आपदा न्यूनीकरण एवं प्रबन्धन उत्कृष्टता केन्द्र, भारतीय प्रौद्योगिकी संस्थान रूड़की,
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1. Subject Code : **DMN-501**   Course Title : **Geodata Processing Techniques and Models**

2. Contact Hours: **L:** 3   **T:** 0   **P:** 3

3. Examination Duration (Hrs.) : **Theory:** 3   **Practical:** 0

4. Relative Weight   : **CWS 15   PRS 25   MTE 20   ETE 40   PRE 0**

5. Credits: **4**   6. Semester: **Autumn**   7. Subject Area: **PCC**

8. Pre-requisite: Nil

9. Objective : To impart knowledge on various geodata processing techniques and models for earth resources mapping and their practices for disaster related studies.

10. Details of Course :

Sl. No.	Particulars	Contact Hours
1	Importance of Geodata processing techniques to disaster related studies, Geodata systems and models	2
2	Coordinate and coordinate systems: Geographical and map projection system, 2D and 3D data transformation; Types of maps, scales, mapsheet numbering systems and uses	3
3	Modern field surveying and GPS surveying data acquisition tools, methods of total station and GPS surveys; Data processing, analysis and presentation techniques	6
4	Aircraft and space based geodata collection tools, photogrammetric and remote sensing models, aerial photogrammetric mapping methods, use of stereo-photogrammetry for creation of 3D earth surface models.	8
5	Remote sensing data acquisition, platforms and sensors, multi and hyperspectral data processing, visual data interpretation for information extraction	4
6	Introduction to digital image processing: Pre-processing, image enhancement, image classification and image change detection techniques	4
7	Digital Geodatabase, spatial and non-spatial data, vector and raster data models, database management system	3
8	Geospatial data modeling; Geographic information systems; Hardware and software components, data transformation, processing and analysis models; Overlay, network and proximity analysis; Data visualization tools and models	6
9	Techniques and tools for digital elevation models and their uses	4
10	Quality assessment of geospatial data	2
	Total	**42**

List of Practicals

1. Familiarity with different types of Geodata.
2. Familiarisation with various 2D and 3D coordinate transformations and map projection Systems.
3. Control establishment using Total Station traversing
4. Topographical map preparation using Total Station surveys
5. Collection and processing of data using different types of GPS for mapping
6. Determination of scale and flying height of an aerial photograph.
7. Determination of 3D surface models using stereo-photogrammetry
   a. Introduction to different types of remote sensing data products.
   b. Use of spectrometer for collection of signatures of different earth objects.
8. Visual analysis of a satellite data.

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रूड़की – 247667
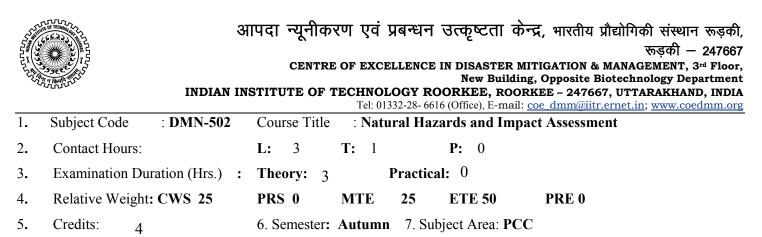**CENTRE OF EXCELLENCE IN DISASTER MITIGATION & MANAGEMENT, 3rd Floor,**
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9.   Demonstration and training on image classification module of ERDAS Imagine. Practice for selection of training areas and their quality assessment using histogram and separability analyses.
10. Demonstration of a GIS software and their salient features. Understanding raster and vector data
11. Scanning and digitization (on screen). Registration of various maps and digitization and editing of features.
12. Database creation and management. Buffering and overlay analysis.
13. DEM creation and visualization

11. Suggested Books:

S No	Name of Authors/Book/Publisher	Year of Publication / Reprint
1	Schofield W and Breach M., Engineering Surveying, 6th Edition, Butterworth-Heinemam	2007
2	Chandra A.M., Surveying, New Age Publishers	2002
3	Lo, C.P. and Yeung, A.K.W., Concepts and Techniques of Geographical Information System, Prentice Hall India	2002
4	Bossler, J.D., Manual of Geospatial Science and Technology, Taylor and Francis	2001
5	Lillesand, T.L., and Keiffer, R.W., Remote Sensing Image Interpretation, John Wiley and Sons	2000

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1. Subject Code : **DMN-502** Course Title : **Natural Hazards and Impact Assessment**

2. Contact Hours: **L:** 3 **T:** 1 **P:** 0

3. Examination Duration (Hrs.) **:** **Theory:** 3 **Practical:** 0

4. Relative Weight**: CWS 25** **PRS 0** **MTE 25** **ETE 50** **PRE 0**

5. Credits: 4 6. Semester**: Autumn** 7. Subject Area: **PCC**

8. Pre-requisite**: Nil**

9. Objective **:** To impart knowledge about the various natural hazards, associated damages and lessons learnt.

10. Details of Course :

Sl. No.	Particulars	Contact Hours
1.	Introduction to various natural hazards: earthquakes, floods, cyclones, and landslides	2
2.	Geological Processes leading to natural hazards, short term & long term prediction	5
3.	Parameters and grade of damage, performa for damage studies, documentation of damage survey, loss assessment and lessons learnt	4
4.	Earthquakes, causes and classification, estimation of size of earthquake, magnitude and intensity, seismic waves, site effect, attenuation effect, isoseismal maps, palaeoseismology, recurrence intervals, fault slip-rates, and fault behaviour models, earthquake ground motion, response spectra	5
5.	Landslides, causative factors, landslide monitoring and prediction, landslide hazard zonation	4
6.	Floods, causes of floods, flood damages, flood analysis and flood plain zoning, drought and its impact	4
7.	Cyclones, their causes, characteristics and their impact	4
8.	Tsunami, Tsunamigenic earthquakes and its impact, tsunami modeling, inundation and tsunami intensity, tsunami zonation.	4
9.	Other natural hazards: volcanic eruptions, forest fires etc., Case histories of hazard assessment	4
10.	Vulnerability and risk due to natural hazards	**2**
11.	Case studies for above natural hazards	**4**
	Total	**42**

