KERALA UNIVERSITY OF FISHERIES AND OCEAN STUDIES

Panangad, Kochi- 682506, Kerala

M.Sc. Disaster Management

Syllabus

2024

M.Sc. Disaster Management

INTRODUCTION

Disaster Management is a strategy for avoiding, reducing, managing and overcoming any type of catastrophic event that threatens humans and the environment. It is of utmost importance to identify potential disasters, man-made or natural and to create contingency plans and procedures to be initiated whenever disaster strikes. This course provides information on natural and human-induced disasters and their impact on societies worldwide. The student will be exposed to various concepts of disaster management and understand the interaction of earth system with the human system.

OBJECTIVES

The course offers a thorough knowledge on the Atmospheric & Hydrological Disasters (Heat& Cold waves, Lightning, Flood, Drought, Cyclones, and Avalanches), Geologically Related Disasters (Earthquake, Tsunami, Landslides, and Volcanic Eruption) as well as Issues & Challenges, Warning, Preparedness, Mitigation& Response measures, Case Studies etc. As for Environmental Disasters, the important aspects like the Environmental Impact Assessment, Wetland conservation & Restoration, Quarrying, Solid waste & E-Waste Management – Issues, Challenges & Remedial Measures, Rules & Regulations, Alternative Technologies etc., are dealt in detail. The course covers Tourism & Environment, Environmental Acts and Policies in India. Air, Water & Land Pollution, Climate Change and its Impacts, Integrated Coastal Zone Management, Urban Risks & Management, Biologically Related Disasters -Disaster Mitigation and Management form some of the core parts. Man-made disasters like Chemical, Industrial & Nuclear related disasters, Road, Rail, Boat & Air Accidents, Reservoir Induced Seismicity, Dam Failure –Causes, Mitigation and Management measures etc. are covered in detail. The students will have to carry out a Project Work in their final semester in any reputed institute related to Disaster Management to complete the program.

SCOPE

Disaster Management is a field that offers a chance to serve the nation and humanity at large while also presenting a good scope for making a career and earning a good salary. Moreover, with the recent emergency conditions surfacing in the world such as Coronavirus outbreak and the climate change related events/disasters, the importance and requirements of Disaster Management professionals may rise in future. In India, the scope of this discipline is high because there are many weak/susceptible regions where the need for better Disaster Management is still at the peak.

ELIGIBILITY

Bachelor's Degree in Science or B.Tech/BE Degree of any discipline with 50%marks or equivalent OGPA.

ASSESSMENT AND STANDARDS OF PASSING

The evaluation of the students in a course shall be based on his/her performance in various examinations, assignments, seminars, records, project reports etc. Assessment will be based on both internal and external evaluation.

NO OF SEATS: 15

MODE OF SELECTION

Through common entrance examination conducted by KUFOS.

PROGRAM SPECIFIC OUTCOMES (PSO)

PSO1. To equip students with a solid foundation in disaster management principles, including risk assessment, response strategies, and recovery planning.

PSO2. To develop a cadre of professionals with multidisciplinary expertise and essential skills, empowering them to apply their knowledge effectively in complex disaster scenarios.

PSO3. To provide specialized expertise to government and administrative bodies, enhancing their capacity to effectively manage disaster preparedness, response, and recovery efforts.

PSO4. To foster safe and sustainable communities through capacity-building initiatives that strengthen resilience and preparedness against disasters.

PSO5. To instill core values of social responsibility, ethical practice, and community engagement while promoting research initiatives that enhance the knowledge base in disaster studies.

EMPLOYMENT OPPORTUNITIES

There are good employment opportunities in disaster management in government as well as in private organizations. The work profile varies like teaching, research, consultancy, documentation, training organizer, field training and mock driller expert. Names of some organizations having likely employment opportunities include National Institute of Disaster Management (NIDM), New Delhi, State Disaster Management Authorities, District Disaster Management Authorities, United Nations Development Programme (UNDP), United Nations Environment Programme (UNEP), Indian Red Cross Society, States Revenue and Disaster Management Department, Indian and International level Non-Governmental Organizations (NGO) working in the field of Disasters Management, Faculty and research positions in universities/institutes and in foreign countries.

KERALA UNIVERSITY OF FISHERIES & OCEAN SCIENCES
M.Sc. DISASTER MANAGEMENT
Credit & Semester System
SCHEME OF EXAMINATION

SEMESTER – I

Sl. No	COURSE CODE	COURSE TITLE	L	P	C	Internal Marks	External Marks
1	DM2101	Fundamentals of Geology	4	0	3	50	50
2	DM2102	Geophysics	4	0	3	50	50
3	DM2103	Meteorology and Oceanography	4	0	3	50	50
4	DM2104	Fundamentals of Disaster management	4	0	4	50	50
5	DM2105	Disaster Management Laws and Policies	4	0	4	50	50
6	DM2106	Natural Hazards	4	0	4	50	50
7	DM2107	Practical	0	6	3	50	50
		TOTAL			24		

SEMESTER – II

Sl. No	COURSE CODE	COURSE TITLE	L	P	C	Internal Marks	External Marks
1	DM2201	Marine and Atmospheric Hazards	4	0	3	50	50
2	DM2202	Anthropogenic Hazards	4	0	3	50	50
3	DM2203	Disaster Monitoring and Data Acquisition (E)	4	0	4	50	50
4	DM2204	Geo-technology in Disaster management (E)	4	0	4	50	50
5	DM2205	Modeling of disasters, early Warning strategy and communication network	4	0	4	50	50
6	DM2206	Chemical, Radiological and Biological hazards	4	0	3		
7	DM2207	Practical	0	6	3	50	50
		TOTAL			24		

SEMESTER – III

Sl. No	COURSE CODE	COURSE TITLE	L	P	C	Internal Marks	External Marks
1	DM2301	Climate change and environmental impact due to disaster events	4	0	4	50	50
2	DM2302	Geospatial technologies in Disaster Management	4	0	4	50	50
3	DM2303	Preparedness, Vulnerability and Risk Assessment of Disasters	4	0	4	50	50
4	DM2304	Rehabilitation and mitigation issues and Management of Resources	4	0	3	50	50
5	DM2305	Relevance of Actuarial Science and Public Sanitation and Health care in Disaster Management (E)	4	0	3	50	50
6	DM2306	Socio-psychological issues and Community Participation Disasters management	4	0	3	50	50
7	DM2307	Fire and safety (E)	4	0	3	50	50
8	DM 2308	Practical	0	6	3	50	50

Sl. No	COURSE CODE	COURSE TITLE	L	P	C	Internal Marks	External Marks
		TOTAL			**24**		

SEMESTER – IV

Sl. No	COURSE CODE	COURSE TITLE	L	P	C	Internal Marks	External Marks
1	DM2401	Project work and Viva voce	0	26	22	50	50
		TOTAL			**22**		

Total Credits = 94

Conditions

1. 15-21 days must be a field work as a part of practical during I & II semesters
2. Fire and Safety is brought into III semester.
3. The project oriented dissertation is alone kept in IV semester with 22 credits, having 540 hours.
4. All the papers have been assigned with five units uniformly keeping in mind the guidelines of the UGC and KUFOS so as to meet the perception of employment and research opportunity.
5. The teaching faculty may be pooled up from the allied departments since it is a multidisciplinary course and can be outsourced wherever it is essential.
6. The University should appoint Faculty members as per UGC norms with the specialization on Geology/Geophysics/Physical Oceanography/Disaster management/Earth and Atmospheric sciences.

SEMESTER – I

DM2101 Fundamentals of Geology

Course Outcomes

CO	EXPECTED COURSE OUTCOME	LEARNING DOMAINS	PSO
CO1	List the origin, structure, and various rock types of the Earth.	R	1
CO2	Describe the processes of weathering and their impact on landforms and soil development.	U	1,2
CO3	Explain geological mapping and measurement techniques using clinometers and Brunton compasses.	Ap	2,3
CO4	Classify the components of the hydrological cycle and explain their role in water resource management.	An	3,4
CO5	Summarize oceanic structures, currents, and sediment transport, and assess their impact on coastal environments.	E	4,5

UNIT I

Introduction: Earth system-Origin of the Earth - Shape, size and structural composition - Rock types: Rock as an aggregate of minerals-Igneous-Sedimentary and Metamorphic rocks-Structure and textures and classification of these rocks- Associated landscapes- Distribution of geological formations of India-importance in relation to water bearing characteristics.

UNIT II

Weathering - Process: Types-mechanical weathering-Chemical weathering-Factors affecting weathering-Weathering of Granite and Basalt- Karst topography-Coastal landforms-Mass wasting-Landslide- Soils-Formation-Types-Factors affecting soil formation-Soil profile and constituents.

UNIT III

Rocks: Introduction-Rock as layers (beds), Rocks attitude-Use of clinometer and Brunton compass. Geologic structures: Folds – Faults – Lineaments –Dykes –Joints - Unconformities: Nomenclature-Classification-recognition. Geomorphology: Geomorphic processes - Endogenic and Exogenic forces - Work of river - Work of wind and waves - Glaciers, Underground water –Erosion-Transportation and Deposition.

UNIT IV

Hydrological cycle: Precipitation- Evapotranspiration- Runoff –Seepage –Aquifer – Groundwater -Seasonal and Regional fluctuations- Water balance -Drainage basin characteristics-Recharge process-Water resource management and conservation.

