Syllabus for Ph.D. Course Work
Centre for Disaster Risk Reduction

Overview of the Course Scheme for the Ph.D. programme

As per the university ordinance and new guidelines, the research scholars who are provisionally registered under the Ph.D. programme will have to undergo pre-Ph.D. coursework. The pre-Ph.D. coursework shall have three components. Every student admitted to the Ph.D. programme will have to pass coursework with a minimum of 14 credits. The candidate can submit his/her thesis only after passing the coursework.

1. Component one (Core Courses)

This component will comprise three courses of 10 credits which are general to a Ph.D. programme in the Centre for Disaster Risk Reduction (CDRR), IUST, and every research scholar will have to opt for these courses mandatorily. It will have the following courses;

i. *Research and Publication Ethics*
ii. *Research Methodology*
iii. *Recent Advances in the Subject*

2. Component two (Research Centric)

The course is based on recent developments on the particular research topic assigned to the research student to envisage the recent developments in the available literature.

3. Component three (Discipline-Centric Elective Courses)

This component will comprise a basket of courses belonging to different research fields. Each course will be of 2 credits and out of the available basket of courses; students will have to opt for at least one course that will be mandatory for completion of the Ph.D. coursework.

Course	Course Code	Course Title	Course Type	Max. Marks			Credit Distribution				Credits
				Internal *	Final	Total	L	T	P	S	
Core	RPE	Research and Publication Ethics	Core	25	25	50	2	0	0	0	2
	DRR901C	Research Methodology	Core	50	50	100	3	1	0	0	4
	DRR902C	Advances in Disaster Sciences	Core	50	50	100	3	1	0	0	4
Research Centric	DRR903C	Research Communication	Core	Write-up = 40 Presentation = 40 Viva = 20		100	0	2	0	0	2
Discipline Centric Elective	DRR904E	Seismology & Earthquake Engineering	Elective	25	25	50	2	0	0	0	2
	DRR905E	Flood Risk Management	Elective	25	25	50	2	0	0	0	2
	DRR906E	Landslide Hazard Assessment	Elective	25	25	50	2	0	0	0	2
Total Credits											**14**

*(Midterm 30 marks + Assignment/Attendance 20 marks)

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Paper-I

(Core Course)

Common Course for all Disciplines

Course Code	Course Title	Credits	L	T	P	S	Marks
RPE	**Research and Publication Ethics**	**02 (30 Hours)**	**2**	**0**	**0**	**0**	**50**

Course Contents

UNIT-I:

Part-A: Philosophy and Ethics **(3 Hours)**

1. Introduction to philosophy: definition, nature, scope, concept, branches.
2. Ethics: definition, moral philosophy, nature of moral judgments, and relations.

Part-B: Scientific Conduct **(5 Hours)**

1. Ethics with respect to science and research.
2. Intellectual honesty and research integrity.
3. Scientific misconduct: falsification, fabrication, and plagiarism.
4. Redundant publications: duplicate and overlapping publications, salami slicing.
5. Selective reporting and misrepresentation of data.

UNIT-II:

Publication Ethics **(7 Hours)**

1. Publication ethics: definition, introduction, and importance.
2. Best practices/standards setting initiatives and guidelines: COPE, WAME, etc.
3. Conflicts of interest.
4. Publication misconduct: definition, concept, problems that lead to unethical behaviour and vice versa, types.
5. Violation of publication ethics, authorship, and contributor ship.
6. Identification of publication misconduct, complaints, and appeals.
7. Predatory publishers and journals.

UNIT-III:

Part-A: Open Access Publishing **(4 Hours)**

1. Open access publications and initiatives.
2. SHERPA/RoMEO online resources to check publisher copyright and self-archiving policies.
3. Software tool to identify predatory publications developed by Savitribai Phule Pune University (SPPU).
4. Journal finder/ journal suggestion tools viz., JANE, Elsevier Journal Finder, Springer Journal Suggester, etc.

Part-B: Publication Misconduct **(4 Hours)**

A. Group Discussions (2hrs)

1. Subject-specific ethical issues, fabrication falsification or plagiarism (FFP), authorship.
2. Conflict of interest.
3. Complaints and appeals: examples and fraud from India and abroad.

