

Syllabus

**for M. Phil. and Ph. D. Programs
in
Disaster Science and Climate Resilience
Academic Session: 2021-2022, 2022-2023 & 2023-2024**



**Department of Disaster Science and Climate Resilience
University of Dhaka
Dhaka 1000, Bangladesh**

Department of Disaster Science and Climate Resilience
University of Dhaka
Syllabus for M. Phil. and Ph. D. in Disaster Science and Climate Resilience
Session: 2021-2022, 2022-2023 & 2023-2024

Syllabus for M. Phil. Program

The duration of M. Phil. program is two years, i.e., 1st Year (Theory) and 2nd year (Thesis). The student must take two theory courses of 02 units of 200 marks (100 marks for each unit), and one Viva Voce/Presentation course of 01 unit of 100 marks in the 1st year examination. On successful completion of 1st year, student will be allowed to complete a supervised thesis work during 2nd year equivalent to 3 units (300 marks). The student must perform the thesis work and must defend his/her thesis in the 2nd year. In all other circumstances, common rules and practices of the University of Dhaka must be applicable for M. Phil. student.

1st Year

An M. Phil. student is required to choose two theory courses and one Viva Voce/Presentation course from the courses mentioned below:

Course No.	Title	Marks	Remarks
DSCRMPT 601	Advanced Disaster Management	100	Any Two
DSCRMPT 602	Multi-hazard Risk Analysis and Management	100	
DSCRMPT 603	Advanced Seismology and Earthquake Risk Management	100	
DSCRMPT 604	Hydro-meteorological Hazards and Risk Management	100	
DSCRMPT 605	Environmental and Ecological Hazards and Risk Management	100	
DSCRMPT 606	Advanced Climate Modeling and Extreme Event Management	100	
DSCRMPT 607	Pre and Post Disaster Damage and Need Assessment	100	
DSCRMPT 608	Built Environment, Urbanization and Development	100	
DSCRMPT 609	Geoinformation for Spatial Planning and Risk Management	100	
DSCRMPT 610	Applied Statistics and Probability for Disaster Management	100	
DSCRMPV 611	Viva Voce / Presentation	100	Compulsory

2nd Year

Course No.	Title	Marks
DSCRMTR 612	Thesis	200
DSCRMTD 613	Viva Voce (Thesis Defence)	100

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The total marks in a course will be converted into letter grade as below:

Numerical Marks	Letter Grade	Grade Point
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
Below 40	F	0.00
Incomplete	I	
Withdrawn	W	

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Syllabus for Ph. D. Program

A student admitted to the Ph. D. program will have to undertake full-time/part-time study at the department under the guidance of his/her supervisor(s). The Ph. D. program will consist of (a) submission of dissertation on an approved topic and (b) an oral examination. The departmental Ph. D. sub-committee (if applicable) or supervisor(s) may recommend taking courses. There is an opportunity to take an optional theory course (non-credit) if a student is interested. There will be written examinations on the approved courses at the end of the year, the passing grade will be minimum C+ (grading range is given below). The student should be required to carry out research on specific topic approved by the supervisor(s) for at least two years for full time and for at least four years for part-time student from the date of admission in the Ph. D. program. During the research work, the student will offer at least two seminars to receive feedbacks from the teachers and students of the department. Then, the student will submit a thesis with the written approval of the supervisor(s). Finally, the student will have to appear at an oral examination provided that his/her thesis is recommended for acceptance by the examiners.

In all other circumstances, common rules and practices of the University of Dhaka must be applicable for Ph. D. student.

Courses offered for Ph. D. Program are given bellow:

Course No.	Title	Marks
DSCRMPT 601	Advanced Disaster Management	100
DSCRMPT 602	Multi-hazard Risk Analysis and Management	100
DSCRMPT 603	Advanced Seismology and Earthquake Risk Management	100
DSCRMPT 604	Hydro-meteorological Hazards and Risk Management	100
DSCRMPT 605	Environmental and Ecological Hazards and Risk Management	100
DSCRMPT 606	Advanced Climate Modeling and Extreme Event Management	100
DSCRMPT 607	Pre- and Post-Disaster Damage and Need Assessment	100
DSCRMPT 608	Built Environment, Urbanization and Development	100
DSCRMPT 609	Geoinformation for Spatial Planning and Risk Management	100
DSCRMPT 610	Applied Statistics and Probability for Disaster Management	100