UNIT V

Ocean: Structures - Relief and Continental shelf- Temperature-Salinity-Distribution-Surface Currents -Sediment Transport-Tides-Factors influencing ocean processes-Ocean resources-types-distribution

REFERENCE
1. Patwardhan, The Dynamic Earth System, Prince Hall Inc.
2. H.J. De Blij and Peter O. Muller "Physical Geography of the Global Environment", John Willey & Sons, New York. 1993
3. Howard J. Critchfield "General Climatology" 4th Ed, Prentice Hall of India, New Delhi, 1997
4. John E. Oliver and John J. Hidore, "Climatology: An Atmospheric Science", Pearson Education India
5. Philip Lake "Physical Geography" The Macmillan Co. of India Ltd., New Delhi, 1974
6. Sharma and Vittal "Oceanography - A view of the Earth", Prentice Hall, New Jersey, USA, 1972
7. Tom Garrison, "Essentials of Oceanography" 9th Ed, Cengage Learning, Brooks/Cole,USA, 2012. ISBN: 978-0-8400-6155-3
8. William D. Thornbury "Principles of Geomorphology" New Age International Publishers, New Delhi, 1996

9. John M. Wallace and Peter V. Hobbs "Atmospheric Science, Second Edition: An Introductory Survey (International Geophysics)", 2nd Ed, Academic Press, 2006. ISBN-13: 978-0127329512
10. James R. Holton and Gregory J Hakim "An Introduction to Dynamic Meteorology" 5th Ed, 2012. ISBN-13: 978-0123848666

DM2102 Geophysics

Course Outcomes

CO	EXPECTED COURSE OUTCOME	LEARNING DOMAINS	PSO
CO1	List the physical properties of earth materials and the basic concepts of seismic methods.	R	1
CO2	Explain the fundamental principles of the gravity method and its application in geophysical exploration.	U	2
CO3	Classify magnetic properties of rocks and describe the geomagnetic field and magnetic anomalies.	An	1
CO4	Summarize the principles of radioactivity in the Earth and explain methods of dating geological samples	E	3
CO5	Analyze the principles of electromagnetic methods and interpret data from MT and TEM geophysical surveys.	An	4

UNIT I
Introduction: Physical properties of earth materials. Active and passive methods, Basic Concepts of the Exploration Seismic Method: Stress and strain; Young's modulus, shear and bulk modules; Poisson's ratio; P and S waves; surface waves; seismic velocity; acoustic impedance; Snell's law ; wave fronts; ray paths; reflection and transmission coefficients; elastic constants.

UNIT II
The gravity Method-Basic Theory Newton's Law of universal gravitation; acceleration and potential; units of acceleration; calculation of acceleration due to a spherical shell and to a solid sphere; concepts of density contrast; density of earth materials. The Gravity Method-instrumentation Sensitivity requirements for gravity measurements, stable and unstable gravity meters, Worden, and Lacoste & Romberg gravimeters.

UNIT III
Magnetic Method – Magnetic force; magnetic field strength; magnetic moment; intensity of magnetization; magnetic susceptibility. Magnetic Properties of Rocks; Classification of rocks on basis of susceptibility, para-magnetism, diamagnetism, ferromagnetism. The Geomagnetic

Field, Intensity at a point due to a magnetic dipole; geomagnetic elements; magnetic anomalies.

UNIT IV
Radioactivity of the Earth: Radioactive elements in the earth; theory of radioactive decay; simple decay scheme; the Rubidium-Strontium dating method; the Potassium-Argon dating method; and the Uranium-Lead dating scheme. The Earth's Internal Heat mechanisms of heat transfer; Fourier's law of heat conduction; heat transport in the earth; continental and oceanic heat flows; heat generation by radioactive isotopes.

UNIT V
Principles of electromagnetic method - Vertical loop (VLEM) - Horizontal loop - (HLEM) – Very Low Frequency (VLF) - Audio Frequency Magnetics (AFMAG) - Time Domain systems - Terrain Conductivity. Magneto Telluric (MT) and Transient Electromagnetic (TEM) methods of geophysical exploration. MT theory, origin of the MT and telluric fields. Processing and interpretation of MT and TEM data.

REFERENCES

1. Keller, G.V. Electrical Methods in Geophysical Prospecting, Frischnett, Pergamon
2. Patra, H.P. and Mallick, K. Principles of Geoelectric Soundings
3. Telford, W. K and Geldart, L.P., Sheriff, R. F and Keys D.A Applied Geophysics Cambridge University Press
4. M. E. Best, Geological Association of Canada (1992)Resistivity mapping and electromagnetic imaging, Geological Association of Canada
5. Mikhail Semenovich Zhdanov, George Vernon Keller (1994) The geoelectrical methods in geophysical exploration, Elsevier
6. John D. Corbett (1991)Electromagnetic Methods in Applied Geophysics, Society of Exploration Geophysicists
7. Stanislav Mares et al., (1984) Introduction to Applied Geophysics, D. REidel Publishing Company, Dordrecht/Bostont
8. Telford, W.M., Goldart, L.P., Sheriff, R.E. and Keys, D.A., (1981) Applied Geophysics, Cambridge University Press, Cambridge.

DM2103 Meteorology and Oceanography

Course Outcomes

CO	EXPECTED COURSE OUTCOME	LEARNING DOMAINS	PSO
CO1	List the structure and composition of the atmosphere and explain the principles of weather forecasting.	R, U	1,2
CO2	Describe physical properties of marine waters and explain oceanic circulation patterns and their dynamics.	u	2,3
CO3	Analyze chemical properties of seawater and summarize the significance of ocean resources and pollution.	An	3,5
CO4	Classify marine environments and describe the biological components of oceanography, focusing on plankton.	U, C	2,4

| CO5 | Evaluate the impact of marine pollution and explain treatment methods for pollutants affecting marine life. | E | 3,5 |

UNIT 1

Atmosphere: Structure and Composition-Insolation-Radiation-Horizontal and Vertical distribution of temperature-Wind and Pressure System-Cyclone and anticyclone-Types-Formation. Monsoon- Clouds and Types-Characteristics-Precipitation-Climatic classifications-Weather information and forecasting

UNIT II

Physical Oceanography: Physical properties of marine waters; temperature, density, optics. Waves-generation, shoreline transformation energy. Currents-Wave generated, thermo-haline, turbidity currents (gravity), large-scale (gyres) oceanic circulation, Coriolis forces upwelling. Dimensions of Oceans. Thermal and optical properties of seawater. Water masses. Currents: General characteristics, effects of fields of pressure, gravity and mass. Relative currents, wind currents, upwelling and sinking. Tides: tide-producing forces and tide characteristics. Circulation patterns and currents in the Indian Ocean. Major currents of the world oceans.

UNIT III

Chemical Oceanography: Water and Salts in the Sea, Major Constituents, Simple Gases & CO_2 System, Marine CO_2 System, Trace Elements, Nutrients, Sediment geochemistry, Dissolved and Particulate Carbon, Radioactive & Stable Isotopes, Organic Molecules, Organics & Marine Pollution, Anoxic Environments, Exchange at Boundaries, Ocean Resources, Geochemical History

UNIT IV

Biological Oceanography: The sea as a Biological environment: classification of marine environment; general characters of the populations of the primary biotic divisions (plankton, nekton and benthos). Introduction of plankton; general classification and composition of plankton; floating mechanism of plankton. Collection of plankton; general account of instruments and nets employed; methods of fixation and preservation of plankton; analysis of samples, methods of estimating standing crop of plankton. Plankton in relation to fisheries; general account. Distribution of plankton in space and time; horizontal distribution; neritic and oceanic plankton; geographical distribution; indicator species. Distribution of plankton, vertical migration; seasonal changes in plankton.

UNIT V

Marine Pollution: Definition by GESAMP, major sources of pollution, dynamics, transport paths and agents. Toxicology: Lethal and sub lethal effects of pollutants on marine organisms, evaluation of toxicity tolerance, bioassay. Enzymatic removal of hazardous organic substances from aqueous effluents. Sewage: composition and fate in the marine environment, toxicity and treatment methods, sewage disposal system. Environmental Impact Assessment Methods of aquaculture activities. Oil pollution: Sources and fate of oil, composition and toxicity of oil, biological effects treatment procedures. Thermal and radioactive pollutants: Source and characteristics, strategies for disposal of RNA and Heated effluents, biological effects and alternative uses of waste dumping, mining and dredging operations, their effects on the organisms and marine environment.

REFERENCES

1. Svedrup H.U, Johnson, M.W. & R.H. Fleming (1942)The Oceans, Prentice Hall,
2. Tait, R.V (1972) Elements of Marine Ecology, 2nd edition, Butterworths
3. Pickard. G.L (1963) Descriptive physical – Oceanography, Pergamon Press,
4. King, C.A.H., (1975) Introduction to Physical and Biological oceanography, ELBS Ltd., London
5. Angel, M.V (1975) Biological Oceanography, Methuen
6. Nair, N.B. & D.M. Thampy (1980) A text book of Marine Biology, Macmillan
7. Ryamont, J.E.G., (1980) Plankton and productivity in Oceans. Vel. 1: Phytoplankton, Vol.II, Zooplankton, Pergamon Press
8. Parsons, T.R. Takahashi, M. and B. Hargrave (1977) Biological Oceanographic processes, Pergamon
9. Broecker W.S.2nd edition, (1974) Chemical Oceanography. Harcout Brace, Jovanovich,
10. Riley O.P. & G.S.Skirrow (1975) Chemical Oceanography, 2nd edition, Vols. I-IV, Ademic Press,
11. A.M.Chakravarthy (1928) Biodegradation and detoxification of Environmental pollutants, CRC Press,
12. O.Kinne: (1984) Marine Ecology, Vol.V.Ocean Management 3&4, John Wiley & Sons,
13. Johnston R. (Ed.) : (1976).Marine Pollution, Academic Press
14. Patin. S.A (1982) Pollution and Biological resources of the Oceans Butterworth & Co. Ltd.
15. Venugopalan, V.K. (1991) Pollution and Toxicology, CAS in Marine Biology
16. Hilary B. Moore (1958) Marine Ecology, John Wiley & Sons

DM2104 Fundamentals of Disaster Management

Course Outcomes

CO	EXPECTED COURSE OUTCOME	LEARNING DOMAINS	PSO
CO1	Define disaster and explain the differences between hazards and disasters, including natural and man-made types.	R, U	1, 5
CO2	Analyze the consequences of disasters, including economic damage and ecological destruction.	An	2, 3
CO3	Describe the historical context and types of natural disasters, including earthquakes, floods, and tsunamis.	U	1, 4
CO4	Summarize the impacts of man-made disasters, such as industrial accidents and disease outbreaks, on society and the environment.	U	2, 5
CO5	Assess disaster-prone areas in India and evaluate the potential for post-disaster diseases and epidemics in those regions.	E	1, 3

Unit I: Introduction
Disaster: Definition, Factors and Significance; Difference between Hazard and Disaster; Natural and Manmade Disasters: Difference, Nature, Types and Magnitude.

