knowledge about the climate system and the processes. The course will enlighten the students on the techniques to assess climatic risk. Furthermore, the course will allow the students to develop models as well as assess their strengths and weaknesses. By the end of the course, the students will be able to conduct climate-related studies.

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 forcings, 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)

Suggested Readings:

1. Neelin J.D., 2011. Climate Change and Climate Modeling, Cambridge University Press, London
2. 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
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
10. Randall, D.A., R.A. Wood, S. Bony, R. Colman, T. Fichefet, J. Fyfe, V. Kattsov, A. Pitman, J. Shukla, J. Srinivasan, R.J. Stouffer, A. Sumi and K.E. Taylor, 2007:
11. Climate Models and Their Evaluation. In: Climate Change 2007: The Physical Science Basis. The contribution of Working Group I to the Fourth Assessment Report of the Intergovernmental Panel on Climate Change [Solomon, S., D. Qin, M. Manning, Z. Chen, M. Marquis, K.B. Averyt, M.Tignor and H.L. Miller (eds.)]. Cambridge University Press, Cambridge, United Kingdom and New York, NY, USA.

DSMMT 505: Integrated Water and Agricultural Risk Management (3 Credits)

Course Outcomes: By the end of the course, students will be able to understand the wide range of water and agricultural hazards and risks within Bangladesh. They 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 risks and to explain the possible consequences in a given situation where these risks will occur and their likely impacts on the population.

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, Bio-fouling 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, H_2O_2, 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 analysis of water-environment-based agriculture:** 'Agroecosystems' approach. Quantitative analysis of water-environment-based agriculture: a Formal modeling approach. Improved productivity of water-environment-driven agriculture: Application of qualitative and quantitative approach for 'Crop system'.

7. **Improved productivity of water-environment-driven agriculture:** Application of qualitative and quantitative approach for 'Livestock system'
8. **Improved productivity of water-environment-driven agriculture:** Application of qualitative and quantitative approach to 'Fish system'. Improved productivity of water-environment-driven agriculture: Application of qualitative and quantitative approach for 'integrated agricultural system'.
9. Scientific writing and presentation of agricultural systems analysis.

Suggested Readings:

1. PARK, Chris (2001) The Environment: Principles and Applications. 2nd Edition, Routledge, UK.
2. SMITH, Keith, and Petley, David N. (2009) Environmental Hazards: Assessing Risk and Reducing Disaster. 5th Edition, Routledge, London, UK.
3. WOODS, Michael and Woods, Mary B. (2008) Environmental Disasters. Minneapolis: Lerner Publications Company.
4. 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.
5. IGHRC (2003) Uncertainty factors: Their use in human health risk assessment by UK Government, MRC IEH, Leicester, the UK available at http://ieh.cranfield.ac.uk/ighrc/pdf/cr%20reports/cr9%5B1%5D.pdf
6. IGHRC (2006) Guidelines on route-to-route extrapolation of toxicity data when assessing health risks of chemicals MRC IEH, Leicester, the UK available at http://ieh.cranfield.ac.uk/ighrc/pdf/cr%20reports/cr12%5B1%5D%5B1%5D.pdf
7. Griem H., Synder R. Toxicology, and Risk Assessment: A Comprehensive Introduction Wiley, UK, ISBN: 978-0-470-86893-5
8. Defra/Cranfield (2011) Guidelines for Environmental risk assessment and management (Green Leaves III) available athttps://www.gov.uk/government/uploads/system/uploads/attachment_data/file/69450/pb13670-green-leaves-iii-1111071.pdf
9. Oltedal, S., Moen, B.E, Klempe, H., Rundmo T. Explaining risk perception. An evaluation of cultural theory, Rotunda available athttp://www.svt.ntnu.no/psy/Torbjorn.Rundmo/Cultural_theory.pdf
10. Sjöberg L., Moen, B.E., Rundmo T. Explaining risk perception. An evaluation of the psychometric paradigm in risk perception research, Rotunda, available at http://www.svt.ntnu.no/psy/Torbjorn.Rundmo/Psychometric_paradigm.pdf
11. 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.
12. Brammer H. 2012. The Physical Geography of Bangladesh. University Press Limited. Dhaka, Bangladesh.
13. Conway G.R. 1986. Agroecosystem analysis. *Agricultural Administration*. 20: 31-55.

