New Vision IAS Academy
....wings to aspirations

CLASS NOTES
DISASTER MANAGEMENT

INTRODUCTION :

- Disaster - French (Origin of Word)
- A disaster is a result from the combination of hazard, vulnerability and insufficient capacity or measures to reduce the potential chances of risk

FEATURES OF A DISASTER

- Described as " Catastrophic Situation " in which the normal pattern of life or ecosystem has been disrupted
- Undesirable Occurrence
- Sudden Onset: Little time for preparation - Strikes Suddenly with Little or No Warning
- Causes Disruption of Life and Property
- Impacts: Society , Economy, Environment, Health -Food Security

Define Disaster :

In India , As per the Disaster Management Act 2005, a disaster is defined as "a catastrophe, mishap, calamity or grave occurrence in any area, arising from natural or man-made cause, or by accident or negligence which results in substantial loss of life or human suffering or damage to, and destruction of property, or damage to, or degradation of, environment, and is of such a nature or magnitude as to be beyond the coping capacity of the community of the affected area

Types of Disaster :

Table 7.2 : Classification of Natural Disasters

Atmospheric	*Terrestrial*	*Aquatic*	*Biological*
Blizzards Thunderstorms Lightning Tornadoes Tropical Cyclone Drought Hailstorm Frost, Heat Wave or Loo.Cold Waves, etc.	Earthquakes Volcanic Eruptions Landslides Avalanches Subsidence Soil Erosion	Floods Tidal Waves Ocean Currents Storm Surge Tsunami	Plants and Animals as colonisers (Locusts, etc.). Insects infestation—fungal, bacterial and viral diseases such as bird flu, dengue, etc.

Major Natural Disasters

- About Hydro-Meteorological Disasters
- About Geological Disasters
- Flood
- Cyclone
- Drought
- Earthquake

Minor Natural Disasters

- Cold wave
- Thunderstorms
- Heat waves
- Mud slides
- Storm

Major Manmade Disaster

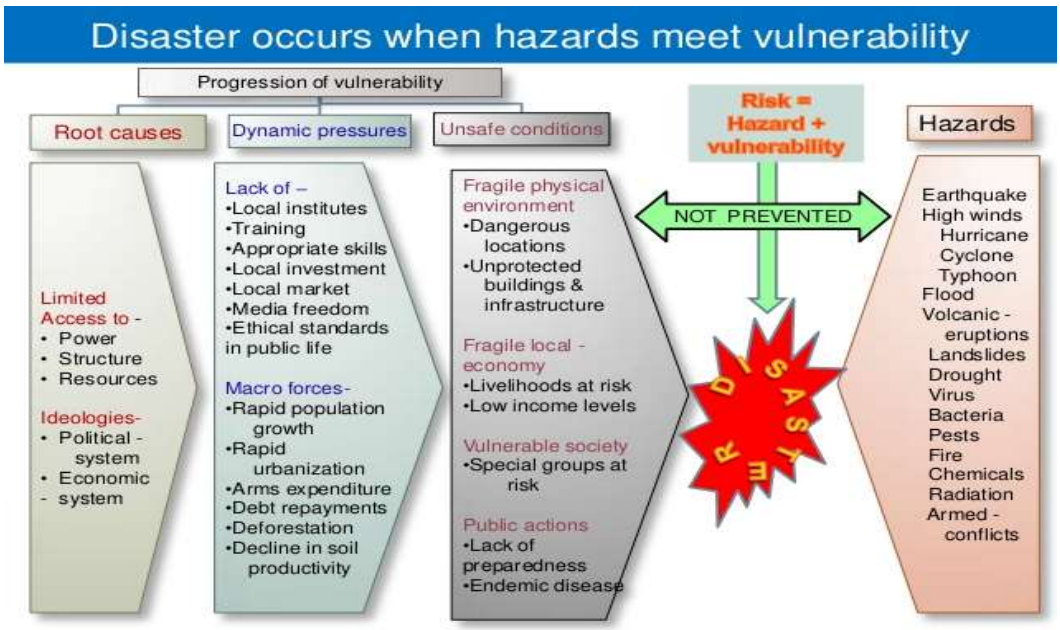
- Setting of fires
- Epidemic
- Deforestation
- Pollution due to prawn cultivation
- Chemical pollution
- Wars

Minor Manmade Disaster

- Road / train accidents, riots
- Food poisoning
- Industrial disaster/ crisis
- Environmental pollution

Relationship : Hazard, Vulnerability and Disaster:

- Hazards become disasters when vulnerability is high and coping capacity is low.
- Disaster occurs only when hazards and vulnerability meet.
- Hazard (a triggering event) + Vulnerability (inadequate resources, sick and elderly, lack of awareness, etc.) = Disaster.



Hazard :

- Hazard: Harmful triggering threatening event or destructive physical phenomenon that can cause harm to people, property, or the environment
- Characteristics : its potential to cause damage when it interacts with vulnerable systems or populations.
    - **Risk** - is combination of probability of an event. Risk: The likelihood of a hazard causing harm based on exposure and vulnerability.
    - **Exposure -** is in terms of People, buildings, businesses, infrastructure
    - **Capacity -** is combination of all the strengths, attributes and resources available within a community, society or organization
    - Disaster Produce a range of Impacts called " Element at risk"

Define: Element at Risk

- Direct effects : deaths, injuries and physical damage , economies , agriculture , food security , water sanitation, environment and Health and more impact high on weaker sections and poor people.
- Indirect impacts: include the ripple effect resulting from the flow of goods, services, unemployment etc, local price rise.

Vulnerability

- refers to the susceptibility of a community or system to suffer harm when exposed to hazards
- The potential for loss to an individual, community or place because of a disaster that is affected by geographical as well as social conditions
- is Characteristics and circumstances of a community, that make it susceptible to the damaging effects of a hazard

Types :

- **Physical Vulnerability:** Structural integrity of buildings and infrastructure (e.g., earthquake-resistant designs).
- **Social Vulnerability**: Socioeconomic factors such as poverty levels, education access, and social networks that affect resilience.

- **Environmental Vulnerability:** Conditions related to environmental degradation or geographical location (e.g., coastal areas prone to flooding).
- **Institutional Vulnerability**: The effectiveness of governance structures and emergency response systems in place.

TANGIBLE VS. INTANGIBLE VULNERABILITY:

Tangible:

1. People: Lives, health, security, living conditions
2. Property: Services, physical property loss.
3. Economy: Loss of production.
4. Environment: Natural resource depletion.

Intangible:

1. Social Structures: Family and community relationships.
2. Cultural Practices: Religious and agricultural.
3. Cohesion: Disruption of normal life.
4. Motivation: Will to recover, government response

Main Definition : Disaster Management

- Disaster management refers to the systematic process of planning, organizing, coordinating, and implementing measures to mitigate the impacts of disasters, respond effectively when they occur, and facilitate recovery afterward
- Disaster Management can be defined as the organization and management of resources and responsibilities for dealing with all humanitarian aspects of emergencies, in particular preparedness, response and recovery in order to lessen the impact of disasters.

Why Dm is essential component of Public Policy Framework?

- Disaster Management occupies an key place in the policy framework
- Because it includes the strategies and actions taken to prepare for, respond to, recover from, and mitigate the impacts of disasters.
- This integration into policy frameworks is crucial for several reasons
- Comprehensive Planning
- Coordination Among Agencies
- Resource Allocation —financial, human, and material—necessary for disaster preparedness and response. includes funding for training personnel, purchasing equipment, and developing infrastructure resilient to disasters.
- Public Awareness and Education helps communities understand how to respond effectively during a disaster, potentially saving lives
- Legal Frameworks: Disaster management policies establish legal frameworks that define roles, responsibilities, and protocols for action during emergencies.
- Recovery and Rehabilitation: Post-disaster recovery is a critical aspect of disaster management policies
- Mitigation Strategies: Incorporating disaster risk reduction strategies into policy frameworks helps minimize the impact of future disasters. This may involve land-use planning, building codes enforcement, environmental conservation efforts, and investment in resilient infrastructure.
- Monitoring and Evaluation: Effective policies include mechanisms for monitoring disaster risks and evaluating response efforts post-event. Continuous improvement based on lessons learned from past disasters enhances future preparedness.
- In summary, integrating disaster management into policy frameworks is vital for fostering resilience within communities against natural or man-made disasters. It ensures comprehensive planning, coordination among stakeholders, efficient resource use, public education, legal clarity, effective recovery processes, proactive mitigation strategies, and ongoing evaluation—all essential elements in reducing vulnerability to disasters.