Unit II: Consequences of Disasters
Repercussions of Disasters and Hazards: Economic Damage, Loss of Human and Animal Life, Destruction of Ecosystem.

Unit III: Global Perspective (Natural Disasters)
Study of Environmental Impacts Induced By Human Activity; History of Disasters and Types of Hazards: Earthquakes, Volcanisms, Cyclones, Tsunamis, Floods, Droughts and Famines, Landslides and Avalanches.

Unit IV: Global Perspective (Man-Made Disasters)
Nuclear Reactor Meltdown, Industrial Accidents, Oil Slicks and Spills, Outbreaks of Disease and Epidemics, War and Conflicts.

Unit V: Disaster Prone Areas in India
Study of Seismic Zones; Areas Prone To Floods and Droughts, Landslides and Avalanches; Areas Prone To Cyclonic and Coastal Hazards with Special Reference to Tsunami; Post-Disaster Diseases and Epidemics. Types of News Media, Structure and Trends, News Media during Crisis, Impact of Media on Policy.

Books Recommended
1. Bryant Edwards (2005): Natural Hazards, Cambridge University Press, U.K.
2. Carter, W. Nick, 1991: Disaster Management, Asian Development Bank, Manila.
3. Central Water Commission, 1987, Flood Atlas of India, CWC, New Delhi.
4. Central Water Commission, 1989, Manual of Flood Forecasting, New Delhi.
5. Government of India, 1997, Vulnerability Atlas of India, New Delhi.
6. Sahni, Pardeep Et.Al. (Eds.) 2002, Disaster Mitigation Experiences and Reflections. Prentice Hall of India, New Delhi.
7. R. Nishith, Singh AK 2012 Disaster Management in India: Perspectives, issues and strategies New Royal book Company, Lucknow
8. Sharma, Kadambari C, Avina 2010 Disaster Management in India Jnanada Prakashan [P&D], New Delhi
9. Mishra A 2012 New Dimensions of Disaster Management in India: Perspectives Approaches and Strategies (Set of 2 Vol) Serials publications, New Delhi
10. Dagur OS Disaster Management: An Appraisal of Institutional Mechanisms in India Center for Land Welfare Studies.

DM2105 Disaster Management Laws and Policies

Course Outcomes

CO	EXPECTED COURSE OUTCOME	LEARNING DOMAINS	PSO
CO1	Describe the key components of the Indian Constitution and their relevance to disaster management, including fundamental rights and duties.	R, U	1,3
CO2	Explain disaster management concepts and the disaster management cycle, including relevant laws and policies for prevention and response.	U	2,5
CO3	Analyze the legal issues related to disaster law and policy, focusing on health, safety, and environmental protection laws.	An	1,2
CO4	Evaluate the legal framework for disaster management in India, including the role of public institutions and the NDMA 2005.	E	3,4
CO5	Summarize other relevant acts and policies in India that impact disaster management, including environmental and resource management laws.	U	2,5

UNIT I
Indian Constitution & rights, Legal Systems and Judicial System, Constitution of India: Supremacy of Indian Constitution, Preamble, Fundamental Rights, DSPS, Fundamental Duties, Constitutional Remedies, fundamental aspects of governance

UNIT II
Disaster Management Concepts : Meaning of disaster, elements and Scope of disaster management, Approaches to disaster management, Disaster Management Cycle, Disaster Law and Policy related to disaster prevention, emergency response, compensation & insurance, human rights, and community recovery, relief policy and procedure

UNIT III
Exploring the legal issues, Disaster Law and Policy, features: legal analysis of issues emerging from disastrous events the causes of disasters and their relationship to laws, designed to protect health, safety, and the environment.

UNIT IV
Legal Framework for Disaster Management in India : Role and law and public institutions including government in Disaster Management Constitutional Perspectives to Disaster Management, Disaster Management Act (NDMA) 2005, Institutional roles and responsibilities for disaster management in India, civil liberties, liability and indemnification under the constitution and legislation

UNIT V
Other related Acts and policies of India; Map policy of India, Remote Sensing Policy, RTI Act, Privacy Act, Groundwater Act, Mines & Mineral Act, Atomic Mineral Act, Oil & Natural Gas Act (including coal), Environmental Pollution and Prevention Act, Wildlife Act, Forest Act, Western Ghats Ecosystem act, National Biodiversity Act, National Marine Biodiversity act, Marine Environmental Act, Integrated Coastal Zone Regulation, Offshore

Mining Regulation, Law of the Sea, Maritime Law; National Data sharing & accessibility policy.

TEXT BOOKS:

1. Disasters and the law / Daniel A. Farber, Jim Chen./ Aspen Pub 2006.
2. Disaster Law and Policy, Wolters Kluwer Law & Business/Aspen Publishers, 2010
3. Disaster Management Act2005 (India)
4. National Policy on Disaster Management2009
5. P.G.Dhar Chakrabarti, Chandrani Bandyopadhyay & Karuna Raina 2009 Disaster Risk Reduction for Safe Development : A study of Corporate Practices in India
6. Anil K. Gupta, Sreeja S. Nair & Swati Singh (2013) Environmental Legislation for Disaster Risk Management: Training Module (Indian)
7. The Disaster Management Act (2005) National Act, Rules and Notifications) along with State DM Rules and Notifications

REFERENCES:

1. Hyogo Framework for Action 2005-2015, pp365
2. International Humanitarian Law Hans Peter Gasser,1993pp 92
3. International Humanitarian Law, Larry May Bee, Benarjii Chakka,- pp92

DM2106 Natural Hazards

Course Outcomes

CO	EXPECTED COURSE OUTCOME	LEARNING DOMAINS	PSO
CO1	Describe the seismic zoning maps of India and assess earthquake risk and vulnerability in the country, along with traditional housing construction practices.	R, U	1,3
CO2	Explain landslide hazard mapping, including vulnerability and risk assessment methods, and identify effective early warning systems.	U	2,5
CO3	Analyze flood hazards, including causes and impacts, and evaluate the effectiveness of flood monitoring and forecasting systems.	An	1,3
CO4	Evaluate drought classification, its impact in the Indian context, and current drought management practices and strategies.	E	2,4
CO5	Summarize marine hazards such as storm surges, tsunamis, and coral bleaching, discussing their causes, impacts, and control strategies.	U	2,5

UNIT I
Seismic Zoning Maps of India, Earthquake Risk and Vulnerability in India, Traditional Housing Construction in Rural Areas, Critical Areas of Concern in Earthquake Management, Overview of Past Initiatives in India, Recent Initiative in India, Earthquake Engineering Education, The Approach to Earthquake Management, The Framework for Earthquake Management, Disaster management Plans, Institutional Mechanism.

UNIT II

Land slide Hazard Mapping, Vulnerability and Risk Assessment, Landslide, Landslide Studies—Methods practiced in India, Slope Monitoring and Landslide Prediction, Modeling & Simulation, Early Warning Systems and Remedial Practices; Snow Avalanche Hazard, Types, Causes and impact, Early Warning Systems, Control Strategies.

UNIT III

Flood Hazard, Flood prone Areas, Flash Floods, Damages Caused by Floods, Drainage Congestion and Water logging , River Erosion, Urban Flooding, Littoral Drift in River Estuaries, Snowmelt/Glacial Lake Outbursts, Formation and Subsequent Bursting, of Landslide Dams, Monsoon/Cyclones/Cyclonic Circulations, Flood Monitoring & Forecasting System.

UNIT IV

Droughts – Classification, the Indian scenario, Drought Risk, Climate Variability, Impact of Drought, National Manual for Drought Management, Current practices in Drought Management

UNIT V

Marine Hazards- Storm Surges, Tsunamis, Coastal Erosion and Sea Level Rise, Red Tides and other biological disasters, Coral bleaching, Submarine Landslides.