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Details of Courses:

DSCRMPT 601: Advanced Disaster Management

1. Introduction to Disaster Management
2. Hazard
3. Risk and Vulnerability
4. Mitigation
5. Preparedness
6. Response and Recovery
7. Early Warning of Disaster
8. Disaster Management: National and International Institution and Instruments
9. Disaster Management in Bangladesh
10. Case Studies

References

1. Damon P. Coppola, Introduction to International Disaster Management, 2007, ELSEVIER
2. W. Nick Carter, Disaster Management: A Disaster Managers Hand Book, Manila: Asian Development Bank, 1991
3. Encyclopedia of Disaster Management, Vol. 1, 2, 3. S. L. Geol, 2006
4. Damon P. Coppola, Erin K. Maloney, Communicating Emergency Preparedness.
5. Anna K. Schwab, Hazard Mitigation and Preparedness, WILEY Publication.
6. Jochen Zschau, Andreas N. Kèuppens, Early Warning Systems for Natural Disaster Reduction
7. Establishing Community Based Early Warning System, PRACTITIONER'S HANDBOOK
8. National Plan for Disaster Management, 2010-2015, Disaster Management Bureau, Disaster Management & Relief Division.
9. Standing Orders on Disaster, Ministry of Food and Disaster Management, Disaster Management Bureau.

DSCRMPT 602: Multi-hazard Risk Analysis and Management

1. Tools and Techniques of Risk Analysis and Risk Management
2. Hazard Specific Risk Analysis (Hazard Identification, Hazard Assessment, Element at Risks, Vulnerability Assessment and Risk Estimation
3. Hazard Specific Risk Management (Risk Evaluation and Risk Control)
4. Risk Reduction theories and practices
5. Case Study of Natural and Manmade Hazards

References:

1. Anna K. Schwab, Katherine Eschelbach, David J. Brower. Hazard Mitigation and Preparedness.
2. Fred G. Bell. Geological Hazards
3. Mu. Ramkumar. Geological Hazards

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DSCRMPT 603: Advanced Seismology and Earthquake Risk Management

1. Seismicity and Earthquake; Brief History of Seismology; Historical & Instrumental Seismicity; Seismic Waves
2. Wave Propagation: waves in unbounded area, waves in a semi-infinite body, waves in layered body, attenuation of stress wave.
3. Fundamental of Seismology- Scope and Development, Theory of elastic deformation-stress and Strain analysis, Equations of motion and theorems on elastic equilibrium, Elastic waves, Surface Waves, Inverse Theory, and Modern Seismographs. Signal enhancement, Strongmotion accelerometers, Portable Seismographs and ocean bottom seismographs
4. Seismological Observatory-Interpretation of seismographs, Determination of hypocenter and earthquake size, group estimations of earthquake parameters; International seismological catalogues; Global digital networks
5. Earthquake- Energy released in earthquakes, earthquakes magnitude, geography and distribution of shallow and deep focus earthquake and their tectonic association forshocks and aftershocks; Earthquakes prediction; prediction theory, periodicity, seismicity patterns, changes in seismic velocities; Dilantancy model, liquefaction and other parameters
6. Earthquake source-Elastic rebound model, causes of earthquake, faults and fracture, double couple model, source mechanism estimation, Strong-motion seismology-Effects of earthquakes, seismic risk, explosion seismology, Seismicity of the Earth, Seismotectonics of Bangladesh and surrounding areas.
7. Introduction to Advanced Geotechnical Earthquake Engineering, Seismology and Earthquake, Strong Ground Motion, Seismic Hazard Analysis, Wave Propagation
8. Dynamic Soil Properties, Measurement of Dynamic Soil Properties (Field tests & Laboratory tests), Stress-Strain Behavior of Cyclically Loaded Soils, Dynamics of Discrete Systems (Single Degree of Freedom System & Multiple Degree of Freedom Systems).
9. Ground Response Analysis: One-Dimensional Ground Response Analysis, Two-Dimensional Ground Response Analysis, Three-Dimensional ground Response Analysis.
10. Local Site Effects and Design Ground Motion, Liquefaction, Seismic Slope Stability
11. Soil Improvements: Densification Techniques, Reinforcement Techniques, Grouting and Mixing Techniques, Drainage Techniques, Verification of Soil Improvement.
12. Seismic Response of Structures: Seismic Response of Multistorey RC Building, Seismic Response of Asymmetric Multistorey RC Building
13. Seismic Design of Retaining Walls, Bridges and Tanks, Dams and Tunnels; Seismic Vulnerability of Building and Structures; Repair and Retrofitting of Structures.
14. Seismic Hazard Analysis, Seismic Slope Stability Analysis, Liquefaction Susceptibility analysis.
15. Seismic Microzonation