11. Suggested Books :

Sl. No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Reiter, L., Earthquake Hazard Analysis: Issues and Insights, Columbia University Press	2000
2.	Hyndman D. and Hyndman D., Natural Hazard and Disasters, Brooks/Cole	2006
3.	Bryant E., Natural Hazards, Cambridge University Press	2005
4.	Mileti D.S., Disasters by Design: A Reassessment of Natural Hazards in United States; The National Academic Press	1999
5.	Keller, Environment Geology, Prentice Hall	2000

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1. Subject Code : **DMN-503** Course Title : **Managerial and Financial Aspects of Disaster Management**
2. Contact Hours: **L:** 3 **T:** 1 **P:** 0

3. Examination Duration (Hrs.) : **Theory:** 3 **Practical:** 0

4. Relative Weight **: CWS** 25 **PRS** 0 **MTE** 25 **ETE** 50 **PRE** 0

5. Credits: **4** 6. Semester**: Spring** 7. Subject Area**: PEC**

8. Pre-requisite**: Nil**

9. Objective: To identify and examine the essential and fundamental elements of disaster prevention, response and recovery within an inclusive management policy framework.

10. Details of the Course:

S. No.	Particulars	Contact Hours
1.	**Introduction to Disaster Management:** Understand disaster hazards and how they pose disaster threats. Categories and characteristics of disaster threats. Identification, description and management of all potential hazards that may occur in the area of responsibility. Forecasting of disaster threats and measures relating to prevention of disaster threats.	7
2.	**Disaster Management Principles and Practices:** Consider most important factors that need attention for the implementation of disaster mitigation and management programmes, legislation, key factors, principles and ethics, consideration for effective planning, controlling, co-coordinating, monitoring and implementing disaster mitigation and management programmes.	8
3.	**Economic and Financial Aspect of Disaster Management:** Financial Planning and control of disaster mitigation and management implementation programmes. Comparative analysis models for disaster mitigation and management. Budgeting, Identifying sources of funds and provision of funds. Economic consequences of disaster and intangible economic impacts of disaster. Principles of economic recovery and strategies for economic recovery. Financial recovery from disaster- disaster insurance, natural disaster relief arrangements and public disaster appeals.	12
4.	**Strategic Disaster Management:** Understanding the application of the principles and procedures of strategic management in the domain of disaster mitigation and management. Strategy formulation, understanding strategic intent, vision, mission for better forecasting of disaster threats and their prevention and strategic management of disaster. Strategic management principles, methods and tools. planning, organizing, leadership and monitoring and evaluation of all role-players in disaster management.	10
5	**Information Technology in Disaster Management:** Understanding the link between information and decision-making. Understanding and classifying information systems that can have an impact on the dynamic disaster environment	5
	Total	42

11. Suggested Books:

Sl. No.	Name of Books/Authors	Year of Publication
1	Management: A Global Perspective, Weihrich, H. and Koontz, H., New York, McGraw Hill	2006
2	Disaster Management: A Disaster Managers Handbook, Carter, W.N., Manila, ADB.	2006
3	Disaster Management Handbook for Bangladesh, Parts I-IV. Dhaka, BDPC and PACT, Rahman, M.S	2005
4	Management, Stoner, J.A.F. and Freeman, R.E., Prentice-Hall, New Delhi	2004
5	Geographic Information: Economic applications, Martin. D., Routledge, London	2001

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1. Subject Code : **DMN-504**   Course Title: **Hydrological Data Collection, Processing and Analysis**
2. Contact Hours: **L:** 3   **T:** 2   **P:** 0

3. Examination Duration (Hrs.) : **Theory:** 3   **Practical:** 0

4. Relative Weight **:**   **CWS** 25 **PRS:** 0   **MTE** 25   **ETE** 50   **PRE** 0

5. Credits: **4**   6. Semester**: Autumn**   7. Subject Area**: PEC**

8. Pre-requisite**:** Nil

9. Objective **:** To introduce various methods for hydrological data collection, processing and analysis.

10. Details of Course **:**

Sl. No.	Particulars	Contact Hours
1	Hydrologic Cycle, Types of hydrometeorological data and their importance, time oriented, space oriented and relational data	3
2	Observation of hydrometeorological data - rainfall, temperature, evaporation, discharge and other parameters, observational and instrumental errors and quality control. Guidelines of WMO, BIS & ISO	5
3	Storage, transmission and retrieval of data, different formats adopted by IMD, CWC and WMO.	4
4	Design and optimization of monitoring systems for rainfall, evaporation, gauge and discharge networks and groundwater data monitoring stations.	4
5	Estimation of missing data in rainfall, runoff and other parameters, record extension for rainfall and runoff data, interpolation and kriging techniques, statistical rainfall-runoff models.	6
6	Development of stage discharge curves using graphical, physical and analytical methods for various types of streams.	3
7	Automatic weather stations - types, data storage and retrieval; Automatic water level recorders - types, data storage and retrieval.	4
8	Analysis of randomness and trends in hydrometeorological data; Computation of statistical parameters and standards errors, components of time series, concepts of short and long term dependence in hydrometeorological data.	5
9	Estimation of extremes using frequency analysis; Graphical and analytical methods for normal, lognormal and Gumbel distributions.	4
10	Case Studies	4
	Total	**42**

11. Suggested Books:

S No	Name of Authors/Book/Publisher	Year of Publication / Reprint
1	Kottegoda N.T., "Stochastic Water Resources Technology", John Wiley & Sons	1980
2	Chow V. T., Maidment D. R. and Mays L. W., "Applied Hydrology", McGraw-Hill	1988
3	Maidment, D.R., "Handbook of Hydrology", McGraw Hill Inc.	1993
4	Singh V. P., "Elementary Hydrology", Prentice-Hall of India Private	1994
5	Hornberger G. M., Raffensperger J. P., Woberg P. L and Eshleman K. N., "Elements of Physical Hydrology", The Johns Hopkins University Press	1998
6.	S.K. Jain & V.P. Singh, "Water Resources Systems Planning and Management", Elsevier ISBN:8131205916 (HB)	2006
7.	Viessman W. and Lewis G. L., "Introduction to Hydrology", Pearson Education	2007
8.	Subramanya K., "Engineering Hydrology", Tata McGraw Hill Ltd	2008