TEXT BOOKS:

1. Amita Sinvhal 2013, Understanding Earthquake Disasters Jain Publishers,New Delhi
2. Anblagan,R, Bhoop Singh, D Chakraborty, Atul Kohli, "A Field Manual for Landslide Investigations", a guide for the beginners working on landslide Investigations
3. Avasthy, R.K , Bhoop Singh & Sivakumar,R "Landslides: A Perception and initiatives of DST", an effort have been made to highlight the studies carried out through DST's sponsored research programmes.
4. Gupta M. C. & Vinod K. Sharma Orissa Super Cyclone ,NDMA
5. Victor Rajamanickam,G.V (2005) Landslides published by Department of Disaster
6. Management ,Thanjavur p.153
7. Victor Rajamanickam,G.V,Varma,O.P and Eugene Wilson (2010) Coastal hazards,p.301
8. Victor Rajamanickam,G.V (1990) Sea level variation and impact on Coastal environment, Tamil University publication,p.452
9. Firefly Guide to Global Hazards Robert Louis Kovach, Bill McGuire
10. Surya Parkash 2012 Comprehensive Landslides Risk Management: Training Module Jain Publishers,New Delhi
11. The earth: an introduction to physical geology, Volume 1, Edward J. Tarbuck, Frederick K. Lutgens

12. Essentials of Geology, Frederick K. Lutgens, Edward J. Tarbuck

REFERENCES:

1. Barbara W. and Murck et. al., Environmental Geology, John Wiley and Sons, New
2. York,1996. PP 535
3. Bohle, H. G., Downing, T. E. and Watts, M. J. Climate change and social vulnerability:
4. The Sociology and geography of food insecurity, Global Environmental Change, 1996.
5. No.4, pp. 3748.
6. Disaster Management. (EDS) RC Choudhry, K Prasada Rao, AC Jena and B
7. Chakravarthy 2001, Publ. National Institute of Rural Development, Hyderabad. PP 348
8. Egbort Bocker and Rienk Van Grondille, Environmental Physics, John Wiley and Sons
9. Ltd.,1999.PP 442
10. John M. Wallace and Peter V. Hobbs, Atmospheric Science: An Introductory Survey,
11. Academic Press, New York, 1977. PP 467
12. William H. Dennen and Bruce R. Moore, Geology and Engineering ,WCB Publishers,
13. Iowa, 1986. PP 378

DM2107 Practical

Course Outcomes

CO	EXPECTED COURSE OUTCOME	LEARNING DOMAINS	PSO
CO1	Identify fault and fracture zones from seismic, resistivity, and GPR images.	U, Ap	1,2
CO2	Classify horst and graben structures using GPR and resistivity imaging systems.	An, Ap	2,3
CO3	Assess landslide risk by identifying and monitoring slopes using Theodolite or Total Station survey techniques.	E	1,4
CO4	Evaluate groundwater quantity and quality from data obtained by Vertical Electrical Sounding (VES) using Wenner or Schlumberger techniques.	E	3,5

Students can opt one from Section A and one from Section B
Section A
1. Identification of Fault/Fracture zones from Seismic/Resistivity/GPR images.
2. Identification of Horst and Graben structures with GPR/Resistivity imaging systems.

1. Identification of Landslide: Identification and monitoring of Slopes by Theodolite/ Total Station survey
2. Ground water quantity/quality assessment from data obtained by Vertical Electrical Sounding (VES) by adapting Wenner or Schlumberger Techniques.

SEMESTER – II

DM2201 Marine and Atmospheric Hazards

Course Outcomes

CO	EXPECTED COURSE OUTCOME	LEARNING DOMAINS	PSO
CO1	Understand the fundamental concepts of oceanography, including shore and coastal processes, waves, currents, tides, and the geological evolution of oceans.	U	1,2,3
CO2	Analyze the causes, impacts, and response strategies related to tsunamis, focusing on the 2004 Indian Ocean Tsunami, vulnerability assessments, and coastal zone management.	An	1,3,4
CO3	Examine the formation, frequency, and impacts of tropical cyclones, and the role of early warning systems and mitigation strategies at national and global levels.	An, E	1,2,4
CO4	Evaluate the causes and hazards associated with submarine landslides, including geological and environmental factors such as gas hydrates and volcanic activity.	E	1,3,5
CO5	Assess severe weather phenomena such as thunderstorms, squalls, and tornadoes, and the effectiveness of monitoring and warning methods.	E	1,4,5

UNIT I
Introduction to Oceanography shore and coast, waves, currents & tides, coastal and submarine landforms bathymetry, Sea air interaction, sediment movements (Long shore &

Cross shore), Bed load sediments, Wave refraction, diffraction, breakers, chemistry of seawater, physical properties of seawater, tectonics & evolution of oceans, seafloor spreading & plate tectonics.

UNIT II
Tsunami - 26th December 2004 Indian Ocean Tsunami, Lessons Learnt and Analysis of Critical Gaps, Past Initiatives with reference to Coastal Areas, Issues for Priority Implementation of Integrated Coastal Zone Management (ICZM), National Initiatives, Recent Major International Developments, Critical Areas of Concern, Tsunami Risk Assessment and Vulnerability Analysis, The Tsunami Hazard and Its Assessment, Multi Hazard Situation in Coastal Areas of States/UTs, Tsunami Vulnerability Assessment, Role of the Indian Naval Hydrographic Department (INHD), Use of Satellite Imageries in Monitoring, Tsunami Preparedness.

UNIT III
Overview – Cyclogenesis, Frequency, Classification & Impact, Naming of Tropical Cyclones, Storm Surge Broad Scale Assessment, Past Initiatives: National Level, Paradigm Shift: Past Initiatives by some States, Paradigm Shift in DM: Genesis of the DM Act, Institutional Framework, Existing Institutional arrangements, National Cyclone Risk Mitigation Project, National Guidelines: Genesis, Structure and Implementation Strategy, Early warning systems.

UNIT IV
Submarine landslide processes & Hazards, Causes: Weak geological layers, Over pressuring, Earthquakes, storm surge, King wave, Gas hydrates, Groundwater seepage, Glacial loading, Volcanic island growth, Over steepening,

UNIT V
Severe-weather associated with thunderstorms- Squalls, Lightnings, Hail storms, Dust storms, Tornados. Monitoring and warning methods.

REFERENCES:

1. Anil K. Gupta, Sreeja S. Nair, Shiraz A. Wajih, Shashikant Chopde, Gautam Gupta & Garima Aggarwal (2014) Training Module Mainstreaming Climate Change Adaptation and Disaster Risk Reduction Into District Level Development Plans,NIDM report
2. Disaster Management Act2005
3. National Policy on Disaster Management2009
4. http://www.igcp585.org/home (Submarine Mass Movements and Their Consequences; EMARSHAL project Earth's continental Margins assessing the geo Hazard from submarine Landslide)
5. Rajamanickam,G.V.(1990) Sea level variation and its Impact on Coastal environment Tamil University publication,Thanjavur,pp.452.
6. Rajamanickam,G.V(2001). Quaternary Sea-Level Variation Shoreline Displacement and Coastal Environment (with M.J.Tooley). Published by New Academic Law Serials, New Delhi, 259 pp.

7. Rajamanickam,G.V.(2005).Landslides.Published by Department of Disaster Management, SASTRA University, Thanjavur, 153 pp.
8. Rajamanickam,G.V.(2004).Tsunami causes, effects, remedial measures pre and post-Tsunami Disaster Management–A Geoscientific perspective. Publisher: New Academic Publishers, New Delhi, 236 pp.
9. Varma, O.P,Rajamanickam,G.V.and Eugene Wilson (2010) Coastal Hazards, M/s Anubhav Printers, Roorkee, (Uttarakhand), 301 pp.

DM2202 Anthropogenic Hazards

Course Outcomes

CO	EXPECTED COURSE OUTCOME	LEARNING DOMAINS	PSO
CO1	Understand the concept of anthropogenic disasters and their types, including industrial, chemical, environmental, biological, and radiological hazards.	U	1,2,3
CO2	Analyze the impact of developmental activities like mining, dam construction, and urbanization on environmental degradation, and disasters linked to these.	An	1,3,4
CO3	Examine the consequences of oil spills, acid rain, nuclear power plant disasters, and chemical disasters, with case studies such as the Bhopal gas tragedy.	An, E	1,2,3
CO4	Evaluate the risks and responses related to biological disasters, including biodiversity loss, communicable diseases, bioterrorism, and biological warfare.	E	1,4,5
CO5	Assess health hazards arising from anthropogenic sources, including air and water-borne diseases, food poisoning, zoonosis, and monsoon-related diseases.	E	1,4,5

UNIT I
Understanding anthropogenic (manmade) disasters; Industrial, Chemical, Environmental, Biological and Radiological disasters; Industrial and Technological Disasters: Fire, unplanned urbanization, e-waste, nuclear waste, solid wastes & landfill.

UNIT II
Developmental activities and disasters: Mining and environment, acid drainage rocks, land and environment degradation, mine land reclamation. Reservoir Induced Seismicity, Dam bursts and rehabilitation, Kumbakonam, Sri Rangam and Patna fire accidents and their impacts and explosives.

UNIT III
Oil spills and its impact on marine environment, acid rain, Nuclear Power and radiation disasters; nuclear leak, gas seepages, Bhopal Disaster.

UNIT IV
Biological Disasters: Biodiversity, Communicable diseases, factors contributing to vulnerability, bioterrorism, Health risks, biological weapons, armed conflicts, land mines.

UNIT V

Health hazards, Communicable diseases, Air and Water borne diseases, Monsoon related diseases, Sun burns, Food poisoning, Zoonosis

REFERENCES:

1. Barbara W. and Murck et. al., Environmental Geology, John Wiley and Sons, New York, 1996. PP 535
2. Bohle, H. G., Downing, T. E. and Watts, M. J. Climate change and social vulnerability: the sociology and geography of food insecurity, Global Environmental Change, 1996. No.4, pp. 3748.
3.Disaster Management Publ. (Eds) Edmund Christopher. Publisher: Shils Publishers,Nagercoil, 2012.PP 857
4.Egbort Bocker and Rienk Van Grondille, Environmental Physics, John Wiley and Sons Ltd., 1999. PP 442
5. John M. Wallace and Peter V. Hobbs, Atmospheric Science: An Introductory Survey, Academic Press, New York, 1977.PP 487
6. Santosh Kumar, Arun Sahdeo & Sushma Guleria, 2013. Bihar Floods : 2007 (A Field Report) Publ.NDMA ,Govt.India,New Delhi
7. Vogelbacher A. (2013) Flood Disaster Risk Management - Hydrological Forecasts Requirements and Best Practices : Publ.NDMA ,Govt.India,New Delhi Training Module

DM2203 Disaster Monitoring and Data Acquisition (E)

Course Outcomes

CO	EXPECTED COURSE OUTCOME	LEARNING DOMAINS	PSO
CO1	Understand the functioning of earthquake seismological networks, including seismometer arrays, GPS monitoring, and seismic area classifications in India and globally.	U	1, 3, 5
CO2	Analyze remote sensing techniques like GPR, SAR, and LIDAR for landslide prediction, risk assessment, and monitoring, using advanced subsurface and terrain mapping.	An	1, 2, 3
CO3	Examine the methods and technologies used for tracking and monitoring tsunamis, cyclones, and hurricanes, with a focus on sensors, radar systems, and positioning methods.	An, Ap	1, 4, 5
CO4	Evaluate the use of satellite-linked automatic weather stations and national data networks for	E	2, 4, 5

	climate data collection, management, and weather forecasting.		
CO5	Assess flood and drought monitoring systems, including gauge networks, water level measurements, and soil moisture tracking using IMD and state-level infrastructures.	E	1, 3, 5

UNIT I

Earthquake Seismological network: seismic observatories in India, broadband seismometer network (local & global), strong motion array micro seismicity, thermal anomalies for seismic area classification, Global Positioning System for monitoring lithospheric deformation.