References:

1. International Handbook of Earthquake and Engineering Seismology, Willium HK Lee & et al, Part A & B, Academic Press. ISBN: 0-12-440652-1 0-12-440658-0
2. Introduction to Seismology, Peter M. Shearer, Cambridge University Press, ISBN-978-0521669535.

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3. The Geology of Earthquakes, Yeats, R.S., K. Sieh, and C.R. Allen (1997), Oxford University Press.
4. Geotechnical Earthquake Engineering, Steven L. Kramer, Prentice Hall Publication.
5. Earthquake Engineering, Volume I, D.K. Paul M.L. Sharma, Elite Publishing.
6. Geotechnical Engineering, Donald P. Coduto, Pearson Education Publication.
7. Geotechnical Earthquake Engineering, Steven L. Kramer, Prentice Hall Publication.
8. Earthquake Engineering, Volume I, D.K. Paul M.L. Sharma, Elite Publishing.
9. Earthquake Engineering for Structural Design, Wal- Fah Chen, E. M. Lui, CRC Press, Taylor & Francis.
10. Geophysics in Engineering Investigations, McDowell P W & et al, CIRIA Publication.
11. Earthquake Risk reduction, David Dowrick, WILEY Publication.
12. Basic Geotechnical Earthquake Engineering, Kamalesh, Kumar, New age International Publishers.

DSCRMPT 604: Hydro-meteorological Hazards and Risk Management

1. Physical, Social, Economic and Environmental Vulnerability of flood, cyclone and river bank erosion.
2. Methods of riverine hazard vulnerability assessment: Land Use Planning, Vulnerability and Hazard Mapping, Risk Mapping.
3. Riverine Hazard Risk Reduction: Integrated River Basin Management, Integrated Flood Management, Flood Management Policy and Planning, Implementation Plan and Monitoring, Trans-boundary International River Laws; Structural and Non-Structural Measures, Watershed Management, Silt Management.
4. Bangladesh: Riverine Risk Management
Rivers and Wetlands of Bangladesh, People and Livelihood Related to River and Flood, Flood Management, FAP, Flood Forecasting, Water Policy of Bangladesh, Farraka Barrage and Bangladesh.
5. Coastal Hazards (Tsunami, Coastal Flooding, Coastal Storms, Saline Water Intrusion), Coastal Hazard Vulnerability Assessment.
6. Coastal inhabitants, their livelihoods & economy.
7. Structural and Nonstructural Measures in Coastal Risk Management, Integrated Coastal Zone Management, Land Use Planning for Coastal Risk Reduction.
8. Introduction to Mountainous Hazards, Overview of Mountainous Vulnerability Assessment and Risk Reduction.
9. Estimating the probability of landslides, Estimating the Consequences, Vulnerability to Landslide, Landslide Vulnerability assessment, evaluation & quantifying landslide risks.
10. Mountainous Risk Reduction Methods (Monitoring, Prediction and Early warning; Engineered Structures; Geophysical tools in Mountainous Hazard investigation; Education, Capacity Building and Public Awareness).
11. Landside risk reduction initiatives in Bangladesh

References:

1. Reports on flood and river bank erosion of CEGIS, BWDB and IWRM.
2. Solutions to Coastal Disasters 2011, Louise Wallendorf, Chris Jones, Lesley Ewing, Bob Battalio, ASCE Publications, 2011
3. Coastal Geomorphology: An Introduction, Eric Bird, John Wiley & Sons, 2011