Key Components of Disaster Management

Disaster management is an essential framework designed to minimize the adverse effects of disasters through comprehensive planning and coordinated action across all phases—from preparedness through recovery.

Disaster Management includes administrative decisions and operational activities that involve the key components :

- Prevention
- Mitigation - Reducing the impact of disasters through risk assessment and preventive measures.
- Preparedness- Planning and training to ensure readiness for potential disasters
- Response- Immediate actions taken to address the effects of a disaster, including emergency services and relief efforts.
- Recovery - Processes aimed at restoring affected areas and communities to normalcy after a disaster.
- Recovery: Recovery is used to describe the activities that encompass the three overlapping phases of emergency relief, rehabilitation and reconstruction.
- Rehabilitation: Rehabilitation includes the provision of temporary public utilities and housing as interim measures to assist long-term recovery.
- Reconstruction: Reconstruction attempts to return communities to improved pre-disaster functioning. It includes such as the replacement of buildings; infrastructure and lifeline facilities so that long-term development prospects are enhanced rather than reproducing the same conditions, which made an area or population vulnerable in the first place.

So Disaster Management is a multi-disciplinary area in which a wide range of issues that range from forecasting, warning, search and rescue, relief, reconstruction and rehabilitation are included

- It is multi-sectoral as it involves administrators, scientists, planners, volunteers and communities.
- Their roles and activities span the pre-disaster, during disaster and post-disaster plans.
- All these activities are complementary and supplementary to each other and here is a critical need for coordinating these activities

As per Disaster Management Act, 2005,

i. "Disaster management" means a continuous and integrated process of planning, organising, coordinating and implementing measures which are necessary or expedient for:
ii. Prevention of danger or threat of any disaster;
iii. Mitigation or reduction of risk of any disaster or its severity or consequences;
iv. Capacity-building;
v. Preparedness to deal with any disaster;
vi. Prompt response to any threatening disaster situation or disaster;
vii. Assessing the severity or magnitude of effects of any disaster; evacuation, rescue and relief;
viii. Rehabilitation and reconstruction;

INTERNATIONAL DISASTER MANAGEMENT FRAMEWORKS:

World level Action for DM:

- Yokohama Strategy Plan (1994) to (2005)
- the Hyogo Framework for Action (2005), adopted by the UN to 2015
- Sendai Framework 2015- 2030.

	Yokohama (1994)	Hyogo (2005)	Sendai (2015)
Year	1994	2005	2015
Focus	Mitigation and preparedness	Two main targets: Reduce disaster risks and increase resilience	Four priorities and seven targets
Approach	Defensive	Preventive and proactive	Preventive and proactive
Aim	How to escape from loss	Reduce risk by increasing capacity	Reduce risk and enhance resilience

Guidance	What to do (targets)	How to do (practical solutions)	Practical implementation and solutions
Local Involvement	Limited focus on local	Emphasizes local involvement	Emphasizes local and state responsibilities
Approach Type	Top-down	Combination of top-down and bottom-up	Combination of top-down and bottom-up
Scope	Focus on disasters	Broadened to DRR	Broadened scope: natural, man-made, and complex risks
Scope Details	Mainly natural disasters	Natural and man-made hazards	Natural, man-made, and complex risks
Fact-Checked Points	First international framework for disaster mitigation.	Introduced goals to reduce risks and increase resilience.	Four priorities with seven targets; comprehensive scope.
	Focused on mitigation with a defensive approach.	Emphasized local involvement and a combination of top-down and bottom-up approaches.	Provided practical solutions and broadened disaster risk scope.

SENDAI FRAMEWORK (2015-2030):

- Successor: Instrument of Hyogo Framework (2005-2015).
- Nature: Voluntary and non-binding agreement.
- Primary Role: States are primarily responsible for reducing disaster risk.
- Shared Responsibility: Involves local governments and the private sector.

7 TARGETS:

1. Reduce disaster mortality: Fewer deaths.
2. Reduce affected population: Fewer victims.
3. Reduce economic loss: Lower costs.
4. Protect critical infrastructure: Safeguard essential services.
5. Increase DRR strategies: More countries with plans.
6. Enhance international cooperation: Global support.
7. Improve early warning systems: Timely alerts.

FOUR PRIORITIES FOR ACTION

1. Understanding risk: Enhance risk knowledge.
2. Strengthened governance: Effective disaster risk management.
3. Increased DRR investment: More funding for disaster risk reduction.
4. 'Build Back Better': Improved recovery and rebuilding.

POSITIVES:

1. Integrated and inclusive measures.
2. Enhanced protection against vulnerabilities.
3. Contributes to SDGs (Sustainable Development Goals).
4. Encourages international cooperation and private sector involvement.
5. Broad, people-centered approach.

NEGATIVES:

1. Voluntary commitments (non-mandatory).
2. No specific targets (vague goals).
3. Insufficient funding from rich nations.
4. Challenges for poorer countries.
5. Limited discussion on energy production disasters and refugee issues.

WAY FORWARD:

1. Develop a centralized database (data hub).
2. Improve early warning systems.
3. Enhance communication and connectivity.
4. Focus on preparedness: Urban planning, building codes, flood proofing.
5. Explore new financial tools: Disaster insurance, catastrophic bonds.
6. Integrate disaster risk reduction with climate change efforts

INDIA ACTION FOR DM:

- The responsibility of managing disasters in India is that of the State Government
- **Nodal Ministry in India for DM - Ministry of Home Affairs**

Depending on the type of disaster, a nodal ministry has been assigned the task of coordinating all activities of the state and district administration and the other support departments/ministry.

Disaster: nodal ministry

1. Earthquake: ministry of earth sciences
2. Flood: ministry of water resources
3. Drought, hailstorm and pest attack:, ministry of agriculture
4. Landslide: ministry of mines
5. Avalanche: ministry of defence
6. Forest fire: ministry of environment and forests
7. Nuclear disaster: deptt. Of atomic energy
8. Industrial and chemical disasters: ministry of environment and forests
9. Biological disaster : ministry of health and family welfare
10. Cyclone/ tornado/ hurricane: India metrological dept. Under ministry of earth sciences
11. Tsunami: ministry of earth sciences
12. Civil war/ biological warfare : ministry of home affairs
13. Railways accidents : ministry of railways
14. Road accidents : ministry of road and transport
15. Air accidents : ministry of civil aviation
16. Urban flooding : ministry of urban development

NIDM

- Formed 1995
- President : Home Minister of India
- Under Ministry of Home Affairs
- HQ Delhi
- Formerly National Centre for Disaster Management
- is a premier institute for training and capacity development programs for managing natural disasters in India, on a national as well as regional basis
- The NIDM has been mandated by the Govt. of India (NDMA – as per DM Act 2005, guidelines for NIDM) to be a deemed University and institute of excellence on higher learning and capacity building

NDMA: National Disaster Management Authority (NDMA),

- Is the apex body for Disaster Management in India.
- Headed by the Prime Minister of India,
- HQ Delhi
- This is an agency of the Ministry of Home Affairs
- Primary purpose is to coordinate response to natural disaster and for capacity-building in disaster resiliency and crisis response
- Setting up of NDMA and the creation of an enabling environment for institutional mechanisms at the State and District levels is mandated by the Disaster Management Act, 2005.
- NDMA is mandated to lay down the policies, plans and guidelines for Disaster Management.