UNIT II

Landslide Remote Sensing data products and applications in landslide prediction, GPR (Ground Penetration Radar) to determine the subsurface profile, Synthetic Aperture Radar (SAR) techniques for landslide risk assessments, LIDAR techniques for landslide monitoring (ALTM Areal Laser Terrain Mapping).

UNIT III

Tsunami, Cyclone, storms & Hurricanes tracking & monitoring through Doppler radar, Tide gauges, wave & current recorders, pressure sensor, sediment accumulation sensor, optical backscattered sensor (OBS), sediment traps, data buoys, navigation lights & signals, positioning systems (radio positioning & satellite), Multiband bathymetry, gravity & magnetic anomalies in sea and surveillance system.

UNIT IV

Network of Satellite linked automatic weather stations, weather and climate data supply and management. IMD Network. National Data Center and Database of related sectors

UNIT V

Flood & Drought – Flood monitoring systems (gauge stations) along with rivers, rain gauge network (IMD & State Government), collection of water fluctuation data, and data logger for water level measurement, soil moisture, nutrient loads.

References:

1. Anil K. Gupta, Sreeja S. Nair, Shiraz A. Wajih & Sunanda Dey (2013) Flood Disaster Risk Management - Gorakhpur Case Study : Training Module
2.George Joseph (2005) Fundamentals of Remote Sensing 2nd Edition, Universities Press (India) Ltd, Hyderabad, pp 471
 3. Gupta, M. C, Gupta, L. C. Anil Sinha & Vinod K. Sharma 2001 Gujarat Earthquake
4.Thomas Lillisand, Ralph W. Kiefer, and Jonathan Chipman (2007) Remote Sensing and Image Interpretation Wiley India, pp 756

DM2204 Geo-technology in Disaster management (E)

Course Outcomes

CO	EXPECTED COURSE OUTCOME	LEARNING DOMAINS	PSO
CO1	Understand the importance of geology in disaster management and apply geo-technology concepts in managing geological hazards.	U, Ap	1,2,4,5
CO2	Analyze the engineering properties of rocks, soils, and minerals, and evaluate their suitability for construction and site selection, referencing the Chernobyl case.	An, E	1,3,5
CO3	Evaluate geological structures for construction projects using stereographic projection and apply geotechnical stabilization techniques in tunneling, caverns, and dams.	E, Ap	1,3,4,5
CO4	Understand the types of foundations and seismic design principles for earthquake-resistant construction, implementing relevant building codes (BIS).	U, Ap	1,3,4,5
CO5	Design embankments and disaster shelters, integrating geospatial technology for rehabilitation and analyze coastal stabilization structures for disaster mitigation.	An	1,3,5

UNIT I
Geology and its importance in disaster management, Introduction to geo-technology and its application in disaster management, classification of rocks and minerals – Para genesis & petro genesis

UNIT II
Engineering Properties of rocks, soils & minerals, Evaluation of physical intact rock and rock mass properties – Uniaxial compressive strength, point load index, shear strength and Modulus of deformation. Rock as construction material – alkali aggregate reaction of concrete, origin and classification of fold, fault, joints, fractures, lineaments & unconformity, geotechnical properties for the site selection of nuclear, thermal & hydropower plant, Chernobyl case study.

UNIT III
Geological structures – collection of data, analysis using stereographic projection technique, Route location for roads and railways, stabilization techniques; Tunnels and underground caverns, geological and geotechnical characters of tunneling, underground caverns, bridges & dams.

UNIT IV
Types of foundation, Earthquake resistant design and construction of new structures, Building Codes (BIS), Seismic strengthening and retrofitting of lifeline and priority structures;

UNIT V
Embankment design including check dams, disaster shelters and community halls, geospatial technological application in the rehabilitation measures, including selection of sites. Coastal Stabilisation structures (hard and soft)

REFERENCE

1. Principles of Engineering Geology and Geotechnics by D.P. Krynine and W.R. Judd 1998, ISBN: 81 2390603X, CBS Publishers, New Delhi, pp 730
2. Principles of Engineering Geology by R.B. Johnson 1988, John Wiley and sons Inc, pp 497.
3. Engineering Rock mass classifications: A complete manual for Engineers and Geologists in Mining. Civil and Petroleum Engineering By Z.T. Bieniawski, German Academic Publishers 1989, pp 251
4. Engineering Geology: Rock in Engineering Construction by R.E. Goodman Tunnel Engineering Handbook Edited by J.O. Bickel, T.R.Kuesel and E.H. King 2002. ISBN: 8123905432CBS Publisher New Delhi, pp 412
5. Engineering for Dams by W.P. Creager, J.D. Justin and J. Hinds 1995, ISBN: 818524574 Nem Chand Bros. Roorkee.
6. Fundamentals of Engineering Geology by F.G. Bell 1983, pp 648.
7. Pare Diwan,2010,A Manual on Disaster Management,Publi.Jain Book house, New Delhi,India
8. Ajinder Walia & Sushma Guleria 2013 Village Disaster Management Plan:Training Module

Additional Study Materials:

1. Tunnels and underground structures [Ed] J. Zhao, J.N. Shirlaw, Krishnan R. Publisher, A A. Balkema, ISBN – 9058091716, Pages 696 November 2000 Netherlands.
2. Early Warning Systems for Natural Disaster Reduction, Zschau, J., Geo Forschungs Zentrum Potsdam (GFZ), Potsdam, Germany; Kuppers, A.N., Geo Forschungs Zentrum Potsdam (GFZ), Potsdam, Germany (Eds.) P. 467 illus, 150 in color Springer Verlag. Pub
3. Numerical Simulation in Tunneling 2003 Approx 490 p. numerous figures, partly in color Hardcover 3211005153, Beer, G., Technische Universitat Graz Austria (Ed...) Springer Verlag. Pub
4. Environmental Hazards, K.S. Valdiya.

DM2205 Modeling of Disasters and Early Warning Strategy and Communication Network

CO	EXPECTED COURSE OUTCOME	LEARNING DOMAINS	PSO
CO1	Understand modeling concepts, including causal and statistical models, and apply these principles in disaster model development, calibration, and verification using mass conservation.	U, Ap	1,2,4,5
CO2	Analyze seismic wave propagation, forward and inverse modeling, and evaluate response models for structural design and historical data back analysis for seismic and tsunami	An, E	1,3,5

events.

CO3	Develop landslide models using deposition profiles, probability analysis, and integrate geospatial technology and advanced algorithms (ANN, GA, SA) for scenario development.	An	1,3,4,5
CO4	Model flood and drought hydrodynamics, apply spatial data techniques for micro-level disaster planning and evaluate open channel hydraulics and soil moisture models.	M, Ap, E	1,3,4,5
CO5	Understand interactions between atmospheric layers, apply meteorological principles in modeling air pollution and analyze the role of remote sensing in disaster scenario planning.	U, Ap, An	1,3,5

UNIT I
Modeling concepts Causal and statistical models Characteristics Steps in model development Importance of model building. conservation of mass and mass balance –calibration and verification of models; Transport phenomena – Advection, diffusion, dispersion, simple transport models; chemical reaction kinetics – Law of mass action, Rate constants, reaction order, types of reactions, equilibrium principles

UNIT II
Seismic Wave (P & S) propagation, forward modeling and inverse modeling, response to various structures, model testing for structural design, Back analysis with historical data, Tsunami propagation, Storm surge & cyclone modeling.

UNIT III
Landslide modeling including deposition profile and distance travelled by the material, probability of landslide occurrence, statistical analysis, geospatial technology for scenario development, DEM generation, Artificial Neural Network (ANN), Genetic Algorithm (GA), Simulated Annealing (SA) for highly nonlinear models.

UNIT IV
Flood & drought hydrodynamic modeling, spatial data modeling for micro level planning & management, hydraulics of open channels, hydrological models, soil moisture modeling,

UNIT V
Stratosphere Troposphere interaction, Monsoon meteorology, Boundary layer meteorology, Remote sensing, Ocean-land atmosphere biosphere interaction, air pollution meteorology, Atmospheric pollution modelling.

TEXT BOOK:
Dimri, V. P., Deconvolution and inverse theory application to geophysical problems, ELSEVIER, 1992.