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1. Subject Code **: DMN- 505**   Course Title **: Landslide Hazard Assessment & Mitigation**

2. Contact Hours :   **L:** 3   **T :** 1   **P:** 0
3. Examination Duration (Hrs) **: Theory :** 3   **Practicals:** 0

4. Relative Weight **: CWS** 25 **PRS:** 0 **MTE:** 25 **ETE:** 50 **PRE:** 0

5. Credits **: 4**   6**.** Semester**: Autumn**   7. Subject Area **: PEC**

8. Pre-requisite**: Nil**
9. Objective: To understand mapping and hazard assessment techniques of landslides and protection against landslide.
10. Details of the Course:

S. No.	Particulars	Contact Hours
1.	Definition; overview of Hazard assessment techniques on regional, semi detail and detailed scales and their application for planning purposes; Terrain classification and mapping methods, use of RS and GIS.	5
2.	Causative factors of landslides – natural including inherent factors and external factors as well as anthropogenic factors; Impacts of natural causative factors like lithology, structure, slope morphometry, relative relief, hydrogeological conditions and land use and land cover on stability of slopes ; Impacts of external factors like concentrated rain fall and earth quakes on slope stability; Various causes of slope instability in Himalaya; extreme hydro-meteorological conditions leading to landslide dams and related damages;	8
3.	Classification of landslides and mass movements, Landslide hazard zonation (LHZ) on regional scales of 1:50,000; LHZ practices in India; LHZ mapping technique suggested by Bureau of Indian Standards with examples; Application of regional scale LHZ maps;	10
4.	Landslide hazard zonation on Meso scale (1:5000); Application of Meso scale maps for town and zonal planning.	05
5	Landslide hazard studies on detailed scale of 1:1000; Mechanics of landslide; Markland test for landslide probability; Strength of slope materials; Assessment of rock mass properties; Overview of slope stability studies for slopes characterized by overburden debris and rock materials.	08
6	Landslide control measures – grading of slopes, retaining walls, breast walls, drainage measures, rock bolts and rock anchors, Biotechnical measures, Special toe walls and other stability measures.	4
7	Case studies of important landslides of Himalaya and their control practices	2
	Total	**42**

11. Suggested Books:

S. No	Name of Books / Authors / Publisher etc.	Year of Publication
1	Mitigation of Natural hazards and Disasters: International perspective. Haque, C. Emdad, Springer, Dordrecht.	2005
2	Rock slope Engineering. Hoek and Bray. Spon Press, 4th edition	2000
3	Environmental geosciences. Keller, E.A. John Wiley & Sons, NY	1999
4	Natural hazard risk assessment and Public policy. Petak, W.J. and Atkinson, A.D. Springer Verlag, NY	1982
5	A field manual for landslide investigations, R.Anbalagan, B. Singh, D.Chakraborthy and A. Kohli. DST, Government of India, New Delhi	2007

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1. Subject Code : **DMN-506**   Course Title : **Cyclone and Wind Engineering**
2. Contact Hours: **L:** 3   **T:** 1   **P:** 0

3. Examination Duration (Hrs.)   :   **Theory:** 3   **Practical:** 0

4. Relative Weight**:**   **CWS** 25   **PRS** 0   **MTE** 25   **ETE** 50   **PRE** 0

5. Credits: **4**   6. Semester**: Spring**   7. Subject Area**: PEC**

8. Pre-requisite**: Nil**

9. Objective**:** To impart knowledge on the basics of enhancing wind load resistance of structures.
10. Details of Course:

Sl. No.	Particulars	Contact Hours
1.	Climate change and its impact on tropical cyclones , Nature of cyclonic wind	5
2.	Boundary layer winds - velocities and pressures	3
3.	Behaviour of structures in past cyclones and wind storms - lessons learnt	5
4.	Basic wind engineering, aerodynamics of bluff bodies, vortex shedding and associated unsteady along and across wind forces. Peak factor and gust factor estimation. Analytical procedures for along wind and across wind forces.	10
5.	Wind tunnel testing and its salient features.	2
6.	General planning and design considerations under wind storms and cyclones; Wind effects on buildings, towers, glass panels etc, and features in their design. Codal Provisions – design wind speed, pressure coefficients; Introduction to international codes.	8
7.	Vulnerability and risk assessment in high cyclone prone areas	4
8.	Cyclonic risk mitigation and preparedness. Life–line structures such as cyclone shelters. Retrofitting and strengthening of structures. Rehabilitation,	5
	Total	**42**

11. Suggested Books:

Sl. No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Simiu E. and Scanlan R.H., Wind Effects on Structures-Fundamentals and Applications to Design, 3rd Ed., John Wiley	1996
2.	Dyrbye C.D., Dyrbye C., Dyrbye C., Wind Loads on Structures, John Wiley	1997
3.	Smith B.S. and Coull A., Tall Building Structures : Analysis and Design, Willey – Inderscience	2001
4.	Taranath B.S., Wind and Earthquake Resistant Buildings : Structural Analysis and Design (Civil and Environmental Engineering) , CRC Press	2004
5.	Talwar A.K. and Juneja S., Cyclone Disaster Management, Commonwealth Publishers	2009
6.	Holmes J.D., Wind Loading of Structures, 2nd Ed., Taylor & Francis	2007

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1. Subject Code : **DMN-507** Course Title : **Disaster Preparedness and Mitigation**