14. Groom B. 2012. *Climate Change Adaptation: The Bangladesh Experience*. World Wide Fund for Nature – Pakistan.
15. Hossain S.M.A. et al. (Eds). 1993. Farming Systems Research. Graduate Training Institute, Bangladesh Agricultural University, Mymensingh, Bangladesh.
16. Kabir, M.S., M.U. Salam, A. Chowdhury, N.M.F. Rahman, K.M. Iftekharuddaula, M.S. Rahman, M.H. Rashid, S.S. Dipti, A. Islam, M.A. Latif, A.K.M.S. Islam, M.M. Hossain, B. Nessa, T.H. Ansari, M.A. Ali and J.K. Biswas. 201). Rice Vision for Bangladesh: 2050 and Beyond. *Bangladesh Rice Journal*. 19: 1-18.
17. Kaida Y. (Ed). 1990. Agricultural and Rural Development in Bangladesh: A Review of Related Studies. JSARD Pub. No. 19. Japan International Cooperation Agency (JICA), Dhaka, Bangladesh.
18. 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.
19. Ruane A.C. 2013. Multi-factor impact analysis of agricultural production in Bangladesh with climate change. *Global Environmental Change*. 23: 338–350.
20. Salam M.U. 1992. A Systems Approach to the Potential Production of Boro Rice in the Haor Region of Bangladesh. Ph.D. Thesis, University of Reading, UK.
21. Spedding C.R.W. 1975. The Biology of Agricultural Systems. Academic Press, London, UK.
22. Timsina J. and E. Humphreys. 2006. Applications of CERES-Rice and CERES-Wheat in research policy and climate change studies in Asia: a review. *International Journal of Agricultural Research* 1: 202–225.
23. UN 2013. Studies of Sustainable Agriculture and Food Systems, Technical Report the Post*2015 Development Agenda.
24. Van Keulen H. and J. Wolf (Eds). 1986. Modelling of Agricultural Production: Weather, Soils, and Crops. Pudoc, Wageningen, Netherlands.
25. World Bank. 2000. Bangladesh: Climate Change and Sustainable Development. Report No. 21104, World Bank Office, Dhaka, Bangladesh.

DSMML 506: Advanced Research Methodology (3 Credits)

Course Outcomes: Upon completing the course the student will be able to identify the main characteristic of scientific research. They should develop the capability to find, evaluate and summarize pertinent scientific literature to find the scope and to formulate their research problem. They should develop the skills how to read any research output critically and write technically. They should be able to construct the framework to be followed in the thesis/project work. They would be able to know how to store, manage, and use the bibliographic data in scientific writing. The student will be able to critically evaluate & choose the methods & techniques they have learned so far. Emphasize will be given to maintaining research ethics and professionalism. 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.

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. Mendeley
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.

Suggested Readings:

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.

DSMML 507: Advanced Remote Sensing and GIS (3 Credits)

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

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

Suggested Readings:

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.

DSMMT 508: Institutional, Organizational & Social System (3 Credits)

Course Outcomes: Learning outcomes of the course are that students recall information about, demonstrate an understanding of, apply and evaluate information in these key areas: Critical Thinking, Institutional Systems of Disaster Management, Social System Theory, Social Institutions, Organizational stratification.

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.

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

Suggested Readings:

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

DSMMT 509: Disaster Statistics and Economic Modeling (3 Credits)

Course outcome: upon completing the student will get the advanced concept of disaster economics. They should figure out the trend of disaster statistics and realize the necessity of disaster database. They should know how to apply economic modeling utilizing these data to perform economic system analysis. Moreover, the students shall learn how to incorporate the information derived from Damage and Need Assessment in development plan and policies.

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:** the 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.

Suggested Readings

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. Anthoff, D. and Tol, R.S.J. 2010. On international equity weights and national decision making on climate change. *Journal of Environmental Economics and Management* 60(1): 14-20.
4. Berz, G. 1994. The Insurance Industry and IDNDR: Common Interests and Tasks. *Natural Hazards* 9: 323-332.
5. Brookshire, D., Thayer, M., Tschirhart, J., and Schulze, W. 2001. A Test of The Expected Utility Model: Evidence from Earthquake Risks. *Journal of Political Economy* 93(1): 369-389.
6. Butler, J. and Doessel, D. 1980. Who Bears the Costs of Natural Disasters? An Australian Case Study. *Disasters* 4(2): 187-204.
7. Chang, S. 1984. Do Disaster Areas Benefit from Disasters? *Growth and Change* 15(4): 24-31.
8. Cochrane, H. 2004. Economic Loss: Myth and Measurement. *Disaster Prevention and Management* 13(4): 290-296.
9. Daly, H.E. 1997. Georgescu-Roegen versus Solow/Stiglitz. *Ecological Economics* 22: 261-266.