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4. Coastal Hazards, Charles W. Finkl, Springer, 2012
5. El Niño and the Southern Oscillation: Multiscale Variability and Global and Regional Impacts, Henry F. Diaz, Vera Markgraf, Cambridge University Press, 2000
6. Assessing Coastal Vulnerability: Developing a Global Index for Measuring Risk, United Nations Environment Programme, UNEP/Earthprint, 2005, ISBN 9789280725773
7. The Hidden Costs of Coastal Hazards: Implications For Risk Assessment And Mitigation, The H. John Heinz III Center for Science, Economics, and the Environment, Island Press, 2000, 9781559637565
8. Integrated Coastal and Ocean Management: Concepts And Practices, Biliana Cicin-Sain, Island Press, 1998.
9. Bangladesh Coastal Zone Policy, 2005.
10. Landslides Disaster Risk reduction, Kyoji Sassa, Paolo Canuti, Springer.
11. Landslide Risk Assessment, E M Lee & D K C Jones, Thomas Telford Publication.
12. Landslide Hazard and Risk, Ditors Thomas Glade and et al, WILEY Publication.

DSCRMPT 605: Environmental and Ecological Hazards and Risk Management

1. Basic Concepts, Biotic and Abiotic Environment
2. Adverse effects of Environment Pollution; Air Pollution, Water Pollution, Noise Pollution, and Degradation.
3. Ecology; Introduction, Objectives, Aspects of Ecology, Functional concepts of Ecology, Ecosystem.
4. Water Quality Management, Wastewater Management, Solid Waste Management, Hazardous Waste Management
5. Environmental Act and Regulations
6. EIA- Introduction, Necessity, Methodology of EIA
7. Economic Valuation of EIA, Issues in the incorporation of environment values into cost benefit analysis, Methods for economic valuation of environmental Impacts.
8. Chemical and Biological Hazard Vulnerability Assessment and Risk Reduction.
9. Role of EIA in Planning and Decision Making Process, Public Participation in EIA.

References

1. R. C. Gaur, Basic Environmental Engineering
2. Mackenzie L. Davis, David A. Cornwell. Introduction to Environmental Engineering
3. Rahn, Environmental Engineering: An Environmental Approach.
4. The Global Environment: Institution, Law and Policy, Norman J. Vig, Regina S. Axelrod, EARTHSCAN Publication.
5. Canter, L.W. 1996. Environmental Impact Assessment, McGraw Hill Inc. (2nd ed.).
6. Modak, P.C. & Biswas, AK. 1999. Conducting EIA for developing countries, OXFORD.
7. Ortolano, L, 1997. Environmental Regulations & Impact Assessment, John Wiley & Sons, Inc. New York.
8. Treweek, Jo, 1999. Ecological Impact Assessment, Blackwell Science Ltd. UK.
9. HandBook of Pollution & Hazardous Materials Compliance A Source Book For Environmental Managers, Nicolas P. Chereminioff, 1996, Marcell Dekker.
10. Environmental Challenges of 21st Century, Banking and Basu, APH.

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DSCRMPT 606: Advanced Climate Modeling and Extreme Event Management

1. Introducing Climate Modeling, Types of Climate Models: Energy Balance Climate Model, One dimensional Radiative-convective Climate Model, and Dimensionally Constrained Climate model, General Circulation Models, Paleoclimatic Model, and Projections of Future Climate Change.
2. Processes of Climatic Model Development, Sensitivity of Climate Model & Model Evaluation.
3. Types of adaptation to climate change: anticipatory and reactive.
4. Adaptation characteristics and processes: Components and Forms of adaptation, Climate Stimuli for Adaptation, Adaptation Types and Forms, Systems, Scales, and Actor, Processes and Evaluation of Adaptation
5. Technologies & Options for Adaptation: adaptation in coastal zones, adaptation technologies for water supplies, adaptation options for agriculture, adaptation options for health, infrastructure technologies for adaptation
6. Adaptive Capacity and its Determinants: Economic Resources, Technologies, Information and skills, Infrastructure, Institution, Equity. Enhancing Adaptive Capacity.
7. Climate Change Adaptation Options in Bangladesh, NAPA, Endowed Knowledge Inclusion in Adaptation.