2. Contact Hours: **L:** 3 **T:** 1 **P:** 0

3. Examination Duration (Hrs.) **: Theory:** 3 **Practical:** 0

4. Relative Weight **: CWS** 25 **PRS** 0 **MTE** 25 **ETE** 50 **PRE** 0

5. Credits: 4 6. Semester**: Spring** 7. Subject Area**: PEC**

8. Pre-requisite**: Nil**

9. Objective**:** To impart knowledge towards the assessment of various hazards, disasters and their mitigation.

10. Details of Course :

Sl. No.	Particulars	Contact Hours
1.	**Introduction to Various Hazard:** Definitions, vulnerability and risk, hazard estimation, hazard mapping, effect of site conditions on structures, event monitoring, processing and integration of data (such as topography, geology, remote sensing, various geophysical anomalies, soil characteristics, economic development)	10
2.	**Damages:** Grade of damages, direct and indirect damages, damage to structures, lessons learnt	5
3.	Seismic Vulnerability and Risk: Seismic Vulnerability Assessment – various methodologies, building typology survey, empirical and analytical methods, estimation of life loss, direct and indirect economic losses, shelter needs.	8
4.	**Disaster Mitigation:** Warning and evacuation, do's and don't about disaster, damage survey for designing aid package and detailed survey for reconstruction, repair and retrofitting, post disaster surveys, survey proformas, long term measures- Disaster resistant construction, codal practices, retrofitting cost-benefit analysis.	10
5.	**Post Disaster Issues:** Post Disaster Reconstruction and recovery for sustainable development, issues and policies	3
6.	**Disaster Management Act :** Disaster management policy; Techno legal aspect: Techno-Legal and Techno-Financial work; Model Town and country planning legislation land use zoning regulation, development control regulations and building bye-laws registration, qualification and duties of professionals, disaster response policy.	6
	Total	**42**

11. **Suggested Books :**

Sl. No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Dowrick D.J., Earthquake Risk Reduction, John Wiley & Sons	2003
2.	Reiter, L., Earthquake Hazard Analysis: Issues and insights, Columbia University Press	1992
3.	Aki, K. and Richard, P. G., Quantitative seismology: Theory and Methods, Vol I and II, W. H. Freeman & Co.	1980
4.	Mileti D.S., Disasters by Design: A Reassessment of Natural Hazards in United States, The National Academic Press	1999
5.	Bryant E., Natural Hazards, Cambridge University Press	2005
6.	Richter,C.F., Elementary Seismology, W. H. Freeman and Company Inc/ Eurasia	1969

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1. Subject Code   : **DMN-508**   Course Title: **Climate Change : Impact**

2. Contact Hours: **L:** 3   **T:** 1   **P:**

3. Examination Duration (Hrs.) : **Theory:** 3   **Practical:** 0

4. Relative Weight **: CWS** 25 **PRS** 0 **MTE** 25 **ETE** 50 **PRE** 0

5. Credits: **4**   6. Semester**: Autumn** 7. Subject Area**: PEC**

8. Pre-requisite**: Nil**

9. Objective **:**

10. Details of Course **:**

Sl. No	Particulars	Contact Hours
1.	Climate and Climate Change: Components, Phenomena, raditive forces, Energy budget and transport, atmospheric circulation, ocean circulation, land-surface process, carbon cycle	5
2.	Atmospheric Thermodynamics: Equation of state, Dalton's of partial pressure, Poisson's law, equivalent potential temperature, concept of air parcel, virtual temperature, dry adiabatic lapse rate and saturated adiabatic lapse rate, hydrostatic equilibrium equation, dispersion of air pollutants	6
3.	Physical processes: Conservation of momentum, equation of state, temperature equation, continuity equation, conservation of mass	5
4.	Climate Models: Introduction to GCM and RCM simulations, SRES, downscaling GCM outputs	5
5.	ENSO: El Niño basic, Tropical pacific climatology, El Niño mechanism, ENSO indices, predictions and teleconnections	3
6.	Greenhouse effects and climate feedbacks: Global energy model, greenhouse effect and global warming, climate feedback	3
7.	Climate Model scenarios for global warming: Greenhouse gases, aerosols forcing, global-average response to GhG warming scenarios on temperature, rainfall, sea, ice/snow, extreme events	6
8.	Extreme Events analysis of climatic parameters, Climate Change Impact Assessment on floods, droughts,	5
9.	Climate Change induced disaster – Case Studies	4
	Total	**42**

11. Suggested Books :

Sl. No.	Name of Authors/Book/Publisher	Year of Publication / Reprint

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1. Subject Code   : **DMN-601**   Course Title: **Hazard Monitoring, Prediction and Microzonation**

2. Contact Hours: **L:** 3   **T:** 1   **P:** 2/2

3. Examination Duration (Hrs.) : **Theory:** 3   **Practical:**   0

4. Relative Weight **:**   **CWS** 20   **PRS** 20   **MTE** 20   **ETE** 40   **PRE** 0

5. Credits: **4**   6. Semester**: Autumn** 7. Subject Area**: PCC**

8. Pre-requisite**: Nil**

9. Objective **:** To introduce methodologies to monitor, predict and assessment of various kinds of natural hazards.

10. Details of Course **:**

Sl. No	Particulars	Contact Hours
1.	Monitoring of cyclones, earthquakes, tsunamis, floods, landslides; requirement of warning system, communication protocol	3
2.	Cyclone monitoring, instrumentation for cyclone monitoring, satellites communication, cyclone prediction, case studies of some major cyclones	4
3.	Flood monitoring, distribution of rainfall, hydrological forecasting, flood mapping, basin studies, case studies of some major floods	4
4.	Use of remote sensing in landslide monitoring, GIS application, qualitative and quantitative hazard approaches, landslide hazard zonation, statistical approaches, weight and rating schemes	6
5.	Probabilistic and deterministic approaches for seismic hazard assessment, seismotectonic modeling, source and distance definitions, probabilistic distributions, conditional probabilities, uniform seismic hazard	8
6.	Macrozonation and microzonation, social economic factors and considerations, microzones, engineering aspects, return periods	5
7.	Basic concepts and procedure for microzonation of urban cities	4
8.	Case studies of microzonation of some mega cities	2
9.	Foreshocks and aftershocks, earthquake monitoring using seismographs and accelerographs, earthquake alert systems, earthquake prediction	6
	Total	**42**