REFERENCES:

1. Deaton and Wine Brake, "Dynamic Modeling of Environmental Systems", Wiley & Sons, 2002.
2. John R. Jensen (2009) Remote Sensing of the Environment: An Earth Resource Perspective. 2nd Edition, Dorling Kindersley (India) Pvt. Ltd, NODIA, India, pp 585
3. J.L.Schnoor, Environmental Modeling Fate and Transport of Pollutants in Water, Air and Soil, John Wiley & Sons Inc., New York, 1996.
4. Sekhar Chandra Dutta , Parthasarathi Mukhopadhyay,2012. Improving Earthquake And Cyclone Resistance Of Structures

DM2206 Chemical, Radiological and Biological hazards

Course Outcomes

CO	EXPECTED COURSE OUTCOME	LEARNING DOMAINS	PSO
CO1	Understand the factors that lead to chemical disasters and analyze the impact of major chemical accidents in India, including process and safety system failures, natural calamities, and terrorist attacks.	U, An	1,2,4,5
CO2	Apply good engineering practices for safety, investigate accident causes, and analyze guidelines for chemical transport accidents, focusing on air and maritime transportation and accident hazards in India.	Ap, An	1,3,5
CO3	Identify types of chemical hazards, evaluate chemical agents' effects, and assess the current institutional and legislative frameworks for managing chemical hazards.	U, E, An	1,4,5
CO4	Understand nuclear and radiological disaster scenarios, analyze accident criticality during transportation of radioactive materials, and evaluate safety measures for nuclear fuel cycle management.	U, An, E	1,2,3,4,5
CO5	Examine biological agents and their impact as causes of mass destruction, assess biosafety and biosecurity issues, and analyze institutional frameworks for managing biological disasters and bioterrorism risks.	E, An	1,3,5

UNIT I

Chemical Disasters Causative Factors Leading to Chemical Disasters, Initiators of Chemical Accidents, Process and Safety System Failures, Natural Calamities, Terrorist Attacks/Sabotage, Impact of Chemical Disasters, Major Chemical Accidents in India, Aims and Objectives of the Guidelines, Industrial (Chemical) Installations and Storages, Industrial (Chemical) Installations,

UNIT II

Good Engineering for Safety, Accident Reporting, Investigation and Analysis, Safety Promotional, Guidelines for Transport Accidents, Air Transportation, Maritime Transportation, Major Accident Hazards (MAH) areas in India.

UNIT III

Chemical Hazards, types of Chemical hazards, Acquisition and Delivery of Chemical Agents, Effects of Chemical Agents, Aims and Objectives of the Guidelines, Present Status and Context, Institutional Framework, Legislative and Regulatory Framework.

UNIT IV

Nuclear and Radiological Emergency/Disaster Scenarios-Accidents in Nuclear Power Plants and other Facilities, 'Criticality' of Accidents-Accidents during transportation of Radioactive Materials-Issues in nuclear fuel cycle.

UNIT

Biological Agents as Causes of Mass Destruction, Sources of Biological Agents, Biosafety and Biosecurity, Epidemics, Biological Disasters (Bioterrorism), Impact of Biological Disasters, Regulatory Institutional and Framework

REFERENCES:

1. National Disaster Management Guideline – Chemical Disaster (Industrial) – NDMA, Govt. of India
2. National Disaster Management Guideline – Chemical Disaster (Terrorism) – NDMA, Govt. of India
3. National Disaster Management Guideline – Biological Disasters – NDMA, Govt. of India
4. National Disaster Management Guideline – Nuclear & Radiological emergencies – NDMA, Govt. of India

DM2207 Practical

Course Outcomes

CO	EXPECTED COURSE OUTCOME	LEARNING DOMAINS	PSO
CO1	Develop skills to perform hazard assessment of a local area, institution, or establishment using spatial data and satellite imagery, enhancing practical understanding of geospatial analysis techniques.	Ap, C	2,3,4
CO2	Understand and apply vulnerability assessment methodologies to evaluate the exposure and susceptibility of infrastructures and communities to various natural and anthropogenic hazards.	U, Ap	1,3,4
CO3	Perform risk analysis integrating hazard and vulnerability data to evaluate potential impacts and risks for decision-making and disaster preparedness strategies.	Ap, E	1,3,5

| CO4 | Use satellite imagery and other remote sensing tools for structural mapping, helping to identify vulnerabilities and risks associated with various natural and man-made hazards. | Ap, An | 2,4,5 |
| CO5 | Critically analyze spatial data outputs to support disaster management planning and risk reduction initiatives, fostering practical competencies in disaster management applications. | An, E | 1,3,5 |

Hazard Assessment, Vulnerability Assessment, and Risk Analysis of any local area/Institution or Establishment/ Structural mapping using satellite imagery.

<p align="center">SEMESTER – III</p>

<p align="center">DM2301 Climate change adaptation and mitigation</p>

Course Outcomes

CO	EXPECTED COURSE OUTCOME	LEARNING DOMAINS	PSO
CO1	Understand the fundamental concepts of climate variability, climate change, global wind systems, and natural phenomena such as El Niño, La Niña, and ENSO, along with their impact on global climate patterns.	U, An	1, 3, 5
CO2	Analyze trends and projections of climate change based on global, regional, and local temperature, precipitation, and sea-level changes, utilizing reports from IPCC and IMD to critically assess climate change impacts.	An, E	2, 4, 5
CO3	Evaluate the sectoral impacts of climate change on water, agriculture, biodiversity, human health, and industries, providing in-depth knowledge of projected regional impacts using various methods and scenarios.	E, An	1, 3, 5
CO4	Apply adaptation strategies and options across various sectors, including agriculture, water, infrastructure, and human health, while also exploring mitigation technologies such as carbon capture and storage (CCS).	Ap, C	2, 3, 4
CO5	Examine global mitigation strategies, including renewable energy, biofuels, and green energy initiatives, to assess their potential in addressing climate change through innovative approaches like geoengineering.	An, E	2, 4, 5

UNIT I
Introduction to climate variability and climate change - Climate shifts- Global Wind Systems –Cloud Formation and Monsoon Rains – Storms and Hurricanes - The Hydrological Cycle – Global Ocean Circulation – El Nino and La Nina phenomena – ENSO- Indian Ocean Dipole –The Earth's Natural Green House Effect – Green House Gases and air pollution - Global Warming

UNIT II
Trends and projections of Climate Change – Global, regional and local changes in patterns of temperature, precipitation and sea level rise – 4th and 5th IPCC reports-IMD reports on

climate change and projections- Observed effects of Climate Changes – Patterns of Large Scale Variability – Drivers of Climate Change – Climate Sensitivity and Feedbacks

UNIT III
Impacts of Climate Change on various sectors – Water –Agriculture includes animal husbandry and Fisheries, Forestry, biodiversity and Ecosystem – – Human Health – Industry, Settlement and Society – Methods and Scenarios – Projected Impacts for Different Regions

UNIT IV
Adaptation Strategies/Options in various sectors – Water – Agriculture – Infrastructure and Settlement including coastal zones – Human Health – Tourism – Transport – Energy – Key Mitigation Technologies and Practices. Energy Supply – Transport – Buildings – Industry – Forestry, Carbon Sequestration – Carbon Capture and Storage (CCS).

UNIT V
Mitigation strategies at Global level – Geo Engineering- Renewable energy-Biofuels-Green energy

REFERENCES

1. Jan C. van Dam, Impacts of "Climate Change and Climate Variability on Hydrological Regimes", Cambridge University Press, 2003
2. Al gore 'inconvenient truth" – video form
3. IPCC Fourth and Fifth Assessment Reports.
4. Dash Sushil Kumar, "Climate Change – An Indian Perspective", Cambridge University Press India Pvt. Ltd, 2007
5. Anil Kumar Thakur, Gangadhar V Kayande Patil, 2012 Disaster Management and Climate Change,Pupl .NDMA,Govt India,New Delhi.
6. Global Warming- the complete briefing (second edition): John Houghton, Cambridge University Press (2009)

DM2302 Geospatial Technologies in Disaster Management

Course Outcomes

CO	EXPECTED COURSE OUTCOME	LEARNING DOMAINS	PSO
CO1	Understand the fundamentals of remote sensing, including the physical basis, electromagnetic spectrum, atmospheric effects, and EMR interaction with surface materials, to explore its application in disaster management.	U, An	1,3,5
CO2	Analyze different remote sensing platforms, sensors, and satellite systems such as Landsat, IRS, SPOT, and RADARSAT, along with their characteristics for disaster monitoring and response.	An, E	2,4,5
CO3	Apply techniques for visual interpretation and digital image analysis, including supervised and unsupervised	Ap, C	2,3,4

	classification, image enhancement, and accuracy estimation for geospatial data relevant to disaster scenarios.		
CO4	Utilize Geographic Information Systems (GIS) and Global Positioning System (GPS) technologies, understanding their integration, data structures (raster and vector), and the project management process in disaster contexts.	U, Ap	1,3,4
CO5	Evaluate geospatial techniques for specific disaster management applications such as landslides, earthquakes, tsunamis, and floods, and apply geoinformatics to urban disaster management and ecosystem monitoring.	E, Ap	2,4,5

UNIT I
Introduction to Remote Sensing, definition, physical basis of remote sensing, electromagnetic spectrum, radiation laws, atmospheric effects, basics of optical, thermal and microwave remote sensing, history of remote sensing, geometric and radiometric aspects of RS data. EMR interaction with earth surface materials, Spectral signatures of vegetation, water, soil, snow etc. in different regions of EMR, ground truth data.

UNIT II
Platforms, Sensors and Satellites Aerial and space borne platforms, orbits, sensors types – optical (multispectral, hyper spectral), thermal and microwave, resolutions, Satellites: Land sat, SPOT, IRS, ERS, Radar sat, RISAT, and other operational remote sensing satellites.

UNIT III
Data Analysis Visual interpretation – Scale, maps and map projections, interpretation keys; image characteristics, media and formats of digital images, image enhancement, image transformations, classification – unsupervised and supervised classification, classifiers, accuracy estimation, change detection.