NDMA Act 2005

- Framework for effective disaster management.
- Provides institutional mechanisms like NDRF and NIDM.
- Roles: NDMA (policy), NDRF (rescue), NIDM (capacity building).
- Chairperson - Prime Minister of India
- Vice-Chairperson - Appointed by the Chairperson
- Members - Up to nine members, appointed experts

National Disaster Response Force (NDRF)

- **Formed 2006**
- **Is under the national disaster management authority**
- **Presently, the NDRF comprises 16 Battalions drawn from the CAPF, viz BSF, CISF, CRPF, ITBP, SSB and Assam Rifles**
- **The total strength of each battalion is approximately 1149.**
- **These ndrf battalions are located at 16 different locations in the country based on the vulnerability profile to cut down the response time for their deployment**
- **Under ministry of home affairs**
- **Bases: guwahati, nadia - west bengal, cuttuck, velore , pune, vadodara, bhatinda, ghaziabad ,patna, guntur in andhrapradesh, varanasi , itanagar.**
- **Backbone of relief and rescue operations in the country**

NDMP 2016

- Aligns with SDGs and Sendai Framework.
- Covers all disaster phases: Prevention, Mitigation, Rescue, Rehabilitation, Recovery
- Emphasizes Mainstreaming DRR and Building Back Better
- Responsibility and Accountability clearly defined.

Issues with NDMP 2016

- No definite time frame or targets.
- Funding sources not included.
- No mention of disaster insurance.
- Role of corporates and industries not integrated.

VULNERABILITY PROFILE OF INDIA:

India, due to its unique geo-climatic and socio-economic conditions, is vulnerable, in varying degrees, to floods, droughts, cyclones, tsunamis, earthquakes, urban flooding, landslides, avalanches and forest fire
Almost 85% of the country is vulnerable to single or multiple disasters .

- Out of 36 States and Union Territories (UTs) in the country, 27 are disaster prone.
- 59% of the area is prone to earthquakes.
- 12% of the land is flood-prone.
- 8% of the land is vulnerable to cyclones. 7516 KM - 5700 km prone to cyclones
- 70% of the cultivated land is drought-prone.
- 57% of the area lies in high seismic zones.
- 25% of the area is prone to landslides.
- 60% of forest area is prone to forest fires.
- 21% of forest area is highly fire-prone
- Fire incidents, industrial accidents and other manmade disasters involving chemical, biological and radioactive materials are additional hazards, which have underscored the need for strengthening mitigation, preparedness and response measures.
- India is also vulnerable to Chemical, Biological, Radiological and Nuclear (CBRN) emergencies and other man-made disasters. Terrorism and stampede also add new dimension to manmade disasters.

Impact of disaster on Old people and disabled people:

- Infrastructures for disabled is lacking
- Less financial resources
- Dependent on other people
- Exclusion feeling
- Poor strength and weak resistance capacity
- Cognitive impairments makes them vulnerable

Impact of disaster on Poor People/ weaker sections

- Poor section of people is more affected as they directly dependent on natural resources. So poverty interlinked with disaster
- Also, large scale Rural- Urban migration takes place, increase social conflict decrease social capital.

Social Capital :

- It refers to the social interaction
- formed by the networking & the social cohesiveness or interaction with people working in various affairs.

DISASTER MANAGEMENT CYCLE

Key Phases of Disaster Management

There are three key phases of activity within disaster management:

1. Pre – Disaster: Before a disaster to reduce the potential for human, material or environmental losses caused by hazards and to ensure that these losses are minimized when the disaster actually strikes.
   Focus : Prevention and Mitigation, Preparedness
2. During Disaster: It is to ensure that the needs and provisions of victims are met to alleviate and minimize suffering.
   Focus : Response
3. Post Disaster: After a disaster to achieve rapid and durable recovery which does not reproduce the original vulnerable conditions
   Focus: Recovery, Rehabilitation. Reconstruction and Development

Disaster risk management:

- Disaster risk management (DRM) is a comprehensive approach that includes the application of policies and strategies aimed at reducing disaster risks, managing existing risks, and enhancing resilience against disasters and ensuring recovery through community involvement and strategic planning.

Key Principles :

- Understanding Risk Assessment
- Hazard and vulnerability analysis
- Involves various stakeholders- Government Bodies, NGO, Community and Private sector
- Strengthening resilience and governance
- Reactive and Proactive or Holistic Approaches

DISASTERS EARLIER APPROACH (REACTIVE/DRR BEFORE SENDAI)

Based on 4 Rs:

Rescue

1. Search & rescue operations.
2. Rapid damage & needs assessment.
3. Provision of relief and first aid.
4. Temporary shelters and humanitarian assistance.
5. Eg. Immediate relief efforts during the 2004 Indian Ocean Tsunami

Relief

1. Provision of food, water, and medical aid.
2. Eg. Relief camps set up after the 2015 Nepal earthquake.

Rehabilitation

1. Restore basic services & lifeline.
2. Resume normal patterns of life.

3. Eg. Rehabilitation programs post the 2008 Sichuan earthquake.

Restoration

1. Restoration of all services and local infrastructure.
2. Replacement of damaged physical infrastructure.
3. Eg. Reconstruction efforts in New Orleans post Hurricane Katrina.

MEASURES THIS TIME

1. Disaster Management Act (2005
2. National Policy on Disaster Management (2009)
3 . National Disaster management plan
4 . National platform for disaster risk reduction

NEW APPROACH (RESPONSIVE/HOLISTIC/DRR AFTER SENDAI)

Based on 3 Ps:

Prevention

- Measures to prevent or mitigate the impact of disasters.
- Eg. Flood barriers in the Netherlands
- Earthquake - Strict building codes (e.g., Building regulations in Japan
- Landslide- . Slope stabilization measures (e.g., Retaining walls in Himachal Pradesh)

P**reparedness**

- Activities to prepare for potential disaster events.
- • Eg. Earthquake drills in Japan.
- Earthquake drills and preparedness programs
- Landslide early warning systems

Proofing

- Strengthening infrastructure and systems to withstand disasters.
- Eg. Cyclone shelters in Odisha, India.
- Shelter belts near coastal region
- Earthquake -Retrofitting of structures
- Afforestation and reforestation (e.g., Reforestation projects in the Western Ghats)

Key Lines : NDMA Guidelines

- Assessment of Damage of tangible vulnerability
- Create Monitoring cells
- Encourage NGO, PRI, ULB to generate awareness
- Increase coping capacity by providing training and capacity building measures
- Focus more on risk assessment (PMP) than crisis management (RRR)
- Preparation of Hazard and vulnerability maps
- Integration of disaster management plans with Developmental Plans

To Address Challenges we need Comprehensive Approach :

Focus on Risk Assessment :

- Preventive Measures
- Mitigation Strategies
- Preparedness Measures
- Sustainable Practices
- Community Participation

LONG TERM PREVENTION AND MITIGATION MEASURES

can be broadly be divided under three heads -

i. Structural Measures
ii. Non-structural measures.

STRUCTURAL MEASURES

1. Shelter Belts: (Example: Green Belt in New York)
2. Embankments: (Example: Thames Barrier in London)
3. Engineering Solutions: e.g., retention walls. (Example: Rotterdam Flood Defenses)
4. Forests and Mangroves: (Example: Sundarbans Mangroves)

NON-STRUCTURAL MEASURES

- Legislation and Policy: Implement disaster-resilient laws and guidelines. (Example: National Building Code of India)
- Mapping and Land Use Planning: Effective zoning and mapping. (Example: FEMA Flood Maps)

- Information Dissemination: Regular updates and warnings. (Example: Japan Meteorological Agency)
- Response Structures: Clearly defined roles and responsibilities.
- Awareness and Training: Continuous public education and training. (Example: Disaster Preparedness Workshops)

Disaster risk reduction

- focuses on preventing new risks, reducing existing vulnerabilities, through comprehensive strategies that involve community participation and integration into broader development frameworks.

PRIME MINISTER'S TEN POINT AGENDA ON DRR:

1. **Disaster Integration**: Embed risk management in all sectors.
2. **Universal Coverage**: Include all from poor to nations.
3. **Women's Involvement**: Central role in management.
4. **Risk Mapping**: Invest globally in mapping.
5. **Tech Leverage**: Enhance with technology.
6. **University Network**: Develop research and expertise.
7. **Social Media**: Utilize for risk reduction.
8. **Local Capacity**: Build on indigenous practices.
9. **Lessons Learned**: Study disasters for insights.
10. **International Cohesion**: Strengthen global response.