11. Suggested Books :

Sl. No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Reiter, L. , Earthquake Hazard Analysis: Issues and Insights, Columbia University Press	2000
2.	Keller, Environment Geology, Prentice Hall	2000
3.	Kramer S. L., Geotechnical earthquake engineering, Pearson Education	2003
4.	Hyndman D. and Hyndman D., Natural Hazards and Disasters, Brooks/Cole	2006
5.	Mileti D.S., Disasters by Design: A Reassessment of Natural Hazards in United States, The National Academic Press	1999

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1. Subject Code : **DMN-602** Course Title: **Climate Change and Sustainable Development**

2. Contact Hours: **L:** 3 **T:** 1 **P:** 0

3. Examination Duration (Hrs.) **: Theory:** 3 **Practical:** 0

4. Relative Weight **: CWS** 25 **PRS** 0 **MTE** 25 **ETE** 50 **PRE** 0

5. Credits: **4** 6. Semester**: Autumn** 7. Subject Area**: PCC**

8. Pre-requisite: **Nil**
9. Objective: To impart knowledge on climate change and sustainable development
10. Details of Course:

S. No.	Contents	Contact Hours
1.	**Introduction:** Macro-, meso-and microclimate; Population and development; Sustainability and its various dimensions (economic, social and ecological); Sustainable Development; Global Warming and Climate Change	6
2.	**Sustainable Development :** Energy, Earth/Soil , Materials – production and use, Water, Quality of indoor/outdoor environment, Site, transport, urban density and infrastructure – waste and water management, food procurement, farming	8
3.	**Urban climate system:** Ecosystem-atmosphere interactions: underlying principles and measurement (carbon, water, energy, trace-gasses; Energy balances, conduction, convection, radiation, evapo-transpiration, anthropogenic heat production; Urban boundary layer, urban canopy layer; Layer of inversion; Urban roughness and winds, Aerosols and their effect on cloud and precipitation; Urban water balance, Air pollution; Ground level ozone, increased energy demand; Urban Canyon, UHI	10
4.	**Urban Environmental Policies:** Principles of Sustainable Development, policies and regulations, The Stockholm Convention on Persistent Organic Pollutants, Montreal Protocol, Rotterdam Convention, Long-range Transboundary Air Pollution convention, Kyoto Protocol, Climate Policy- IPCC	6
5.	**Adaptation and Mitigation:** Conservation and preservation, Adaptation and Mitigation; Urban green infrastructure, green roof, green alleys; Urban forestry; rainwater harvesting, etc.	8
6.	**Application potential of simulation software:** Simulation tools for assessment of environmental performance ENVI-met, Rayman, IES VE-Pro, etc.;	4
	Total	42

11. Suggested Books:

S. No.	Name of Authors/Books/Publishers	Year of Publication/ Reprint
1.	Oke, T.R., 1987, *Boundary Layer Climates*, Routledge, London	1987
2.	Bonan, G., 2002, *Ecological Climatology*, Cambridge University Press	2002
3.	Ari Miesel, LEED Materials: A Resource Guide to Green Building, Princeton Architectural Press	2010
4.	Deb, S., 'Environmental Management', Jaico Publishing House	2003
5.	Speth, J.G., "The Bridge at the Edge of the World: Capitalism, the Environment, and Crossing from Crisis to Sustainability", Yale University Press	2008

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1. Subject Code   : **DMN-603**   Course Title   : **Disaster Induced Risks**
2. Contact Hours: **L:** 3   **T:** 1   **P:** 0
3. Examination Duration (Hrs.)   :   **Theory:** 3   **Practical:** 0
4. Relative Weight **: CWS** 25 **PRS** 0   **MTE** 25 **ETE** 50 **PRE** 0
5. Credits :   **4**   6. Semester**: Spring**   7. Subject Area**: PEC**   8. Pre-requisite**: Nil**
9. Objective: To develop understanding of both natural and anthropogenic disaster induced risks and impacts on various components of the environment and manmade systems.
10. Details of the Course:

S. No.	Particulars	Contact Hours
1.	**Introduction and scope**: Natural and anthropogenic disasters	2
2.	**Hazards and disasters**: emergencies, disasters and related concepts, nature-society interface, fragmented Vs systems thinking, concept of disaster systematics, simple and compound disasters	6
3.	**Disasters Vs development**: Disaster-development linkages, interaction of socio-economic developmental activities and disasters, development plans incorporating disaster risks; Human Development Index (HDI) Vs Disaster Risk Index (DRI), cross-cutting themes in Disaster-Development interface	6
4.	**Causes and effects of disasters**: Hazards, vulnerability and risk; Risks taxonomy according to hazardous agents such as physical, chemical, and biological agents, natural forces, social-communicative hazards, and synergic (or complex) manmade-systems hazards; Risk patterns at the national and local levels; Disasters and climate change	6
5.	**Risk governance framework**: Risk perception, pre-assessment, appraisal, characterization and evaluation, analysis, assessment, communication, management and governance	4
6.	**Risk assessment**: Hazard identification and estimation, exposure / vulnerability assessment, risk estimation; Risk characterization: Simple risk problems, complexity-induced risk problems, uncertainty-induced risk problems, ambiguity-induced risk problems	6
7.	**Impacts of disasters**: Impacts on the environment, critical infrastructure and socio-economic systems, factors affecting social vulnerability to hazards, short-term and long-term impacts, systemic resilience, emergency response; Disaster recovery and rehabilitation; Lessons learnt for better policies and programs to effectively mitigate and manage future disasters	6
8.	**Present status and future directions in assessment and management of disaster-induced risks and impacts**: Hazard specific risk profiles, risks in urban and rural settings, disaster indicators, disaster risk and impacts in the context of global change and technological advancement, multi-hazard disaster risk and impact modeling; Integrated climate risk management	6
	Total	**42**