References:

1. Kendal McGuffie, Ann Henderson-Sellers, A Climate Modelling Primer, John Wiley & Sons, 2005
2. CLIMATECHANGE 2001: THE SCIENTIFIC BASIS, Oxford University Press.
3. Assessment reports of IPCC.
4. National Adaptation Program of Action, MoEF and UNDP.
5. Technologies for Adaptation to Climate Change, UNFCCC.
6. Framework Document on Water and Climate Change Adaptation: For Leaders and Policy-makers in the Asia-Pacific Region, Asia Pacific Water Forum.
7. BARRY SMIT (CANADA) AND OLGA PILIFOSOV A (KAZAKHSTAN), Adaptation to Climate Change in the Context of Sustainable Development and Equity.
8. Avoiding Dangerous Climate Change, Hans Joachim Schellnhuber, Wolfgang P. Cramer, Cambridge University Press, 2006.
9. Assessing Vulnerability to Global Environmental Change: Making Research Useful for Adaptation, Decision Making and Policy, Anthony G. Patt, Earthscan, 2008.
10. Climate change vulnerability and adaptation in Asia and the Pacific, Lin Erda, Kluwer, 2009.
11. Vulnerability and adaptation assessments: an international handbook, Sandra Guill, Kluwer, 1996.

DSCRMPT 607: Pre and Post Disaster Damage and Need Assessment

1. Introduction: Concept of economic development; Determinants of development; National income as a measure of development; International and national development strategies; Concept of disaster risk reduction (DRR).
2. National Income Measures, Effects of Disasters on National Income, Mainstreaming disaster risk reduction, Approaches for Integrating DRR into Development Plans, Financing DRR

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3. Demand and Supply, Creative destruction hypothesis, Broken window hypothesis, Economic Policies
4. Introduction: Concept of disaster damage and losses; Factors causing increase in damage and losses;
5. Damage and Loss Measures: Assessment versus estimation; Concept of Post-disaster Needs Assessment (PDNA); Concept of disaster damage and loss assessment (DaLA); Concept of pre-disaster loss estimation (PDLE).
6. DaLA Method: Features of DaLA/ECLAC methodology; Advantages and disadvantages of using ECLAC Methodology; General steps involved in DaLA;
7. Economic Sectors: Basics of economic sectors- agricultural, industrial, commerce, and tourism; feature of economic sectors, procedure of assessing damage and estimating losses; typical indicators for data collection; typical sources of information.
8. Infrastructure Sector: Basics of infrastructure sectors- energy, drinking water and sanitation, transport and communications; feature of infrastructure sectors, procedure of assessing damage and estimating losses; typical indicators for data collection; typical sources of information.
9. Social Sector: Basics of social sectors- housing, education, and health; feature of infrastructure sectors, procedure of assessing damage and estimating losses; typical indicators for data collection; typical sources of information.
10. Cross-cutting Sectors: Basics of cross-cutting sectors- environment, air pollution, water resources, land and soils, and biodiversity; procedure of assessing damage and estimating losses; typical indicators for data collection; typical sources of information.
11. Introduction: Definition of public goods, importance of public goods.
12. Basic Concepts: Concept of Welfare state; Functions of a modern state and government; Forms of Government- democracy and autocracy; Pros and cons of government interventions in DRR.
13. Government as Disaster Risk Manager: Relief distribution mechanism; Role of national and local governments; Government initiatives in reconstruction and rehabilitation phase; Political influences in relief and recovery phases.
14. Disasters, Income and Political Transitions: Basics of political transitions; Direct effects of disasters on political party in power; Indirect effects of disasters on incumbent political party through income; Overall effects of disasters on political transitions.

References:

1. ADPC (2012), *Module 2: Natural Disasters and Development*, and *Module 6: Economic Policy making for DRR*, in Regional Training Course on Pre-Disaster Natural Hazard Loss Estimation, Bangkok, Thailand.
2. Bull, R (1994), *Disaster Economics*, Disaster Management Training Programme, UNDP.
3. Mankiw, NG (2011), *Principles of microeconomics*, South-Western Pub.
4. ECLAC (2003), *Handbook for Estimating the Socio-economic and Environmental Effects of Disasters*, Economic Commission for Latin America and the Caribbean and the World Bank.
5. Albala-Bertrand, J 1993, *The political economy of large natural disasters: with special reference to developing countries*, Oxford University Press, USA.

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6. Dacy, D & Kunreuther, H (1969), *The economics of natural disasters: Implications for federal policy*, Free Press.
7. Kapoor, A(2007), *Principles of Political Science*, New Delhi: S. Chand & Co.