B. Software Tools (2hrs)

1. Use of plagiarism software like Turnitin, Urkund and other open-source software tools.

Unit-IV:

Part-A: Databases **(4 Hours)**

Indexing databases, Citation databases: Web of Science, Scopus, etc.

Part-B: Research Metrics **(3 Hours)**

Impact Factor of journal as per journal citation report, Source Normalized Impact per Paper (SNIP), Scientific Journal Rankings (SJR), Impact Per Publication (IPP), Cite Score.
Metrics: h-index, g index, i10 index, altimetric.

Suggested Reading Material:

1. Indian National Science Academy (INSA) (2019). Ethics in Science and Education, research and government. ISBN:978-81939482-1-7 http://www.insaindia.res.in/pdf/EthicsBooks. pdf
2. Chaddah, P. (2018). Ethics in competitive Research, do not get scooped; do not get plagiarized, ISBN: 978-9387480865.
3. Beall, J. (2012). Predatory publishers are corrupting open access, Nature, (489 (7415), 179-179, http://doi.org/10.1038/489179a.
4. Resnik, D.B. (2011). What is ethics in research and why it is important, National Institute of Environmental Health Sciences, 1-10, retrieved from, http://niehs.nih.gov/research/resources/bioethics/whatis/index.cfm.
5. National Academy of Sciences, National Academy of Engineering and Institute of Medicine (2009) on being a scientist: guide to Responsible conduct in research: Third Edition, National Academies Press.
6. Bird, A. (2006). Philosophy of Science.
7. MacIntyre, A. (2003). A short history of ethics: a history of moral philosophy from the Homeric age to the 20th Century. Routledge.

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Paper-II

(Core Course)

Course Code	Course Title	Credits	L	T	P	S	Marks
DRR901C	**Research Methodology**	**04 (60 Hours)**	**3**	**1**	**0**	**0**	**100**

Course Contents

Unit-I: Fundamentals of Scientific Research **(15 Hours)**

Scientific research: importance, and its needs. Types of research: descriptive vs. analytical, applied vs. fundamental, quantitative vs. qualitative, conceptual vs empirical. Literature review: primary and secondary sources, preparation of index card, identifying gaps, and science questions, and formulating hypothesis. Research problem: identification, motivation, formulation of research objectives, and execution of a research plan. Art of scientific writing: crafting research papers/ proposals, and thesis.

Unit-II: Data Collection **(15 Hours)**

Types of data: categorical, nominal & ordinal. Primary, and secondary data sources. Methods of data collection: field investigation, experimental observations, reports, historical records, questionnaires, interviews, group discussions, and sensor networks. Fieldwork: selection and training of field investigator, field operation, and administration. Data network, sampling methods, and tools.

Unit-III: Data Processing and Analysis **(15 Hours)**

Software packages for data processing and analysis: Arc GIS and remote sensing for spatial data analysis. R or python for statistical analysis. Data error estimation: root mean square error (RMSE), Standard Deviation, instrument precision, and accuracy. Analysis of variance (ANOVA), covariance (ANOCOVA), correlation, and regression. Hypothesis testing through parametric and non-parametric tests. Pearson's r, Chi-Square, t-Test.

Unit-IV: Data Interpretation and Dissemination **(15 Hours)**

Interdisciplinary approaches for disaster risk reduction. Risk-sensitive land use planning. Components of disaster risk matrix: likelihood, and impact. Tools and techniques for disaster audit. Community-Based Disaster Risk Management (CBDRM).

Books Recommended:

1. Kothari, C.R. & Garg, G. (2019). Research Methodology: Methods and Techniques. 4th Edition. New Age International Publishers, New Delhi.
2. Panneerselvam, R. (2019). Research Methodology, PHI Learning Pvt. Ltd., New Delhi.
3. Gupta, S.P. (2008). Statistical Methods. 37th ed. (Rev), Sultan Chand and Sons. New Delhi, 1470p.
4. Kumar, R. (2005). Research Methodology-A Step-by-Step Guide for Beginners, (2nd ed.).
5. Garg, B.L., Karadia, R., Agarwal, F., & Agarwal, U.K. (2002). An introduction to Research Methodology.
6. Mishra R.P. (2001). Research Methodology, Concept Publishing Company, New Delhi.
7. Robert, A.S. (2001). Methods of Disaster Research, Xlibris Corporation.