11. Suggested Books:

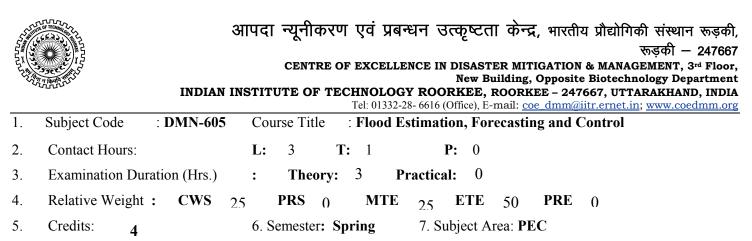| S. No	Name of Authors/Book/Publisher	Year of Publication
1.	Grossi, P. and Kunreuther, H. (eds.) , Catastrophe Modeling: A New Approach to Managing Risk, Springer	2005
2.	Kirschenbaum, Chaos Organization and Disaster Management, Alan Marcel Dekker	2004
3.	MacDaniels T.L. and Small M.J. (eds.)Risk Analysis and Society: An Interdisciplinary Characterization of the Field, Cambridge University Press	2004
4.	Jaeger,C., Renn,O., Rosa, E. and Webler, T., Risk, Uncertainty and Rational Action, Earthscan	2001
5.	WBGU (Wissenschaftlicher Beirat der Bundesregierung Globale Umweltveränderungen), World in Transition: Strategies for Managing Global Environmental Risks, Springer	2000

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1. Subject Code   : **DMN-604**   Course Title   : **Instrumentation and Data Mining Techniques**

2. Contact Hours: **L:** 3   **T:** 2   **P:** 0

3. Examination Duration (Hrs.)   :   **Theory:** 3   **Practical:** 0

4. Relative Weightage**: CWS** 25   **PRS** 0   **MTE** 25 **ETE** 50   **PRE** 0

5. Credits: **4**   6. Semester**: Spring**   7. Subject Area**: PEC**

6. Pre-requisite**: Nil**

7. Objective**:** To impart knowledge of basic principles, methods, and applications of instrumentation, data processing and data mining

8. Details of Course :

Sl. No.	Particulars	Contact Hours
1.	Seismic instrumentation, ground motion measurement, instrumentation of structures	2
2.	Theory of seismic sensors **-** seismographs, strong motion accelerographs, SRRs; Equation of motion, characteristics, calibration and use	4
3.	Sampling theorem, anti-aliasing filter, recording system, networking and data transmission	4
4.	Processing of recorded data, noise, transducer correction, low pass and high pass filters	4
5.	Real time engineering seismology, shake maps, early warning systems	2
6.	Response spectra, Fourier spectra, spectrum compatible time history	4
7.	Introduction to data mining, seismic instrumentation, displacement, velocity, and accelerometers, adjustment and interpretation of recorded data	2
8.	Data preparation for knowledge discovery, data understanding, data cleaning, data transformation, discretization, feature selection	5
9.	Classification and regression **-** Maximum likelihood methods, Bayesian methods, Decision Tree classification; Neural Networks	8
10.	Clustering **-** K-means, hierarchical clustering, self organizing feature maps, principal component analysis	4
11.	Evaluation and visualization **-** Classification with train, test and validation sets, cross-validation, bootstrap, 1,2 and 3 D visualization of data	3
	Total	**42**

11.   **Suggested Books :**

Sl. No	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Stearns S.D., Digital Signal Processing with Examples in MATLAB, Prentice Hall	2003
2.	Hano D., Mamnila H and Synth P., Data Mining, Prentice Hall of India	2004
3.	Newnes , Digital Signal Processing : A Practical Guide for Engineers and Scientists, Elsevier Science	2003
4.	Agarwal P. and Shrikhande M., Earthquake Resistant Design of Structures, Prentice Hall of India	2006
5.	Dunham M.H., Data Mining: Introductory and Advanced Topics, Prentice Hall	2003

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1. Subject Code   : **DMN-605**   Course Title   : **Flood Estimation, Forecasting and Control**

2. Contact Hours: **L:** 3   **T:** 1   **P:** 0

3. Examination Duration (Hrs.)   :   **Theory:** 3   **Practical:** 0

4. Relative Weight **:   CWS** 25   **PRS** 0   **MTE** 25   **ETE** 50   **PRE** 0

5. Credits: **4**   6. Semester**: Spring**   7. Subject Area: **PEC**

8. Pre-requisite**: Nil**

9. Objective : To introduce various methods of flood estimation, forecasting and control.

10. Details of Course **:**

Sl. No.	Particulars	Contact Hours
1.	Understanding floods, rainfall runoff method, Importance and classification of hydrological forecasts, flash floods, coastal floods, flood routing	3
2.	Statistical procedure for flood frequency estimation, flooding due to dam break, flooding due to embankment failure	4
3.	Urban drainage and runoff computations, urban flooding, GIS based inundation maps	3
4.	Damage and loss due to flood, damage survey proforma	2
5.	Statistical and deterministic approaches for flood estimation	4
6.	Data collection and flood forecasting network design, data transmission	4
7.	Physically based models, graphical and statistical models, stochastic models and adaptive filter models, UH and SCS based deterministic models, watershed models, updating	7
8.	Verification and dissemination of forecast; Flood control measures, river training structures, protection measures for flood safe housing	4
9.	River management using remote sensing techniques	2
10.	Concept of flood risk, risk assessment in technological, social and environment context, techniques of risk assessment, application of probabilistic and Markov models in risk estimation	5
11.	Major flood case studies – Kosi flood, simulation of major flood events	4
	Total	**42**

11. Suggested Books **:**

Sl. No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Marcel, M., Flood risk management, Deltares	2010
2.	Schumann, A., Flood Risk Assessment & Management, Springer Publication	2010
3.	Kjeldsen, T. R., Flood Estimation Handbook, Centre of Ecology & Hydrology, Oxfordshire, UK	2007
4.	Pertti H., Giuliano Z., André Van Der B., Hydrological Forecasting and Real-Time Monitoring: The Watershed Simulation and Forecasting System (WSFS), John Wiley & Sons, ISBN: 9780471899884	2007
5.	US Army Corps of Engineer (USACE), Flood Risk Management and the American River Basin: An Evaluation, The National Academies Press	1995
6.	Central Water Commission, Manual on Flood Forecasting	1980