DSCRMPT 608: Built Environment, Urbanization and Development

1. Built Environment: Introduction and its components.
2. Structural forms and systems for buildings, bridges, communication and transmission structures.
3. Types of construction materials - steel, reinforced and prestressed concrete etc;
4. Physical and chemical properties of built materials.
5. Loads on structures; types of foundation, concept of bearing capacity, settlement.
6. Impact of Built Environment on Health, sustainable design, towards environment friendly built environment.
7. Concept on building code, General building requirements, control and regulations; Structural Design; construction practice and safety; building services; Alteration, Addition and Change of Existing Building Codes.
8. Urban System; Nature of Urbanization, The system of Cities, Urban Ecology, Urban Commercial Structure and Urban Population
9. Urban Landuse and Land Policy
10. The structural, socio-demographic and geographic concepts of urbanization
11. Rapid growth of urban population and the role of migration in the process of urbanization in the developing countries.
12. The name of urban economic dualism and the role of the informal sector in Asian cities.
13. Urban poverty in asian cities: Magnitude Causes and Consequences.
14. Mega cities: the prospects and problems and the search of alternatives.
15. The role of secondary cities.
16. Urban Environment and sustainability.
17. Urban management, problems and prospects.
18. Regional perspectives on urbanization and development
19. Urbanization and development: selected policy challenges: Urban informality: the shifting locus of poverty, The power of place: environmental sustainability and urban health, Violence in cities: the limits of community and the reign of terror, Governing developing cities: structure and agency in local governance
20. Critical analyses of urbanization and development: The 'glocal' politics of urban development: harmony and havoc, City futures: global predictions and local resurgence

References:

1. Basic Civil Engineering, Rakesh Boeher
2. Comprehensives Basic Civil Engineering, Dr. B.C. Punmia, Ashok Kumar Jain, Arun Kr. Jain
3. Bangladesh National Building Code, 1993.
4. Paul Tymkow, Savas, Tassou, Maria Kolokotroni, Hussam Jouhara; Building Services Design for Energy Efficient Buildings; Taylor and Francis.
5. James Douglas and Bill Ransom; Understanding Building Failures; 4th edition, Taylor and Francis.

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6. Mathew Carmona; Design and the Built Environment.
7. Sadhu Afochs Johnston, Steven S. Nicholas and Julia Parzeen; The Guide to Greening Cities.
8. Albert P.C. Chan, Esther Cheung; Public Private Partnership in International Construction. Routledge Publication
9. R.P.Mishra & B.S. Bhooshan: Human settlements in Asia: Public policies and programmes (New Delhi: Heritage)
10. T.G. MC Gee, The urbanization Process in the Third World, 1971.
11. Y.M.Yeung & C.P. lo (Editors), Changing South-east Asian Cities: Readings on Urbanization, 1976.
12. U.N. Global Review of Human Settlements: A support paper for habitat, 1976.
13. World Bank, National Urbanization Policies in Developing Countries, 1979.
14. Ronald J. Fuchs, G.W. Jones & E.M. Perina. Urbanization and Urban Policy in Pacific Asia. (West view press, 1987.)
15. Government of Bangladesh: National report on Habitat Human Settlements, in Vancouver Habitat Conf.
16. Planning Commission: GOB: Task Force Report on Social Implication of Urbanization, Dhaka 1971.
17. Urban Research in Developing World: papers for the global programme on Urban Research in the developing Countries, Cairo, 1993.
18. T.G.No. Gre & O.P. Mathur, Urbanization in Asia: Patterns and trends, (Bangkok: UN-ESCAP, 1993.
19. N.Islam. Rural-Urban Migration in Asia: Pattern, Impact and Consequences. (HSD, AIT Research paper, 1985).

DSCRMPT 609: Geoinformation for Spatial planning and Risk Management

1. Fundamentals of GIS
Development of GIS, Scope, Advantages and limitations
2. Data and Information
Data and Information, Distinguishing Properties of Geographic Data, Spatial Data Model (Vector and Raster data), Attribute Data, Measurement scales
3. Map Projection and Coordinate System
Geographic Coordinate System, Vertical Coordinate System, Projected Coordinate System
4. Digitizing (Manual Digitizing, Raster Scanning)
5. Mapping and Visualization
6. Multicriteria decision system,
(1) Heuristic method (Knowledge based), (2) Fuzzy logic (3) AHP method
7. Terrain analysis
8. Lidar remote sensing and its application in disaster science
9. Hazard mapping using advance geographic information system
(1) Flood hazard, (2) Landslide hazard, (3) Drought hazard (4) Bank erosion hazard (5) coastal vulnerability indexing (6) Sea water ingress mapping using GALDIT method, (7) Liquefaction study (8) earthquake hazard mapping (9) Soil erosion hazard (10) Groundwater pollution mapping using DRASTIC method
10. Geostatistical analysis of spatial database