Reference Material:

Salatino, D. R. (2019). Fundamentals of a new research method. International journal of research & methodology in social science, 5(1), 53.

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Paper-III

(Core Course)

Course Code	Course Title	Credits	L	T	P	S	Marks
DRR902C	**Advances in the Disaster Sciences**	**04 (60 Hours)**	**3**	**1**	**0**	**0**	**100**

Course Contents

Unit-I: Current Issues **(15 Hours)**

Governance and policy. Local, national, and global legislation for DRR. National policy and Plan. Disaster Management Act. Disaster Management Authorities: NDMA, SDMA, NDRF, etc. Yokohama Declaration, Hyogo Framework for Action, Sendai framework for DRR and its mid-term review. Framework for integrating climate change adaptation into DRR. Community awareness, education, and training programs. Disaster research, and mitigation funding, resources, and risk transfer.

Unit-II: Advances in Disaster Risk Reduction (DRR) **(15 Hours)**

Hazards and its classification – Geological (Earthquakes, and Landslides), Hydro-meteorological (Floods, Glacier Lake Outburst Floods, Droughts, and Snow Avalanches, Climatological (long-term climate variability), etc. Various strategies in DRR. Vulnerability-types and assessment. Role of Early Warning System (EWS) in DRR. Critical infrastructure and resilience.

Unit-III: Technological Innovations in DRR **(15 Hours)**

Applications of Geographic Information System (GIS) and remote sensing in DRR. Mobile technology for real-time disaster information dissemination. Utilization of drones for disaster assessment and relief operations. Artificial Intelligence (AI), and Machine Learning (ML) in DRR. Global Positioning System (GPS) Navigation.

Unit-IV: Disaster Vulnerability and Risk Assessment **(15 Hours)**

Vulnerability assessment models: Social Vulnerability Index (SoVI), Climate Vulnerability Index (CVI), and Community-Based Risk Assessment (CBRA). Disaster Risk Index (DRI), and Disaster Environmental Matrix (DEM). Multi-hazard disaster mitigation plans. Decision Support Systems (DSS). Development of disaster risk assessment, management & response plans at community levels.

Books Recommended:

1. Longley, P.A. (2010). Geographic Information Systems and Sciences, John Wiley & Sons Ltd, 536p.
2. Skidmore, A. (2008). Environmental Modelling with GIS and Remote Sensing, Taylor & Francis.
3. Keller, E.A., & Blodgett, R.H. (2008). Natural hazards. Pearson Prentice Hall. 488p.
4. Schowengerdt, R.A. (2007). Remote Sensing: Models and Methods for Image Processing.
5. Goel. S.L. (2006). Encyclopaedia of Disaster Management. Deep & Deep Publication pvt. Ltd.
6. Edwards, B. (2005). Natural Hazard. Cambridge University Press, UK.
7. Goodchild, M.F. (2005). GIS, principles, techniques, management & applications. John Wiley Sons.
8. Barthwal R.R. (2002). Environmental Impact Assessment. New Age International Publisher, 354 p.
9. Stallings, R.A. (2001). Methods of Disaster Research, Xlibris Corporation, 528p.

Reference Material:

1. Izumi, T., Shaw, R., Djalante, R., Ishiwatari, M., & Komino, T. (2019). Disaster risk reduction and innovations. Progress in Disaster Science, 2, 100033.

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Paper-IV

(Research Centric Course)

Course Code	Course Title	Credits	L	T	P	S	Marks
DRR903C	**Research Communication**	**02 (30 Hours)**	**0**	**2**	**0**	**0**	**100**

Course Contents

Review of published literature **(40 Marks)**

Preparation of a comprehensive and critical review of the published literature in the proposed field of study and the same may be submitted to a refereed/reputed journal as notified by UGC. Also, development of a detailed research proposal related to the chosen research topic.

Presentation/Group discussion **(40 Marks)**

Weekly presentation/group discussion on the chosen topic providing formative feedback on the aims and objectives of the proposed research problem.

Final Evaluation **(20 Marks)**

The candidate will be evaluated by the DRC) based on a comprehensive report submission, weekly presentation/group discussion, and a final seminar to be delivered at the end of the Ph.D. Course work semester.