PM Ten Point Agenda for DRR

the PM Ten Point Agenda for Disaster Risk Reduction provides a comprehensive framework aimed at strengthening resilience through institutional frameworks, community engagement, risk assessment, early warning systems, capacity building, financial mechanisms, resilient infrastructure development, climate adaptation strategies, research innovation, and international cooperation.

1. All development sectors must imbibe the principles of disaster risk management
2. Risk coverage must include all, starting from poor households to SMEs to multi-national corporations to nation states
3. Women's leadership and greater involvement should be central to disaster risk management
4. Invest in risk mapping globally to improve global understanding of Nature and disaster risks
5. Leverage technology to enhance the efficiency of disaster risk management efforts
6. Develop a network of universities to work on disaster-related issues
7. Utilise the opportunities provided by social media and mobile technologies for disaster risk reduction
8. Build on local capacity and initiative to enhance disaster risk reduction
9. Make use of every opportunity to learn from disasters and, to achieve that, there must be studies on the lessons after every disaster
10. Bring about greater cohesion in international response to disasters

Other Measures:

- Remote Sensing satellites tools should be used to integrate spatial data such as topography, hydrology, land use, land cover, settlement pattern and built structure as well as non-spatial data such as demography, socio-economic conditions and infrastructure on a common platform for real time monitoring of crisis situations and for scientific assessment of damages.
- Awareness generation programmes should be undertaken using tools of social marketing.
- A responsible media, which is also well informed about all aspects of disaster, is a very powerful tool for sensitizing people. Proactive disclosures about all aspects of disaster management would build a healthy relationship between the media and disaster management agencies.
- Details of past accidents and disasters and the lessons learnt, should be documented and kept in the public domain. The Disaster Management Authorities have to take up this task.
- The activities in the disaster management plans should be included in the development plans of the line agencies and local bodies like panchayats and municipal bodies.
- Environment management should be made an integral part of all development and disaster management plans.

KEY WAY FORWARD LINES :

- **From 'Response and Relief' to 'Prevention and Mitigation'**

Uses: Emphasizes a shift from reacting to disasters to preventing and mitigating them.
Example: "Adopting a prevention and mitigation-centric approach will significantly reduce disaster impacts."

- **From 'Disaster Management' to 'Disaster Risk Management'**

Uses: Focuses on managing risks rather than just handling disasters.

Example: "Transitioning to disaster risk management allows for better preparedness and resilience."

From 'Reactive' to 'Proactive' Measures
Uses: Emphasizes taking action before disasters occur.
Example: "Proactive measures can prevent disasters from escalating into crises."

From 'Short-term Relief' to 'Long-term Resilience'
Uses: Focuses on sustainable recovery and resilience
Example: "Building long-term resilience is key to sustainable disaster recovery."

From 'Vulnerability' to 'Resilience'
Uses: Focuses on transforming vulnerable communities into resilient ones.
Example: "Building resilience reduces vulnerability and enhances disaster preparedness."

From 'Centralized Control' to 'Decentralized Empowerment'
Uses: Promotes local autonomy in disaster management.
Example: "Decentralized empowerment enables communities to respond quickly and effectively to disasters."

From 'Isolation' to 'Integrated Approach'

Uses: Advocates for coordinated efforts across sectors and regions.
Example: "An integrated approach ensures all stakeholders work together seamlessly."

From 'Ignorance' to 'Awareness and Education'
Uses: Highlights the role of public awareness and education in disaster preparedness. o Example: "Raising awareness and educating the public are crucial for effective disaster risk reduction."

From 'Temporary Solutions' to 'Sustainable Solutions'

Uses: Focuses on creating lasting solutions to disaster challenges.
Example: "Sustainable solutions ensure long-term safety and resilience."

From 'Individual Efforts' to 'Collective Action'
Uses: Emphasizes the need for collective efforts in disaster management.
Example: "Collective action amplifies the impact of disaster management initiatives."
From 'Traditional Methods' to 'Innovative Approaches
Uses: Encourages the use of new technologies and methods in disaster management.
Example: "Innovative approaches can enhance the efficiency and effectiveness of disaster management.
From 'Fragmented Policies' to 'Holistic Policies'
Uses: Advocates for comprehensive and cohesive disaster policies.
Example: "Holistic policies address all aspects of disaster risk reduction."
From 'Short-term Gains' to 'Long-term Benefits
Uses: Focuses on the long-term advantages of disaster management strategies.
Example: "Prioritizing long-term benefits leads to sustainable resilience."
From 'Top-down Command' to 'Community Empowerment
Uses: Promotes empowering local communities in disaster management.
Example: "Community empowerment ensures that disaster responses are swift and locally relevant."

From ‘Unplanned Growth’ to ‘Risk-Sensitive Development’
Uses: Advocates for development that considers disaster risks.
Example: "Risk-sensitive development prevents future disasters and ensures sustainable growth
From ‘Catastrophe Response’ to ‘Catastrophe Resilience’
Uses: Focuses on improving the ability to withstand and bounce back from catastrophic events.
Example: "Communities with strong catastrophe resilience can recover swiftly from severe disasters."
From ‘Reactive Adaptation’ to ‘Proactive Adaptive Capacity’
Uses: Emphasizes proactive measures to build adaptive capacity for future risks.
Example: "Proactive adaptive capacity prepares communities to handle evolving climate challenges."
From ‘Socio-Economic Inequality’ to ‘Inclusive Risk Management’
Uses: Focuses on addressing disparities and ensuring all groups are included in disaster management.
Example: "Inclusive risk management ensures that vulnerable populations are protected."
From ‘Linear Economy’ to ‘Circular Economy’
Uses: Moves from a traditional economic model to one that emphasizes sustainability and resource efficiency.
Example: "Adopting a circular economy reduces waste and enhances resource use efficiency."
From ‘Low Awareness’ to ‘High Disaster Literacy’
Uses: Focuses on increasing public understanding and knowledge of disaster risks.
Example: "High disaster literacy equips people with the knowledge to prepare for and respond to emergencies."
From ‘General Mapping’ to ‘Geo-Spatial Analysis’
Uses: Advances from basic hazard mapping to detailed geographic data analysis for risk assessment.
Example: "Geo-spatial analysis provides precise flood risk maps and hazard assessments."
From ‘Single Hazard Focus’ to ‘Multi-Hazard Approach’
Uses: Expands focus from individual hazards to considering multiple risks in disaster management.
Example: A multi-hazard approach addresses risks from earthquakes, floods, and storms simultaneously."
From ‘General Resilience’ to ‘Climate Resilience Hubs’
Uses: Moves from general resilience efforts to creating dedicated centers focused on climate impacts.
Example: "Climate resilience hubs offer resources and support for communities facing climate change challenges.
From ‘Unilateral Actions’ to ‘Disaster Diplomacy’
Uses: Encourages international collaboration and diplomacy in disaster response.
Example: "Disaster diplomacy fosters international cooperation for effective disaster management."
From ‘Risk Ignorance’ to ‘Risk-Informed Development’
Uses: Moves from neglecting risks to incorporating them into development planning and strategies.
Example: "Risk-informed development ensures that infrastructure projects are resilient to disasters."

Early Warning Apps by IMD

Overview:

Mobile applications developed by the Indian Meteorological Department (IMD) for weather forecasting and early warnings.

Best Practices:

Umang App: Integrates various government services, including weather updates.

- **Rain Alarm App**: Provides real-time alerts on rainfall and weather conditions.
- **Damini App:** Triggers lightning strike warnings up to three hours in advance.