10. Gaddis, E.B., Miles, B., Morse, S., and Lewis, D. 2007. Full-Cost Accounting of Coastal Disasters in the United States: Implications for Planning and Preparedness. *Ecological Economics* 63: 307-318.
11. Ganderton, P., Brookshire, D., McKee, M., Stewart, S., and Thurston, H. 2000. Buying insurance for disaster-type risks: Experimental evidence. *Journal of Risk and Uncertainty* 20(3): 271-289.
12. 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.
13. Hope, C. 2006. The marginal impact of CO2 from PAGE2002: an integrated assessment model incorporating the IPCC's five reasons for concern. *Integrated Assessment* 6(1): 19-56.
14. Horwich, G. 2000. Economic Lessons from the Kobe Earthquake. *Economic Development and Cultural Change* 48(3): 521-522.
15. Kabir, M. 2005. Managing Flood in Bangladesh: Facts and Caveats. *Bangladesh Journal of Political Economy* 22(1&2): 143-156.
16. Kellenberg, K. and Mobarak, A.M. 2011. The Economics of Natural Disasters. *Annual Review of Resource Economics* 3:297–312.
17. Nordhaus, W.D. 2007. A Review of the Stern Review on the Economics of Climate Change. *Journal of Economic Literature* 45: 686–702.
18. Nordhaus, W.D. 2013. *DICE 2013R: Introduction and User's Manual*. Connecticut: Yale University.
19. 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.
20. 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.
21. Pelling, M., Özerdem, A. and Barakat, S. 2002. The Macro-Economic Impact of Disasters. *Progress in Development Studies* 2(4): 283-305.
22. Rezai, A., Taylorb, L. and Mechler, R. 2013. Ecological macroeconomics: An application to climate change. *Ecological Economics* 85: 69-76.
23. Rose, A. 2004. Defining and Measuring Economic Resilience to Disasters. *Disaster Prevention and Management* 13(4): 307-314.
24. 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
25. Rose, A. and Liao, S. 2005. Modeling Regional Economic Resilience to Disasters: A Computable General Equilibrium Analysis of Water Service Disruptions. *Journal of Regional Science* 45(1): 75-112.
26. Skidmore, M. and Toya, H. 2002. Do natural disasters promote long-run growth? *Economic Inquiry* 40(4): 664–687.
27. Stern, N. 2007. *The Economics of Climate Change: The Stern Review*, Cambridge, and New York: Cambridge University Press.

28. Stern, N. 2013. The Structure of Economic Modeling of the Potential Impacts of Climate Change: Grafting Gross Underestimation of Risk onto Already Narrow Science Models. *Journal of Economic Literature* 51(3): 838–859.
29. UNDP. 1994. *Disaster Economics*, 2nd Edition, New York: UNDP.
30. United Nations, European Commission, Food, and Agriculture Organization, International Monetary Fund, Organisation for Economic Co-operation, and World Bank (2014a), *System of Environmental-Economic Accounting: Central Framework*, United Nations, New York.
31. United Nations, European Commission, Organization for Economic Co-operation, and World Bank (2014b), *System of Environmental-Economic Accounting 2012: Experimental Ecosystem Accounting*, United Nations, New York.
32. Weitzman, M.I. 2007. A Review of the Stern Review on the Economics of Climate Change. *Journal of Economic Literature* 45: 703–724.
33. Worthington, A. and Valadkhani, A. 2004. Measuring the Impact of Natural Disasters on Capital Markets: An Empirical Application Using Intervention Analysis. *Applied Economics* 36: 2177-2186.
34. Yezer, A. 2002. The Economics of Natural Disasters. In: R. Stallings (ed), *Methods of Disaster Research*. Philadelphia: Xlibris, pp. 213-235.

DSMMT 510: Public Policy and Governance for Disaster Management (3 Credits)

Course Outcomes: 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.
In this course the students will be able to relate the following issues, especially in the disaster management sector:

- Capacity development
- Past initiatives & best practices
- Cooperation with agencies
- Multi-sectoral synergy

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.

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.

Suggested Readings:

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.

DSMML 511: Geo-hazard Modeling and Mapping (3 Credits)

Course outcome: upon completing the student will get the advanced concept Geo-hazard Assessment and Modeling. The student shall be able to perform the Geo-hazard modeling and should develop a skill to deal with the uncertainty inherent to hazard assessment. Based on the retrieved information, the student shall be able to select proper structural mitigation measures.

1. **Introduction:** Assessment and Modeling of Geo-hazards i.e. earthquake, landslide, tsunami and volcano
2. **Earthquake:** Earthquake Source Modeling, Attenuation Modeling and Site Effects Estimation, Probabilistic and Deterministic Seismic Hazard Assessment
3. **Landslide:** Landslide Hazard Assessment Methods: Knowledge-driven, data driven and deterministic method
4. **Tsunami:** Probabilistic and Deterministic Tsunami Hazard Assessment, Tsunami Inundation Modeling
5. **Volcano:** Probabilistic and event-based tephra fall hazard assessment, volcanic lava flow mapping
6. Structural mitigation measures

Suggested Readings

1. Bozorgnia and Bertero. Earthquake Engineering: From Engineering Seismology to Performance-based Engineering, CRC Press
2. Dowrick D. (2009) Earthquake Resistant Design and Risk Reduction. 2nd Edition. Wiley-Blackwell. US.
3. Kramer S.L. (1996) Geotechnical Earthquake Engineering. Prentice Hall. US.
4. Seth Stein & Michael Wyssession (2012) An Introduction to Seismology, Earthquakes and Earth Structures. Blackwell Publication
5. Seth Stein and Jerome Stein (2014) Playing Against Nature: Integrating Science and Economics to Mitigate Natural Hazards in an Uncertain World, AGU, WILEY

Thesis/ Project Work

Course outcomes: The students must be able to develop well-formulated research problem of sufficient scope and depth. The student should come up with an interesting research proposal and should defend it before digging deeper. They should undertake research following a clear reproducible methodology. The research output should be justifiable with logical argumentation, transparent and coherent writings. Overall the whole research work should be submitted in a well-structured format. The student should able to learn how to defend their research work with proper argumentation. Most importantly the student should able to know how to become an independent researcher.