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1. Subject Code : **DMN-606**   Course Title: **Application of Geo-spatial data for Disaster Mitigation**
2. Contact Hours: **L:** 3   **T:** 1   **P:** 0
3. Examination Duration (Hrs.)   :   **Theory:** 3   **Practical:** 0
4. Relative Weight **:**   **CWS** 25   **PRS** 0   **MTE** 25   **ETE** 50   **PRE** 0
5. Credits: **4**   6. Semester**: Spring**   7. Subject Area: **PEC**   8. Pre-requisite**: Nil**
9. Objective **:** To impart knowledge on the use of remote sensing, GIS and GPS tools in various stages of disaster mitigation plans.
10. Details of Course :

Sl. No.	Particulars	Contact Hours
1.	**Meaning and types of disasters**: Manmade and natural – earthquakes, volcanoes, landslides, floods, cyclones, tsunamis, anthropogenic, industrial, chemical and environmental, fire etc. Stages of a disaster mitigation plan- pre-disaster planning, disaster preparedness, monitoring phase, emergency response or damage assessment, recovery and relief phase. Role of remote sensing, GIS and GPS in each stage	5
2.	**Earthquakes**: Causative factors, hazard assessment, selection of factors, creation of thematic data layers, preparation of seismic hazard zonation maps, regional risk assessment, GIS modeling for risk mitigation plans; Case studies	5
3.	**Landslides:** Causative factors, hazard assessment, selection of factors – triggering and non-triggering, creation of thematic data layers, preparation of landslide hazard zonation maps, regional and site specific risk assessments, GIS modeling for risk mitigation plans; Case studies	7
4.	**Cyclones and Flooding:** Cyclone: cyclone related parameters and effects on land and sea – damage assessment. Flooding: causes, identification of factors, space-time integration, GIS data layers, flood prone area demarcation, analysis and management, risk assessment; Case studies	5
5.	**Drought and Desertification:** Types of droughts, factors influencing droughts, identification of variables, development of vegetation index, assessment of land use and ground water level changes, delimiting drought prone areas, processes of desertification, over utilization of water and land resources. GIS data layer creation – GIS based management strategies; Case studies.	5
6.	**Anthropogenic Disasters:** Atmospheric Disasters: Ozone layer depletion, green house / global warming – acid rain – snow melt – sea level rise – related problems. GIS data layer creation; Case studies; Marine Disasters: oil spill and chemical pollution, coastal erosion and deposition, factor identification, GIS analysis, management strategies; Case studies.	5
7.	**Biodiversity Disasters:** Ecological degradation – nuclear disaster and biodiversity loss. Identification of parameters (mapping of forest types, protected areas and natural forests) – population extinction – conserving bio-diversity (species and subspecies). Soil erosion, coral / mangrove depletion, forest fire-mining. Remote sensing and GIS analysis for preparation of ecological degradation maps, erosion maps, deforestation maps etc. GIS in environmental modeling; Case studies.	5
8.	Differential SAR Interferometry for ground displacement estimations due to earthquakes, landslides, subsidences etc. Validation of displacements through differential GPS surveys	5
	Total	**42**

11. Suggested Books **:**

Sl. No.	Name of Authors/Book/Publisher	Year of Publication/Reprint
1.	Demers, M. N., Fundamentals of Geographic Information Systems, John Willey and sons	2000
2.	John A. M., Natural Hazards and Environmental Change, Bill McGuire	2002
3.	Skeil A., Environmental Modeling with GIS and Remote sensing, John Willey and Sons	2002
4.	Bossler, J.D., Manual of Geospatial Science and Technology, Taylor and Francis	2001
5.	Ariyabandu M. and Sahni P.(Eds), Disaster Risk Reduction in South Asia Prentice-Hall	2003

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1. Subject Code   : **DMN-607**   Course Title   : **Vulnerability and Risk Analysis**

2. Contact Hours: **L:**   3   **T:**   1   **P:**   0

3. Examination Duration (Hrs.)   **:**   **Theory:**   3   **Practical:**   0

4. Relative Weight **:**   **CWS**   25   **PRS**   0   **MTE**   25   **ETE**   50   **PRE**   0

5. Credits: **4**   6. Semester**: Spring**   7. Subject Area**: PEC**

8. Pre-requisite**: Nil**

9. Objective: To impart knowledge of basic steps and processes used for vulnerability and risk assessment due to different hazards.

10.   Details of Course:

Sl. No.	Particulars	Contact Hours
1.	Probabilistic and deterministic risk analysis, concept of probability, random variables, probability distribution, functions of random variables, conditional probability, expectation, law of large numbers	8
2.	Point estimation, method of moments, maximum likelihood, extreme value, Baysian statistics, prior and posterior probability, concept of utility and decision tree	8
3.	Poison process, Filtered Poison process, Normal process, Seismic risk analysis with line, area and volume source, Models of mathematical strength, Damage accumulation laws	4
4.	Vulnerability Assessment: Damage statistics and cumulative damage models, analytical and hybrid methods, calibration of models	6
5.	Preparation of exposure database: Sample surveys, sampling techniques, uncertainty analysis, applications of remote sensing and GIS	6
6.	Risk assessment due to various types of structures, deterministic and probabilistic approach, role of planners, architects, engineers, banks and insurers, rating damage assessment; Disaster impact analysis	10
	Total	**42**

11.   **Suggested Books:**

Sl. No	Name of Authors/Book/Publisher	Year of Publication/Reprint
1.	HAZUS-MH, MR1& MR2 Technical Manual, Federal Emergency Management Agency	2006
2.	Robin K., Seismic Hazard and Risk Analysis, Earthquake Engineering Research Institute, McGuire	2004
3.	Coburn, A. and Spence R., Earthquake Protection, John Wiley & Sons	2002
4.	Reiter, L ., Earthquake Hazard Analysis, Issues and Insights, Columbia University Press	2001
5.	Srinivasan, S.K. and Mehta K.M., Probability and Random Processes, Tata McGraw-Hill	1981