Important Key words

- **Capacity** can be defined as “resources, means and strengths which exist in households and communities and which enable them to cope with, withstand, prepare for, prevent, mitigate or quickly recover from a disaster”. People’s capacity can also be taken into account. Capacities could be: it types
- **Physical Capacity**: People whose houses have been destroyed by the cyclone or crops have been destroyed by the flood can salvage things from their homes and from their farms. Some family members have skills, which enable them to find employment if they migrate, either temporarily or permanently.
- **Socio-economic Capacity**: In most of the disasters, people suffer their greatest losses in the physical and material realm. Rich people have the capacity to recover soon because of their wealth. In fact, they are seldom hit by disasters because they live in safe areas and their houses are built with stronger materials. However, even when everything is destroyed they have the capacity to cope up with it

- **Hazard:** A dangerous phenomenon, substance, human activity or condition that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damag
- **Natural hazard**: Natural process or phenomenon that may cause loss of life, injury or other health impacts, property damage, loss of livelihoods and services, social and economic disruption, or environmental damage.
- **Mitigation:** The lessening or limitation of the adverse impacts of hazards and related disasters.
- **Preparedness:** The knowledge and capacities developed by governments, professional response and recovery organizations, communities and individuals to effectively anticipate, respond to, and recover from, the impacts of likely, imminent or current hazard events or conditions.
- **Prevention:** The outright avoidance of adverse impacts of hazards and related disasters.
- **Public awareness**: The extent of common knowledge about disaster risks, the factors that lead to disasters and the actions that can be taken individually and collectively to reduce exposure and vulnerability to hazards.
- **Recovery**: The restoration, and improvement where appropriate, of facilities, livelihoods and living conditions of disaster-affected communities, including efforts to reduce disaster risk factors.
- **Response**: The provision of emergency services and public assistance during or immediately after a disaster in order to save lives, reduce health impacts, ensure public safety and meet thebasic subsistence needs of the people affected.
- **Retrofitting:** Reinforcement or upgrading of existing structures to become more resistant and resilient to the damaging effects of hazards.
- **Risk**: The combination of the probability of an event and its negative consequences. Sustainable development: Development that meets the needs of the present without compromising the ability of future generations to meet their own needs.
- **Vulnerability**: The characteristics and circumstances of a community, system or asset that make it susceptible to the damaging effects of a hazard.
- **UNFCCC:** climate change as "a change of climate which is attributed directly or indirectly to human activity that alters the composition of the global atmosphere and which is in addition to natural climate variability observed over comparable time periods"
- **Capacity development**: The process by which people, organizations and society systematically stimulate and develop their capacities over time to achieve social and economic goals, including through improvement of knowledge, skills, systems, and institutions
- **Contingency planning**: A management process that analyses specific potential events or emerging situations that might threaten society or the environment and establishes arrangements in advance to enable timely, effective and appropriate responses to such events and situations.
- **Coping capacity**: The ability of people, organizations and systems, using available skills and resources, to face and manage adverse conditions, emergencies or disasters.
- **Critical facilities**: The primary physical structures, technical facilities and systems which are socially, economically or operationally essential to the functioning of a society or community, both in routine circumstances and in the extreme circumstances of an emergency.
- **Disaster risk:** The potential disaster losses, in lives, health status, livelihoods, assets and services, which could occur to a particular community or a society over some specified future time period

EARTHQUAKES

- it is most destructive catastrophic situation mainly generated by internal /endogenic geomorphic processes ie tectonic activities
- **is** shaking and trembling of the Earth caused by energy build up beneath the Earth surface and Sudden release of energy along the fault lines in the form of seismic waves in all directions .

In India, Which Organisation is Related with Earthquake?

National Centre for Seismology (NCS) , New Delhi, is the nodal agency of the Centre under Earth sciences ministry for monitoring of earthquake activity in the country

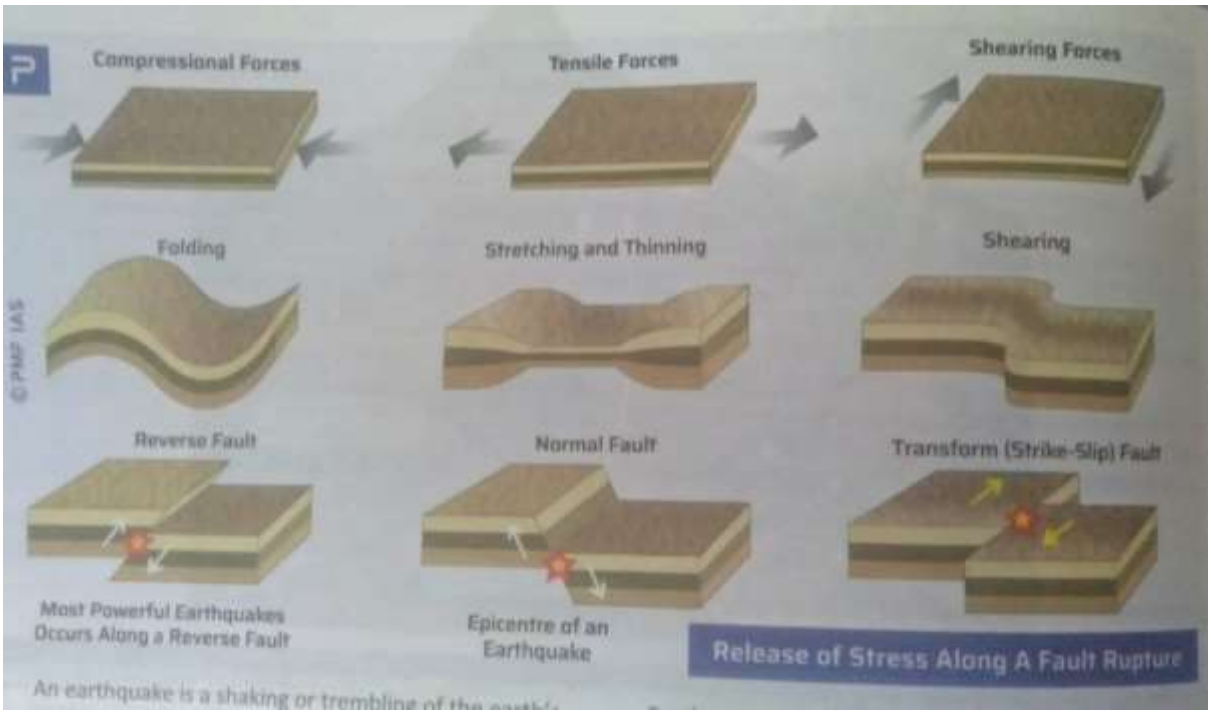
Why does the earth shake?

- The friction between Tectonic plates release sudden stored energy that travel in all directions through Earth Crust in the form of seismic waves.
- The release of energy occurs along a fault.
- A fault is a sharp break in the crustal rocks.
- Tectonic plates are constantly moving, building up stress along fault lines.
- We Conclude that Earthquakes is Release (Readjustment) of Stress along a fault Zone

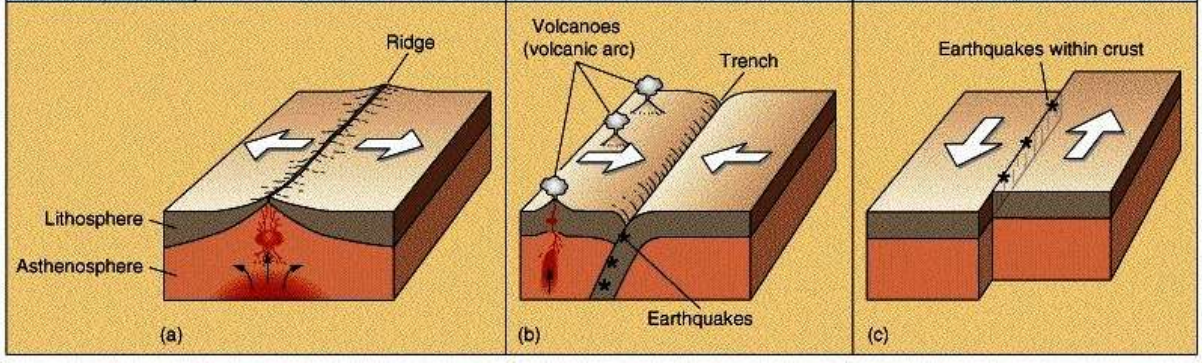
CAUSES OF EARTHQUAKE

WHICH TYPES OF PLATE BOUNDARY RELATED WITH EARTHQUAKES

- **Convergent Plate Boundary**
- **Divergent Plate Boundary**
- **Transform Plate Boundary**



Type of Margin	Divergent	Convergent	Transform
Motion	Spreading	Subduction	Lateral sliding
Effect	Constructive (oceanic lithosphere created)	Destructive (oceanic lithosphere destroyed)	Conservative (lithosphere neither created or destroyed)
Topography	Ridge/Rift	Trench	No major effect
Volcanic activity?	Yes	Yes	No



Main Cause Of Earthquakes :

- Fault Zones
- Movement of plates of earth crust or plate Tectonics (movement)
- Volcanic eruptions
- Folding and faulting of rocks
- Landslides.
- Human Induced Earthquakes are minor earthquakes that are caused by human activity like Mining, artificial lakes, Nuclear test Explosions, Dam and reservoirs creating Hydrostatic pressure or reservoir induced Seismicity earthquakes.