Marks Distribution:

- Write-up = 40 Marks
- Presentation = 40 Marks
- Viva = 20 Marks

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Paper-V
(Discipline Centric Elective (E) Course)

Course Code	Course Title	Credits	L	T	P	S	Marks
DRR904E	**Seismology & Earthquake Engineering**	**02 (30 Hours)**	**2**	**0**	**0**	**0**	**50**

Course objective:

- To understand the fundamental mechanisms of earthquakes, including faulting, plate tectonics, and rupture dynamics, with a focus on historical and recent case studies.
- To explore seismic hazard assessment, earthquake engineering principles, and mitigation strategies, including earthquake-resistant designs and retrofitting techniques.

Course outcome:

- Students will gain an understanding of earthquake mechanisms, historical seismicity, and the impacts of significant earthquakes, enabling informed hazard analysis.
- Students will develop skills to assess seismic risks, propose mitigation strategies, and apply engineering solutions for building resilience against earthquakes.

Course Contents

Unit-I: Earthquake Mechanism **(15 Hours)**

Earthquake Basic Terminology. Earthquake types and mechanism; faults, and plate tectonics. Stress, and strain in the Earth's crust. Active tectonics, faulting, and slip rates. Paleo-seismology, and prehistoric earthquake dating. Earthquake cycle and rupture dynamics. Case studies of some devastating earthquakes in the recent past: 2004 Japan Earthquake, 2005 Kashmir Earthquake, 2015 Nepal Earthquake, & 2024 Turkey Earthquakes. Historical Background of Earthquakes in Jammu and Kashmir.

Unit-II: Earthquake Engineering **(15 Hours)**

Seismicity of the northwest Himalaya, and seismic hazard assessment. Seismic shaking, liquefaction-induced features, liquefaction susceptibility. Seismically induced landslides, Glacial Lake Outburst Floods (GLOFs), and snow avalanches. Earthquake prediction, micro-seismic zonation, and early warning systems. Earthquake engineering: earthquake-resistant structures, and retrofitting of existing structures. Traditional Construction Practices.

Books Recommended:

1. Shearer, P.M. (2019). Introduction to Seismology. Cambridge University Press.
2. Burbank, D.W., & Anderson, R.S. (2013). Tectonic geomorphology. John Wiley & Sons.
3. Dowrick, D.J. (2009). Earthquake Resistant Design and Risk Reduction. Wiley.
4. Stein, S., & Wysession, M. (2003). An Introduction to Seismology, Earthquakes, and Earth Structure. Blackwell Publishing.
5. Lee, W.H.K., Kanamori, H., Jennings, P.C., & Kisslinger, C. (2003). International Handbook of Earthquake and Engineering Seismology. Academic Press.
6. Scholz, C.H. (2002). The Mechanics of Earthquakes and Faulting. Cambridge University Press.
7. Keller, E.A., & Pinter, N. (1996). Active tectonics (Vol. 338). Upper Saddle River, NJ: Prentice Hall.
8. Reiter, L. (1990). Earthquake Hazard Analysis: Issues and Insights. Columbia University Press.

Reference Material:

1. McCalpin, J.P., & Nelson, A.R. (2009). Introduction to paleoseismology. International Geophysics, 95, 1-27. https://doi.org/10.1016/S0074-6142(09)95001-X.

Paper-VI

(Discipline Centric Elective (E) Course)

Course Code	Course Title	Credits	L	T	P	S	Marks
DRR905E	**Flood Risk Management**	**02 (30 Hours)**	**2**	**0**	**0**	**0**	**50**

Course objective:

- To provide a comprehensive understanding of flood types, causes, hydrodynamics, and their impacts, with a focus on flood vulnerability and water management.
- To train students in flood risk mapping, mitigation strategies, and the application of structural and non-structural measures for flood hazard reduction.

Course outcome:

- students will develop the ability to analyse flood causes and impacts, apply hydrological concepts, and assess vulnerability using historical and contemporary case studies.
- students will gain expertise in geospatial applications, engineering solutions, and policy-driven approaches to flood risk management, contributing to sustainable urban planning and infrastructure resilience.