UNIT IV
Geographical Information System and GPS Introduction, GIS definition and terminology, data types, raster and vector data, GIS database design, spatial database creation – digitization, scanning; processing of data, GIS implementation and project management. Commercially available remote sensing and GIS software's, GPS and applications.

UNIT V
Geoinformatics in Disaster Management, Ecosystem inventory and monitoring, Landslides, Forest Fires, Earthquakes, Tsunamis, Cyclone, Floods, Snow/Avalanches; Geospatial techniques in urban disaster management.

REFERENCES:

1. Anandita Sengupta, Debanjan Bandyopadhyay, Nilanjan Paul, Sreeja S. Nair & Anil K. Gupta (2013) Geoinformatics Applications in Chemical Risk Management : Publ.NDMA Govt.India,New Delhi,Training Module
2. Burrough, P.A. (2007) Principles of Geographical Information system. Oxford University Press USA, pp 193
3.George Joseph (2005) Fundamentals of Remote Sensing 2nd Edition, Universities Press (India) Ltd, Hyderabad, pp 471

4.Lo C.P. and Albert K.W. Young (2009) Concepts and Techniques of Geographic Information   Systems, 2nd Edition, PHI Learning Pvt. Ltd., New Delhi, pp 532
5. John R. Jensen (2009) Remote Sensing of the Environment: An Earth Resource Perspective. 2nd Edition,Dorling Kindersley (India) Pvt. Ltd, NODIA, India, pp 585
6. Thomas Lillisand, Ralph W. Kiefer, and Jonathan Chipman (2007) Remote Sensing and Image Interpretation Wiley India, pp 756
7.John R. Jensen (2004) Introductory Digital Image Processing: A Remote Sensing Perspective   Prentice Hall, pp 104
8.Sreeja S. Nair, Anil K. Gupta & Klaus (2013) Röder Database and Statistics for Disaster Risk   Management : Publ.NDMA ,Govt.India,New Delhi,Training Module.

DM2303 Preparedness, Vulnerability and Risk Assessment of Disasters

Course Outcomes

CO	EXPECTED COURSE OUTCOME	LEARNING DOMAINS	PSO
CO1	Understand the fundamentals of risk evaluation, methodologies for risk analysis, and the impact of globalization on disaster risk assessment and management.	U, An	1,3,5
CO2	Assess risks associated with various disaster types through extreme event analysis and hazard ecology, and analyze case studies to understand the potential impacts of disasters.	An, E	2,4,5
CO3	Develop data models for information collection relevant to risk assessment applications, focusing on disaster mitigation and management challenges, and participate in crisis management training.	Ap, C	2,3,4
CO4	Design risk management strategies by analyzing different types of risks, understanding the concept of vulnerability, and applying preparedness and response mechanisms in disaster scenarios.	E, Ap	1,4,5
CO5	Examine gender issues in disaster management, including gender roles, myths, and perceptions, and apply gender-sensitive planning and programming principles in disaster risk assessments and policies.	An, Ap	2,4,5

UNIT I
Introduction to risk evaluation; Fundamentals and methodologies for risk analysis, assessment, evaluation and management. Definitions and Overview of risks and dangers, Impact of globalization.

UNIT II
Assessment of risks for different disaster types, extreme event analysis, hazard ecology, chemical load and environmental health risk, carcinogenic materials and environment. Discussion on selected case studies to analyze the potential impact of disasters.

UNIT III

Data model for collection of information. Risk assessment applications for disaster mitigation and management problems, Training in Crisis management.

UNIT IV

Design of Risk management, different type of risks and solutions, concept of vulnerability, analysis, and preparedness. Prevention and response mechanism, emergency management teams, National and International disaster recovery policies.

UNIT V

Gender Issues- Understanding gender issues, Gender roles in society, Myths and facts in disaster perception-Guiding principles- gender sensitive planning and programming in Disaster management –Basic approaches in gender issues, Practical & strategic needs, Tools for analyzing gender issues, Applying gender lens to policies & programs.

REFERENCES:

1. Anil K. Gupta, Shekher Chaturvedi, Rajnish Goswami & Anupama SethiRisk to Resilience : Strategic Tools for Disaster Risk Management,2009
2. Freeman, H. M. (ed.) 1989 Standard Handbook of Hazardous Waste treatment and Disposal, McGraw H, New York, pp 1168
3. Petak, W. J. and Atkisson, A, A. Natural Hazard Risk Assessment and Public Policy:Anticipating and Unexpected, Springer; New York. Pp 489
4. Muckhopadhyaya, A.K., 2005, Crisis and disaster management: tuberlance and aftermath", Newage International Publications, New Delhi. PP 91
5. William, P. L.; and J. L. Burson, 1985, Industrial Toxicology, Safety and Health Applications in the work place, Van Nostrand Reinhold, New York, pp512
6. Wilson , R; and E. A. C.Crouch, 1987, Risk assessment and comparisons: An Introduction, Science 17, 1987, pp 267270.

DM2304 Rehabilitation and Mitigation Issues and Management of Resources

Course Outcomes

CO	EXPECTED COURSE OUTCOME	LEARNING DOMAINS	PSO
CO1	Understand the institutional framework for disaster preparedness, mitigation, and rehabilitation practices, and the roles of various stakeholders including government, NGOs, and communities.	U, An	1, 3, 4
CO2	Evaluate hazard monitoring techniques, warning protocols, and public health considerations in disaster management, and assess the requirements for shelter during emergencies.	An, E	2, 3, 5
CO3	Analyze operational decision-making processes in emergency management and recovery, and understand the relationship between development and disaster resilience.	An, E	1, 4, 5
CO4	Apply principles of natural hazard reduction to assess damages and implement retrofitting strategies for buildings,	Ap, E	1, 2, 4

	and promote training and awareness for effective disaster preparedness.		
CO5	Conduct Environmental Impact Assessments (EIA) and develop environmental management plans, including cost-benefit analysis and public participation strategies for decision-making.	An, Ap	3, 4, 5

UNIT I
Institutional framework for disaster preparedness, mitigation and rehabilitation practices, Disaster Preparedness Planning, Role and responsibilities of Central, State, District and Local Administration, NGOs and volunteers. Community based disaster management plan.

UNIT II
Hazard monitoring, warning protocols, India Disaster Resource Network of National Institute of Disaster Management, public health aspects (for example: epidemic) of disaster management and emergency services systems. Shelter environments/requirements.

UNIT III
Emergency Management: Operational decision making, Introduction of recovery, reconstruction and rehabilitation; relationship between development and disasters; types of damages and their assessment, short, medium and long term recoveries and rehabilitation. Development of physical and socioeconomic infrastructure.

UNIT IV
Principles of natural hazard reduction, Nature of damage to utilities and dwelling units; retrofitting of buildings; training and awareness; case studies of disaster preparedness and rehabilitation.

UNIT V
Introduction to Environmental Impact Assessment, Environmental management Planning, Environmental auditing; Regional and strategic EIA, Cost benefit analysis, Public participation in environmental decision making.

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2. Goel S.L. and Kumar Ram, Disaster Management, Deep and Deep Publications, 2001PP 434
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6. Technical Report on "Geotechnical/Geophysical investigations for Seismic Microzonation Studies of Urban Centres in India", National Disaster Management Authority, New Delhi, August 2011.
7. 26th December 2004,Tsunami by Dr. GK Victor Rajamanickam Et.al. 2006 Science and Technology Government of India, New Academy Publishers, New Delhi PP 186

8. Harsh K Gupta, Induced Seismicity Publ.Springer, 1995 PP 219
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10. SM Ramaswamy,CJ Kumanan,R Sivakumar & Bhoop Singh, " Geomatics in Tsunami", scientific studies have been undertaken for mapping of damaged areas for recording the possible damages occurred to the building, infrateucture, flora & fauna and associated issues.
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13. Pardeep Sahni , Alka Dhameja,2013. Disaster Mitigation Experiences and Reflections

DM2305 Actuarial Science in Disaster Management (E)

Course Outcomes

CO	EXPECTED COURSE OUTCOME	LEARNING DOMAINS	PSO
CO1	Understand the principles of banking and finance, including money and credit theories, banking systems, and public budgeting relevant to disaster management.	U, An	1, 3, 4
CO2	Analyze the importance of insurance and risk management in disaster contexts, identifying and evaluating various risks and risk management techniques applicable to property and income.	An, E	2, 4, 5
CO3	Evaluate insurance policies and funding strategies for disaster management, including catastrophe insurance pools, government roles, and market participant contributions.	E, An	1, 3, 4
CO4	Apply statistical methods and techniques, including measures of central tendency, sampling, hypothesis testing, and regression analysis, to evaluate data in disaster management contexts.	Ap, An	2, 3, 5
CO5	**Utilize** actuarial models, including binomial and Poisson models, to assess risks and develop insurance schemes, including annuities relevant to disaster recovery efforts.	Ap, E	2, 3, 5

UNIT I
Introduction to Banking & Finance: Theory of money & credit, money and banking systems; Bank credit and clearing operations; Banking law; Bank operations analysis; Tax administration; Public budgeting and finance systems; state and local finances.

UNIT II
Insurance and Risk Management: Introduction on importance of insurance, risks, risk identification and evaluation; Exposure to property loss; Life, health and loss of income

exposures; Risk management techniques; insurance principles and policy provisions; insurance industry and regulatory framework.

UNIT III
Insurance Policies for Disaster Management: Evaluation of risk funding and risk transfer policies; catastrophe insurance pool; Reserve funds and contingent credit policies; Role of Government and market participants; Insurance policy design; Fiscal cost of relief and reconstruction; Grants and low interest loan for reconstruction; Case Studies and review of Disaster insurance models.