Reservoir Induced Earthquakes

- Dam and reservoirs creating Hydrostatic pressure and alter stress along the an existing fault zone or fracture zone .
- Also, the percolation of water weakens the soil structure and lubricates the faults.
- Water loading and unloading can significantly change the stress this lead to sudden movement along the fault zone or fracture , resulting in an earthquake.
- 1967 Koyna Dam Earthquake In Maharashtra and Sichuan earthquake china
- Bhakra Nangal Dam on sutlej
- Sardar Sarovar Dam (Narmada Valley Project)
- Tehri Dam on the Bhagirathi River in Uttarakhand
- hese examples highlight how human activities related to large reservoirs can influence geological stability and lead to significant seismic events

TYPES OF EARTHQUAKES

- Tectonic Earthquakes: Most common, caused by rock movement along fault planes. E.g., San Andreas Fault in California.
- Volcanic Earthquakes: Linked to volcanic activity, triggered by magma movement. E.g., Earthquakes around active volcanoes like Mount Vesuvius.
- Collapse Earthquakes: Minor quakes from sudden underground collapse in mining areas. E.g., Mining regions experiencing subsidence.
- Explosion Earthquakes: Human-induced seismic events from explosions. E.g., nuclear testing sites
- Reservoir-induced Earthquakes: Triggered by the weight of water in large dams. E.g., Reservoir induced seismicity near Koyna Dam (Maharashtra)

Measurements of Earthquakes :

Two Ways to measure different aspects of an earthquake:

- **Intensity:** measure of the shaking and damage caused by the earthquake
- Magnitude : measure of the size of the earthquake

- Slight (M<5.0), Moderate (5.0<M<6.9) and Great (M>7.0) depending upon the magnitude on Richter‟s scale. An earthquake having a magnitude, M<2.0 is termed as microearthquake

- Richter scale: magnitude Scale: relates to the energy released during the quake. And scale expressed in numbers 0 - 10.
- Mercalli Scale: Intensity Scale: takes into account the visible damage caused by the event. The Range of Scale from 1 to 12.
- The Medvedev–Sponheuer–Karnik scale, also known as the MSK or MSK-64, is a macroseismic intensity scale used to evaluate the severity of ground shaking on the basis of observed effects in an area of the earthquake occurrence

Earthquakes can be of three types based on the focal depth:

- Deep:- 300 to 700 kms from the earth surface
- Medium:- 60 to 300 kms
  Shallow: less than 60 kms
- The deep focus earthquakes are rarely destructive because by the time the waves reach the surface the impact reduces.
-

- Shallow focus earthquakes are more common and are extremely damaging because of their proximity to the surface

- **Major earthquakes of World : Megathrust earthquakes**

S. No.	Date	Location	Magnitude
1.	1960	Valdivia, Chile	9.5
2.	Dec 2004	Sumatra, Indonesia	9.3
3.	1964	Alaska, USA	9.2
4.	1952	Kamchatka, Russia	9.0
5.	1700	Cascadia Subduction Zone (Pacific Ocean rim)	9.0

DISTRIBUTION OF EARTHQUAKES

Most of the Earthquakes Occur in

- Earthquakes are generally associated with the weaker and isostatically disturbed areas of the globe
- The Zone of Young Mountains
- The Zone of Faulting and Fracturing
- The Zones representing the junction of Continental and Oceanic Margins.
- The Zones of Active Volcanoes
- Along Different Plate Boundaries

WORLD THREE KEY ZONES:

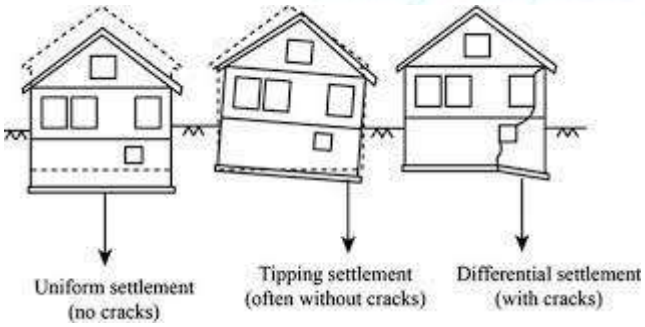
- **CIRCUM-PACIFIC BELT REGION**
- **THE MID-ATLANTIC RIDGE BELT: Purely Oceanic Earthquake Belt**
- **THE MID-CONTINENTAL BELT or Apline Mountains Belt**

EFFECTS OF EARTHQUAKES:

Earthquake is a natural hazard. The following are the immediate hazardous effects of earthquake:

(i) Ground Shaking: the vibration of the ground during an earthquake. Ground shaking is caused by body waves and surface waves.

(ii) Differential ground settlement : Differential settlement occurs when one part of a structure's foundation settles more, or faster, than the other



(iii) Land and mud slides

(iv) Soil liquefaction: is a phenomenon in which the strength and stiffness of a soil is reduced by earthquake shaking

(v) Ground lurching: horizontal shifting : irregular cracks in the ground surface due to seismic activity

(vi) Avalanches : a very large amount of snow that slides quickly down the side of a mountain (The first six listed above have some bearings upon landforms)

(vii) Ground displacement : It is the vertical shifting of the ground which can result in the rising or sinking of the ground

(viii) Floods from dam and levee failures

(ix) Fires

(x) Structural collapse : When internal load bearing structural elements fail, a building will collapse into itself and exterior walls are pulled into the falling structure

(xi) Falling objects

(xii) Tsunami -The effect of tsunami would occur only if the epicentre of the tremor is below oceanic waters and the magnitude is sufficiently high. Tsunamis are waves generated by the tremors and not an earthquake in itself.

CONSEQUENCES OF EARTHQUAKES		
Primary Damage: 1. Human lives 2. Animal lives 3. Human settlements 4. Structures 5. Infrastructure 6. Differential ground settlement	**Secondary Effects:** 1. Fires 2. Dam failures 3. Communication facilities breakdown 4. Tsunami 5. Landslides 6. Avalanches	**Tertiary Impact:** 1. Post-trauma stress disorder 2. Psychological issues 3. Livelihood loss 4. Disruption of social capital

DATA:

1. 59% of India's territory is vulnerable.
2. BIS and IMD classify India into four seismic zones