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11. Spatial data infrastructural system for disaster management.
12. Introductory Remote sensing ; Scope; Concepts and Principles of Remote Sensing; Air- and Space-borne.
13. Remote Sensing; Data Acquisition and Interpretation, History of Remote sensing, Satellites and Sensor Characteristics. Atmospheric Scattering. Visual Image Interpretation from satellite imagery, Aerial Photograph; Fundamentals of Photo Interpretations; Basic Photo-interpretation Equipment; Satellite Remote Sensing- Optical and Microwave Sensors, Multispectral Scanning.
14. Spectral Reflectance of Vegetation, Soil and Water; Selected Application of Remote Sensing; Bridging of GIS and Remote Sensing; Current and Future Trends in Remote Sensing.
15. Fundamentals of microwave and lidar remote sensing and its application in disaster science.
16. Radiometric and Geometric correction
17. Atmospheric correction
18. Hyperspectral image processing
19. Application of Remote sensing in Disaster science.
Mapping techniques using satellite image i.e., geomorphology, geology; Hazard analysis using remote sensing
20. Multicriteria Decision Making: Advanced Multiple Criteria decision making, fuzzy optimization, TOPSIS, AHP, RAHP, computational tools and applications in multidisciplinary design, Introduction to Multiple Attribute Decision Making (MADM), Classification of Multiple Criteria Decision Making (MCDM) /Optimization, Methods Weighting Methods; General MCDM tool, Introduction to Advanced tools on MCDM, Recent Extensions to MADM Models, A Review of Computational Tools/ Select Advanced Topics

References:

1. Lillesand, T.M., Kiefer, R.W. and Chipman, J.W. 2004, Remote Sensing and Image Interpretation, 5th edition, John Wiley and Sons. ISBN 0471152277.
2. Qihao Weng, Remote Sensing & GIS Integration, published by McGraw Hill.
3. Tarek Rashed-Carsten Jurgens, Remote Sensing of Urban and Suburban areas published by Springer.
4. Bonham-Carter, G.F., 1994, Geographic Information Systems for Geoscientists: Modeling with GIS. Elsevier Science Publications. ISBN0 08 041867 8
5. Drew Decker, GIS Data Sources, published by John Wiley and Sons, Inc.
6. M Campagna, GIS for Sustainable Development, published by published by CRC press (Taylor & Francis).
7. Allan Brimicombe, GIS, Environmental Modelling and Engineering, published by CRC press (Taylor & Francis).

DSCRMPT 610: Applied Statistics and Probability for Disaster Management

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

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2. Processing of data: measurement scales, variables, attributes, tabulation, frequency distribution, graphical presentation of data, details of different types of graphs and charts with their relative merits and demerits, stem-and-leaf plot.
3. Characteristics of statistical data: measures of location, dispersion, skewness, kurtosis and their properties, moments, box-and-whiskers plots.
4. Probability Distributions: Probability mass functions and probability density function, mean and variance. Binomial, Poisson, Exponential, Gamma, Lognormal and normal distribution: Fitting of the distributions.
5. Sampling techniques: Simple random sampling, stratified sampling, systematic sampling, sample size determination- application in Environmental Engineering.
6. Regression and correlation: Linear Regression and correlation, multiple correlation coefficient, standard error of estimate, curvilinear regression- Applications.
7. Statistical inference: Intervals estimation, Confidence interval for mean, variances and regression coefficients. Sampling Distribution, Test of significance of (i) Means (ii) Mean of two samples (iii) Proportions (iv) Variance (v) Two variances (vi) Two observed correlation coefficients (Fishers' z-transformation), (vii) Paired T-test (viii) Regression coefficients (ix) Chi-square test of goodness of fit, Skewness and Kurtosis tests.
8. Applications: Analysis of variance (i) Completely randomized designs (ii) Randomized block designs. Latin squares. Grecco Latin square design. Factorial experiments. Graphical presentation techniques.
9. Time Series Models: Components of time series-smoothing- Measuring forecasting accuracy- Testing of ARIMA Models.

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