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1. Subject Code : **DMN-608** Course Title : **Man-made and Biological Disasters- Detection and Mitigation**
2. Contact Hours: **L:** 3 **T:** 1 **P:** 0

3. Examination Duration (Hrs.) : **Theory: 3 Practical:** 0

4. Relative Weight : **CWS** 25 **PRS** 0 **MTE** 25 **ETE** 50 **PRE** 0

5. Credits: **4** 6. Semester: **Spring** 7. Subject Area: **PEC** 8. Pre-requisite: **Nil**

9. Objective : To impart knowledge on various manmade, biological disasters and various mitigation strategies related to them.

10. Details of Course :

Sl. No.	Particulars	Contact Hours
1.	Bioterrorism – Bioterror agents: Bacterial and viral; Agribioterrorism- introduction of plant and animal diseases	6
2.	Infectious diseases – Infectious agents, mortality due to major bacterial outbreaks, spread of bacterial infections and the never ending fight, pathogens and multiple drug resistance, means of detecting and mitigating bacterial pathogens	8
3.	Viral diseases - Outbreaks and incidences; Viral outbreaks – SARS, Bird flu, Swine flu and HIV, detection and mitigation of viral agents	8
4.	Chemical Emergencies: Pesticides, industrial pollutants, heavy metal contamination.	6
5.	Radiation emergencies : Nuclear radiation leakage, Chernobyl disaster and implications on biological systems , effect on genetic material; Mutations-chromosomal	4
6.	Biotechnology and Biodiversity : Issues of Biodiversity, value of biodiversity; Emergence of Biotechnology; Biotechnology and promises to society; Biotechnology Techniques; Managing the Hazards of Genetic Engineering, regulations and control of biotechnology; Biosafety	10
	Total	**42**

11. Suggested Books:

Sl. No.	Name of Authors/Book/Publisher	Year of Publication / Reprint
1.	Grey M. and Spaeth K., The Bioterrorism Sourcebook, McGraw Hill	2006
2.	Yousef A. K., et.al., Biology, Pathogenicity, Epidemiology, and Biodefense, Wiley-Blackwell	2007
3.	Luther E. L., George Korch, Biological Weapons Defense: Infectious Diseases and Counter bioterrorism, Humana Press	2004
4.	Fong I .W. and Alibek K., Bioterrorism and Infectious Agents: A New Dilemma for the 21st Century, Springer	2009
5.	Hawksworth D.L., Methods and Practice in Biodiversity Conservation, Springer	2009

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1. Subject Code : **DMN-609**   Course Title: **Socio Economic Aspects of Disaster Management**

2. Contact Hours: **L:** 3   **T:** 1   **P:** 0

3. Examination Duration (Hrs.)**:**   **Theory:** 3   **Practical:** 0

4. Relative Weightage**: CWS** 25   **PRS** 0   **MTE** 25   **ETE** 50   **PRE** 0

5. Credits: **4**   6. Semester**: Spring**   7. Subject Area: **PEC**   8. Pre-requisite: **Nil**

9. Objective**:** To focus on the socio economic aspects of disaster management and its impact on the mankind.

10. Details of Course:

Sl. No.	Particulars	Contact Hours
1.	**Introduction to disaster management:** Definition and Introduction to social and economic factors that affect the life of the people. Impact of the disasters on the social and economic fabric of the people living in the disaster prone areas. Assessment of the economic loss and disturbance of emotional stability along with human and material loss and its recoupment. Impact upon future generations living in the disaster prone areas and their preparedness for any such kind of happenings. A collective approach to deal with any kind of disastrous happenings.	**07**
2.	**Emerging approaches in disaster management:** 1. Pre- disaster stage (preparedness) (a) Preparing hazard zonation and maps, Predictability/ forecasting & warning (b) Preparing disaster preparedness plan (c) Land use and zoning (d) Preparedness through (IEC) Information, education & Communication, 2. Emergency Stage (a) Rescue training for search & operations at national & regional level (b) Immediate relief (c) Assessment surveys 3. Post Disaster stage-Rehabilitation.	**12**
3.	**Institutional setup & programmes in India:** Institutions & National Centers for Natural Disaster reduction, Environmental Legislations in India, Awareness, Conservation Movement, Education & training. Voluntary action, voluntary organization and non-government organizations and their role in Disaster Management. Social Action Groups, Advocacy Initiatives, Civil Society Organizations and Social Movements and their role in disaster management.	**08**
4.	**Standardization of the assessment of economic and social aspects:** Standardization of the assessment of economic, social and environmental aspects/losses of disaster management for comparative purposes and for an approach that reflects the reality on the community level. Community-based disaster management. Risk sharing and risk transfer (Insurance). Valuation of losses. Response strategies at National, Regional and community level.	**8**
5.	**Knowledge Management:** Disaster knowledge management at international, national and regional level and strategies of handling disasters. Sharing of disaster handling strategies at all levels. Case studies focusing on socio-economic and technical issues related to disasters about India, China, Indonesia and other Asian countries who have suffered from disasters.	**07**
	Total	**42**

11. Suggested Books :

Sl. No.	Name of Books/Authors	Year of Publication
1	Management: A Global Perspective, Weihrich, H. and Koontz, H., New York, McGraw Hill	2006
2	Disaster Management: A Disaster Managers Handbook, Carter, W.N., Manila, ADB.	2006
3	Mohanty, Ranjita and Prayag Mehta, NGOs and Civil Society, New Delhi: Sanskriti Publications.	2002
4	Siwach, Raj Kumar Voluntary Organizations and Social Welfare, Shanker Publications, Delhi,	2004
5	R.B. Singh (Ed) Disaster Management, Rawat Publication, New Delhi.	2000
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