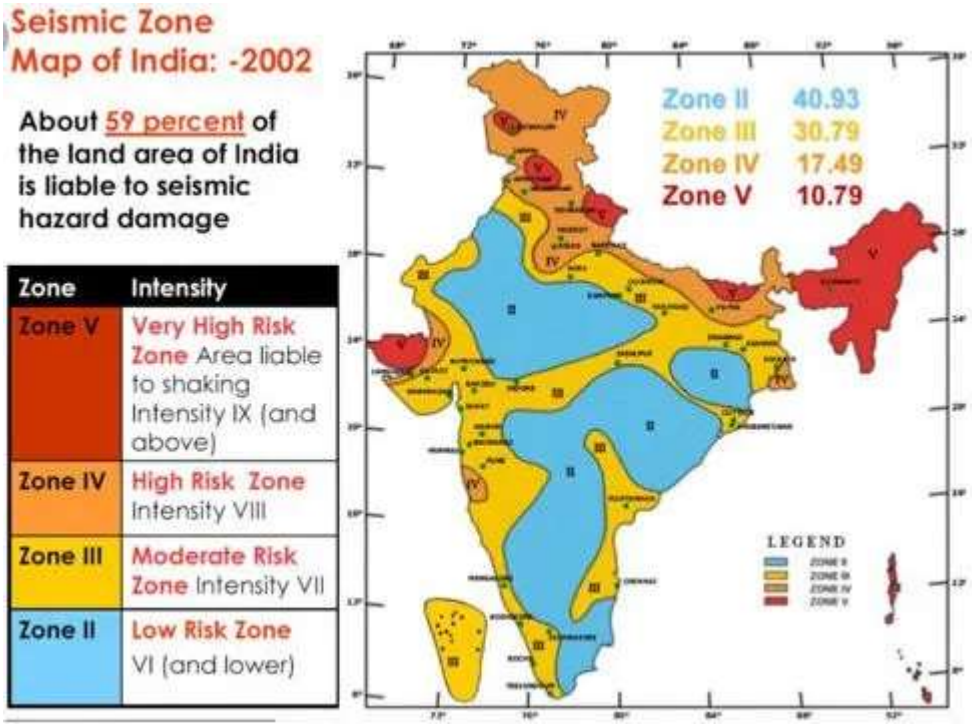
Bureau of Indian Standards

- Ministry of Consumer Affairs, Food & Public Distribution, Government of India
- It is established by the Bureau of Indian Standards Act, 2016
- Manak Bhawan, Old Delhi
- formed 1986

SEISMIC ZONES OF INDIA:

1. Zone II - Low risk
2. Zone III - Moderate risk
3. Zone IV - High risk
4. Zone V - Very high risk

India Seismic Zone Map



- Bureau of Indian Standards (BIS) prepared the seismic zoning map of India
- India has been divided into four zones – II, III, IV and V
- Zone V is seismically the most active region, while Zone II is the least.
- Around 11% of the country falls in Zone V, 18% in Zone IV, 30% in Zone III and the remaining in Zone II.

Damage risk and Intensity	**Region**
Earthquake Very high damage risk zone	The entire North-east, including all the seven sister states, the Kutch district, parts of Himachal and Jammu & Kashmir, and the Andaman and Nicobar islands. These areas may experience
Earthquake High damage risk zone	Parts of the Northern belt starting from Jammu and Kashmir to Himachal Pradesh. Also including Delhi and parts of Haryana. The Koyna region of Maharashtra is also in this zone.
Earthquake Moderate damage risk zone	A large part of the country stretching from the North including some parts of Rajasthan to the South through the Konkan coast, and also the Eastern parts of the country.
Earthquake Low damage risk zone	These two zones are contiguous, covering parts of Karnataka, Andhra Pradesh, Orissa, Madhya Pradesh, and Rajasthan, known as low risk earthquake zones.

A list of important cities falling in various seismic zones, has also been prepared by BIS and is given below:-

Town	State/UT	Zone	Town	State/UT	Zone
Agra	Utter Pradesh	III	Chitradurga	Karnataka	II
Ahmedabad	Gujarat	III	Coimbatore	Tamil nadu	III
Ajmer	Rajasthan	II	Cuddalore	Tamil Nadu	III
Allahabad	Utter Pradesh	II	Cuttack	Orissa	III
Almora	Uttrakhand	IV	Darbhanga	Bihar	V
Ambala	Haryana	IV	Darjeeling	West Bengal	IV
Amritsar	Punjab	IV	Dharwad	Karnataka	III
Asansol	West Bengal	III	Dehradun	Uttrakhand	IV
Aurangabad	Maharastha	II	Dharmpuri	Tamil Nadu	III
Baharich	Utter Pradesh	IV	Delhi	Delhi	IV
Bangalore	Karnataka	II	Durgapur	West Bengal	III
Barauni	Bihar	IV	Gangtok	Sikkim	IV
Bareilly	Utter Pradesh	III	Guwahati	Assam	V

Belgaum	Karnataka	III	Goa	Goa	III
Bhatinda	Punjab	III	Gulbarga	Karnataka	II
Bhilai	Chattiagarh	II	Gaya	Bihar	III
Bhopal	Madhya Pradesh	II	Gorakhpur	Utter Pradesh	IV
Bhubaneswar	Orissa	III	Hyderabad	Andhra Pradesh	II
Bhuj	Gujarat	V	Imphal	Manipur	V
Bijapur	Karnataka	III	Jabalpur	Madhya Pradesh	III
Bikaner	Rajasthan	III	Jaipur	Rajasthan	II
Bokaro	Jharkhand	III	Jamshedpur	Jharkhand	II
Bulandshahr	Utter Pradesh	IV	Jhansi	Utter Pradesh	II
Burdwan	West Bengal	III	Jodhpur	Rajasthan	II
Cailcut	Kerala	III	Jorhat	Assam	V
Chandigarh	Chandigarh	IV	Kakrapara	Gujarat	III
Chennai	Tamil Nadu	III	Kalapakkam	Tamil Nadu	III
Kanchipuram	Tamil Nadu	III	Pondicherry	Pondicherry	II
Kanpur	Utter Pradesh	III	Pune	Maharastha	III
Karwar	Karnataka	III	Raipur	Chattisgarh	II
Kohima	Nagaland	V	Rajkot	Gujarat	III
Kolkata	West Bengal	III	Ranchi	Chattisgarh	II
Kota	Rajasthan	II	Roorkee	Uttrakhand	IV
Kurnool	Andhra Pradesh	II	Rourkela	Orissa	II
Lucknow	Utter Pradesh	III	Sadiya	Assam	V
Ludhiyana	Punjab	IV	Salem	Tamil Nadu	III
Madurai	Tamil Nadu	II	Simla	Himanchal Pradesh	IV
Mandi	Himanchal Pradesh	V	Sironj	Madhya Pradesh	II
Mangalore	Karnataka	III	Solapur	Maharastha	III
Monghyr	Bihar	IV	Srinagar	Jammu & Kashmir	V
Moradabad	Utter Pradesh	IV	Surat	Gujarat	III
Mumbai	Maharastha	III	Tarapur	Maharastha	III
Mysore	Karnataka	II	Tezpur	Assam	V
Nagpur	Maharastha	II	Thane	Maharastha	III
Nagarjunasagar	Andhra Pradesh	II	Thanjavur	Tamil Nadu	II
Nainital	Uttrakhand	IV	Thiruvananthapuram	Kerala	III
Nasik	Maharastha	III	Tiruchirappali	Tamil Nadu	II
Nellore	Andhra Pradesh	III	Tiruvennamalai	Tamil Nadu	III
Osmanabad	Maharastha	III	Udaipur	Rajasthan	II
Panjim	Goa	III	Vadodara	Gujarat	III
Patiala	Punjab	III	Varanasi	Utter Pradesh	III
Patna	Bihar	IV	Vellore	Andhra Pradesh	III
Pilibhit	Uttrakhand	IV	Vijayawada	Andhra Pradesh	III
			Vishakhapatnam	Andhra Pradesh	II

New Delhi the capital city of India lie in zone IV where as big cities like Mumbai and Chennai are in zone III, Nagpur zone II

- Earthquakes in Indian subcontinent occur due to the north-eastward movement of the Indian Plate and its interaction with the neighboring Eurasian Plate in the north. Most of earthquakes occur in the plate boundary regions; however, a few damaging earthquakes have occurred in the plate interior regions as well.
- A few damaging earthquakes in the plate-boundary regions include the following: 1897 Shillong plateau,
- 1905 Kangra,
- 1934 Nepal-Bihar,
- 1950 Chayu-Upper Assam,
- 2004 Sumatra-Andaman,
- 2005 Kashmir and
- 2015 Gorkha earthquakes.

- In the plate interior regions, damaging earthquakes occurred in 1967 Koyna , 1993 at Killari Latur , Maharashtra, in 1997 at Jabalpur, Madhya Pradesh, and in 2001 in Kachchh, Gujarat.