UNIT IV
Basic statistics- Measures of central tendency-Mean, Median Mode-standard deviation-coefficient of variation-Correlation and Regression-Simple and multiple Regression; Sampling Techniques- Statistical Inference-Estimation and Testing of hypothesis, Critical test statistics for Z, T, F and Chi square distribution, Analysis of Variance-one way and two way. Application of Statistics in Disaster Management.

UNIT V
Actuarial modeling; Binomial and Poisons models – graduation and statistical tests methods of graduation, different insurance schemes available, Annuity and its applications

REFERENCES:

1. Anil K. Gupta, Shekher Chaturvedi, Rajnish Goswami & Anupama Sethi 2012.Safeguard Environment for Disaster Risk Reduction: Poem & Slogan Book, Publ.NDMA,Gosvt OF India,NewDelhi,
2. Anil K. Gupta, Sreeja S. Nair, Shiraz A. Wajih & Sunanda Dey 2013 Flood Disaster Risk Management - Gorakhpur Case Study: Training Module Publ.NDMA,Govt oF India,NewDelhi,
3. ADB, "Finance for the Poor: Micro finance Development Strategy", Asian Development Bank, Manila, 2000.pp347
4. Bouman, FJA, "Small, Short and Unsecured: Informal Rural Finance in India", Oxford
5. Hulme, David and Paul Mosley, "Finance against Poverty", Routledge London, 1996.pp218
6. Meyer, Richard L, "Micro finance, Poverty alleviation and Improving Food Security: Implications for India" in Food Security and Environmental Quality, CRC Pres LLC, Boca Raton, FL. 2002.pp347
7. Tushar Bhattacharya, 2012. Disaster Science and Management Publ. NDMA, Govt. of India, New Delhi,

DM2306 Socio-psychological issues and Community Participation in Disaster Management

Course Outcomes

CO	EXPECTED COURSE OUTCOME	LEARNING DOMAINS	PSO
CO1	Understand the role of communities and social solidarity in disaster management, including the development of disaster-resilient communities and the culturalization of disaster	U, An	1, 3, 4

	practices.		
CO2	Analyze the impact of socioeconomic vulnerability and gender perspectives on disaster management, utilizing case studies to explore community responses and the utilization of public resources.	An, E	2, 4, 5
CO3	Evaluate the role of voluntary organizations, ethical considerations, and the influence of media in disaster management, emphasizing professionalism and humanitarianism.	E, An	1, 3, 4
CO4	Assess the significance of psychosocial support and mental health services in disaster management, analyzing institutional and policy frameworks related to mental health initiatives.	An, E	2, 3, 5
CO5	Examine various government initiatives and programs, including the National Mental Health Programme and the Disaster Management Act, evaluating their resources and impact on community resilience.	E, An	1, 4, 5

UNIT I

Community and social solidarity; Role of local community in Disaster Management, Disaster resilient community, habitualization and culturalization of Disaster Management practices, Community based disaster management practices – case studies. Socioeconomic vulnerability to disaster, gender perspective to disasters, Utilization of public property during disasters, Community response to disasters.

UNIT II

Professionalism and humanitarianism in Disaster Management, The role of voluntary organizations in disaster management, Ethical issues in Disaster Management- Role of academics and media in disaster management

UNIT III

Trends in Resource Mobilization for Disaster Management, Disaster Management Budgeting, Risk Sharing and risk transfer systems, Sustainable Disaster Management Budgeting, Disaster Management and Economic Development, National Institute of Disaster Management, Role of central teams in disaster evaluation and recommendation for relief; Local government disaster evaluation process

UNIT IV

Significance of Psychosocial Support and Mental Health Services (PSSMHS) in Disaster Management, Aims and Objectives of the Guidelines, Institutional and Policy Framework, National Policy of PSSMHS.

UNIT V

The National Mental Health Programme (NMHP), National Rural Health Mission (2005), Panchayat Raj Act (1992), Other Government Initiatives, Disaster Management Act, (2005), National Disaster Management Authority (NDMA), National Crisis Management Committee (NCMC), State and District Disaster Management Authority, Resources for PSSMHS, PSSMHS in Disaster Management.

REFERENCES
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2. Horowitz, M Stress response syndromes, Northvale, N.J. Jason Anderson (1996) PP 451.
3. Peter, K. Hodgkinson, (1998) Copying with Catastrophe, A handbook of post disaster psychological after care. Routledge. pp249
4. Kazimiera Adamowski (1998) Creating Excellence in Crisis Care, John Wiley and Sons Inc. Psychosocial Support for Disaster Affected population in India, World Health Organization, India PP 278
5. Joseph O, Prewitt Diaz, (2004) Disaster Mental Health in India, Voluntary Health Association of India PP 267
6. Samir Dasgupta (2010) Womens Encounter with Disaster,Publ.Jain book house , New Delhi, India
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8. Narendra Padhan,(2009) Disaster Management With Case Studies Publ.Jain book house, New Delhi, India

DM2307 Fire and Fire Safety (E)

Course Outcomes

CO	EXPECTED COURSE OUTCOME	LEARNING DOMAINS	PSO
CO1	Understand the fundamentals of fire, including types of combustion, stages of fire development, and classifications based on material, fostering a comprehensive knowledge of fire behavior.	U, An	1, 3, 4
CO2	Analyze the products of combustion, focusing on flame characteristics, smoke movement, and their effects on human health, integrating knowledge of smoke control principles in buildings.	An, E	2, 3, 5
CO3	Evaluate fire ground operations, including preplanning, control methods, personnel safety, and ventilation procedures, to enhance practical skills in fire response and rescue	E, An	1, 4, 5
CO4	Assess electrical fire hazards, safe maintenance procedures, and compliance with statutory requirements, emphasizing safety provisions outlined in the Indian Electricity Act & Rules.	An, E	2, 4, 5
CO5	Demonstrate knowledge of medical fire aid and safety protocols related to radioactive materials and explosives, highlighting occupational health practices and first aid measures.	E, An	1, 3, 5

UNIT I

Introduction to fire, Types of combustion rapid, spontaneous, explosion; Development of fire incipient, smoldering, flame and heat stages; Explosion physical explosion, chemical

explosion; Special kinds of combustion Flash fire, Pool fire, Deep seated fire, Spillover, Boil over, Dust explosion, Classification of fire based on material.

UNIT II
Product of combustion flame, heat, smoke, fire gases; Flame and its characteristics, Effect of heat exposure to human body, Smoke – constituents of smoke, smoke movement in buildings, modeling of smoke movement; Smoke control in buildings natural and mechanical ventilation, pressurization; Design principles of smoke control using pressurization technique; Principles of smoke vent design.

UNIT III
Fire ground operations preplanning, action on arrival and control, methods of rescue, methods of entry. Personnel safety. Control procedure and use of other safety equipment. Ventilation and salvage operations, mine fires, Safety procedures

UNIT IV
Electrical fires – hazards of static electricity. Safe procedures for electrical maintenance statutory requirements. Safety provisions in Indian Electricity Act & Rules
UNIT V

Medical fire aid; Radioactive and explosives-Occupational health and first aid.

References:

1. David L. Goetsch, Occupational Safety and health, Prentice Hall Ron Hirst,"Underdowns
   Practical Fire Precautions", Gower Publishing Company Ltd., England, 1989
2. Rao .S.,and Saluja,H.L. : Electrical Safety, Fire Engineering and Safety Management, Khanna Publishers, Delhi.
3. Standard & Ashutosh D. Kaushik,(2013) Forest Fire Disaster Management

DM2308 Practical

Course Outcomes

CO	EXPECTED COURSE OUTCOME	LEARNING DOMAINS	PSO
CO1	Demonstrate proficiency in onscreen digitizing techniques for point, line, and polygon features, enhancing technical skills in GIS data creation.	E	1, 2, 4
CO2	Design and develop a structured GIS database, focusing on data organization and management to support efficient querying and analysis.	An, E	1, 3, 5
CO3	Create effective map layouts and thematic maps, including road, drainage, contour, land use, and vulnerability maps, to communicate spatial information.	E, C	2, 3, 4
CO4	Implement data editing and layer management techniques, enhancing the ability to refine GIS data and improve map symbology for better visualization.	An, E	2, 4, 5
CO5	Prepare a Standard Operating Procedure (SOP) for a selected institution, demonstrating the application of GIS tools and	C, An	1, 3, 5

methodologies in real-world settings.

Section A (Geographical Information System)

1. Onscreen digitizing (point, line and polygon)
2. Data base design
3. Layout preparation
4. Querying data base
5. Displaying data
6. Editing data
7. Working with layers and map symbology
8. Thematic Map preparation:
    a) Road Map
    b) Drainage map
    c) Contour map
    d) Land use map
    e) Vulnerability map

Section B

Standard operation Procedure (SOP) for any school/ industrial unit/Government office/Panchayath Raj Institution. (Students are required to visit any School/Establishment/Industrial Unit/Government office/Panchayath Raj Institution to prepare SOP)

DM2401: Project work and Viva voce

CO	EXPECTED COURSE OUTCOME	LEARNING DOMAINS	PSO
CO1	Identify and formulate a research problem related to a specific disaster in the chosen study area, demonstrating critical thinking and problem-solving skills.	An	1, 2, 3
CO2	Conduct a thorough literature review and background study, integrating various research methodologies and technologies to assess the identified problem.	An, E	1, 2, 4
CO3	Apply appropriate technological tools and techniques for data collection and analysis, showcasing practical skills in geospatial and statistical methods.	E, C	2, 3, 4
CO4	Evaluate and interpret research findings, drawing conclusions that address the identified problem and provide recommendations for disaster management strategies.	An, E	1, 3, 5
CO5	Present research outcomes effectively through a structured viva voce, demonstrating communication skills and the ability to defend research findings to an academic audience.	C	1, 3, 5

ABBREVIATIONS
R- remember, U-Understand, Ap-Apply, An –Analyze, E- Evaluate, C-Create