Course Contents

Unit-I: Introduction to Floods **(15 Hours)**

Floods, types, and their causes: rainfall-runoff processes, topography, gradient, lithology, and climate. River hydrodynamics. Urban hydrology and flooding. Flash floods – climate change, precipitation extremes, dam or levee failure. Flood frequency analysis. Urban planning. Vulnerability of Kashmir to Floods- causes and consequences. Water management. Historical perspective of significant flood events. Case study of Kashmir 2014 flood.

Unit-II: Flood Hazard Impacts & Risk Reduction **(15 Hours)**

Physical, socio-economic, and environmental impacts of floods. Application of geospatial technology in flood risk mapping. Engineering solutions of flooding: structural measures (dams, levees, floodwalls), and non-structural measures (land-use planning, flood forecasting). Interdisciplinary approaches for flood risk reduction. Smart cities and management of river channels. International frameworks and policies. Implications of flooding on infrastructure e.g., hospitals, schools, airports, hotels, shopping malls.

Books Recommended:

1. Hegger, D.L.T., Driessen, P.P.J., & Bakker, M.H.N. (2016). Flood Risk Management in Europe: Innovation in Policy and Practice. Springer.
2. Wisner, B., Gaillard, J.C., & Kelman, I. (2012). Handbook of Hazards and Disaster Risk Reduction and Management. Routledge.
3. Beven, K. (2012). Rainfall-Runoff Modelling: The Primer. Wiley.
4. Smith, K., & Ward, R. (1998). Floods: Physical Processes and Human Impacts. Wiley.
5. Penning-Rowsell, E., & Fordham, M. (1994). Floods Across Europe: Flood Hazard Assessment, Modelling, and Management. Middlesex University Press.

Reference Material:

1. Plate, E.J. (2002). Flood Risk and Flood Management. Journal of Hydrology.
2. Romshoo, S. A., et. Al., (2018). Climatic, geomorphic and anthropogenic drivers of the 2014 extreme flooding in the Jhelum basin of Kashmir, India. Geomatics, Natural Hazards and Risk, 9(1), 224-248.

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Paper-VII

(Discipline Centric Elective (E) Course)

Course Code	Course Title	Credits	L	T	P	S	Marks
DRR906E	**Landslide Hazard Assessment**	**02 (30 Hours)**	**2**	**0**	**0**	**0**	**50**

Course objective:

- To provide an in-depth understanding of landslide processes, classification, dynamics, and impacts, while introducing slope stability concepts and analysis.
- To train students in advanced techniques for landslide hazard and risk assessment, including remote sensing, GIS, and monitoring methods.

Course outcome:

- Students will be able to identify, analyse, and classify landslides, assess their socio-economic and environmental impacts, and apply slope stability principles.
- Students will acquire the skills to develop hazard maps, implement monitoring techniques, and propose effective mitigation measures for landslide-prone areas.

Course Contents

Unit-I: Introduction to Landslides **(15 Hours)**

Landslides: Classification, causes and triggering factors (geological, hydrological, etc). Mass movement dynamics and types of failures (rotational, translational, and flow). Slope stability concepts and analysis (shear strength, and pore water pressure). Socio-economic and environmental impacts of landslides.

Unit-II: Landslide Risk Assessment **(15 Hours)**

Techniques for hazard mapping: Experimental, statistical, and deterministic approaches. Use of remote sensing and GIS in landslide susceptibility mapping. Quantitative and qualitative methods of risk assessment. Structural and non-structural mitigation measures. Landslide early warning systems and monitoring networks. Monitoring techniques for landslide-prone areas (Ground-based monitoring and remote sensing techniques; LiDAR, SAR Interferometry).

Books Recommended:

1. Hungr, O. (2018). A review of landslide hazard and risk assessment methodology. Landslides and engineered slopes. Experience, theory and practice, 3-27.
2. Glade, T., Anderson, M.G., & Crozier, M.J. (Eds.). (2005). Landslide hazard and risk (Vol. 807). Chichester: Wiley.
3. Abramson, L.W., Lee, T.S., Sharma, S., & Boyce, G.M. (2001). Slope stability and stabilization methods. John Wiley & Sons.
4. Martinsen, O. (1994). Mass movements. In The geological deformation of sediments (pp. 127-165). Dordrecht: Springer Netherlands.

Reference Material:

1. Dai, F. C., Lee, C. F., & Ngai, Y. Y. (2002). Landslide risk assessment and management: an overview. Engineering geology, 64(1), 65-87.