Causes of Bhuj Earthquake 26 Jan 2001

- Gujarat is located 300 to 400 km from the boundary of the Indian and Eurasian Plates.
- This area faced roughly west-east rifting trend during the break up of Gondwana in the Jurassic Period.
- Continuous collision shorting the crust and Kachchh region reactivating the existing rift faults and developing new low angle thrust faults under the surface
- The 2001 Gujarat earthquake was caused by movement on a previously unknown south-dipping fault, trending parallel to the inferred rift structures

HIMALAYA Earthquakes :

- Youthful topography and unstable zone
- The Indian Plate is moving at a speed of one centimetre per year towards the North and North eastern direction and this movement of plates is being constantly obstructed by the North Eurasian Plate.
- Result: Both Plates are said to be locked with each other resulting in accumulation of Energy at different points of time.
- Excessive accumulation of Energy results in building of stress, which leads to breaking up the lock and sudden release of energy causes Earthquakes along the Himalayan arch.
  Vulnerable region: All Himalayas states and North East region.

Reason for Peninsular Region Earthquakes

- Peninsular region: oldest and most stable and mature landmass.
- Still experience severe earthquakes like in Gujarat (1819, 1956, 2001) and Maharashtra(1967 koyna and Latur 1993)
- Recently, some earth scientist have come up with a theory of emergence of fault line and energy build up along the fault line represented by river Bhima(Krishna) near latur and osmanabad(MS) and the possible breaking down of the Indian Plate.
  The other seismically active regions of the country include the Gulf of Khambhat and Rann of Kutch in Western Gujarat, parts of peninsular India, the islands of Lakshadweep and Andaman and Nicobar Islands

Why Himalayas are more prone to earthquakes than Western Ghats?

- The Himalayas and the Western Ghats have been formed by the plate movements and are prone to a variety of disasters including earthquakes and landslides. However, the Himalayas have more chances of earthquakes when compared to Western Ghats. The reasons are:
- The Himalayas are Young – tertiary mountains whereas Western Ghats are Older-block Mountain.
- Himalayas has not yet reached its isostatic equilibrium which makes it more prone to frequent earth quakes but on the other hand Western Ghats are located on stable part of Indian plate and the chances of colliding of plates in this region are less when compared to Himalayas.
- Indian plate is moving northwards and subsiding under Eurasian plate, 5-10 cm a year. This leads to rising of Himalayas every year whereas Moving of Indian plate does not affect Western Ghats. This also affects the earthquakes that come in the region.
- Unplanned growth of houses in the hill areas increases the damage and the loss that occurs due to the disasters in the region whereas limiting the damage in Western Ghats.
  Thus, the main reason for more earthquakes in the Himalayas is due to proneness to more plate movements and due to instability of the Himalayan Mountains.

Focus Pre Disaster : PREPAREDNESS MEASURES

- Community preparedness
- Public Education
- Planning
- Post Disaster Assistance Needs
- Earthquake Response Plan

NATIONAL INITIATIVES

1 National Earthquake Risk Mitigation Project (NERMP)

2. National Building Code of India (NBC)

3. Building Materials & Technology Promotion Council (BMTPC)

4. National Centre for Seismology (NCS)

5. Tsunami Early Warning System

6. Seismic Retrofitting- Seismic retrofitting is the process of strengthening existing buildings to make them more resistant to earthquakes

- Design appropriate earthquake resistant building plans based on the relevant BIS Codes and other guidelines of BMTPC, HUDCO and NDMA for across the country.
- Housing and Urban Development Corporation (HUDCO) & Building Materials & Technology Promotion Council (BMTPC) have also published guidelines and brochures for construction and retrofitting of buildings.

National Building Code of India, 2005

- It is a comprehensive building code for regulating the building construction activities across the country was formulated by the Bureau of Indian Standards

Note : BMTPC Building Materials and Technology Promotion Council (BMTPC)

- Is an autonomous body under Ministry of Housing and Urban Affairs.
- It is registered under the Societies Registration Act, 1860 and is primary task is the mainstreaming of new construction technologies.
- It is responsible to undertake research, development and large scale application of new building material technologies.

NDMA'S 6 PILLARS OF EARTHQUAKE MANAGEMENT IN INDIA

1. Earthquake-Resistant Design and Construction of New Structures
2. Seismic Strengthening and Retrofitting of Lifeline and Priority Structures
3. Regulation and Enforcement of Building Codes and Other Safety Codes
4. Creation of Public Awareness on Seismic Safety and Risk Reduction
5. Capacity Development Including Education, Training, R&D, and Documentation
6. Emergency Response: Incident Command System by Local Administration

STRUCTURAL MEASURES :

- Structural measures involve physical modifications to buildings and infrastructure to enhance their resistance to earthquake shaking.
- Retrofitting Existing Structures- This involves strengthening existing structures to improve their seismic performance
- **Ductile Concrete and Steel:** Using ductile materials in construction allows structures to deform significantly without fracturing, absorbing energy during an earthquake
- Building Materials and Techniques: The use of appropriate building materials is vital for earthquake-resistant construction.
- Infrastructure Development: Critical infrastructure such as bridges, dams, and hospitals
- Land Use Planning: Proper land use planning helps avoid construction in high-risk zones prone to earthquakes. Zoning laws can restrict development in areas identified as vulnerable based on geological surveys

NON-STRUCTURAL MEASURES

- Emergency Planning and Preparedness: Developing and implementing emergency plans, conducting drills, and educating occupants on earthquake safety procedures can help minimize casualties and facilitate effective response
- **Land-Use Planning:** Careful land-use planning can help avoid building in areas with high seismic risk or on unstable soils
- **Early Warning Systems:** Early warning systems can provide valuable seconds or minutes of warning before strong shaking arrives, allowing people to take protective actions.
- Public Awareness Campaigns: Educating the public about earthquake preparedness is essential
- Training and Drills: Regular training sessions for emergency responders and community drills help prepare citizens for effective evacuation procedures during an earthquake event.
- Community-Based Approaches: Engaging local communities in disaster preparedness initiatives fosters resilience at the grassroots level.

- **Strengthening Emergency Response Capabilities:** Enhancing the capacity of emergency responders to effectively handle earthquake disasters
- **Promoting Community-Based Disaster Preparedness:** Empowering local communities to take proactive measures to reduce their vulnerability to earthquakes.
  By implementing a combination of structural and non-structural measures, communities can significantly reduce the risks associated with earthquakes and improve their resilience to seismic events

The Critical Areas Of Concern For The Management Of Earthquakes In India Include The:
CHALLENGES

- Lack of awareness among various stakeholders about the seismic risk;
- lack of adequate preparedness and response capacity among various stakeholder groups.
- Inadequate enforcement of earthquake-resistant building codes
- Lack of formal training among professionals in earthquake-resistant construction practices
- Lack of preparedness and poor response capacity of various stakeholder groups
- Lack of awareness among various stakeholders about the seismic risk

INTERNATIONAL COOPERATION

1. Sendai Framework for Disaster Risk Reduction
2. Coalition for Disaster Resilient Infrastructure (CDRI)

News : Asia-Pacific Ministerial Conference on Disaster Risk Reduction (APMCDRR) Oct 2024 in Manila, Philippines
India is committed to implement inclusive and proactive actions to mitigate the impact of disasters, in line with the Prime Minister of India Shri Narendra Modi's 10-point agenda for Disaster Risk Reduction (DRR) strategies
The Minister focused on the key priorities in Disaster Risk Reduction (DRR) viz. Early Warning System (EWS) and Early Action, Disaster Resilient Infrastructure and Financial Provisions for DRR

15th Finance Commission of India has allocated USD 30 billion for the National Disaster Risk Management Fund (NDRMF) and State Disaster Risk Management Fund (SDRMF) for the financial cycle 2021-22 to 2025-26.

The Coalition for Disaster Resilient Infrastructure (CDRI)

- an international coalition of countries, United Nations (UN) agencies, multilateral development banks, the private sector, and academic institutions
- aims to promote disaster-resilient infrastructure
- It was launched by the Indian Prime Minister Narendra Modi at the 2019 UN Climate Action Summit in September 2019 Modi's "experience in dealing with the aftermath of the 2001 Gujarat earthquake" as the chief minister led him to the idea
- HQ Delhi
  Total : 47 members countries - and is providing technical assistance and capacity-building for investing in disaster-resilient infrastructure

EARTH QUAKE HAZARD MITIGATION

- Focus should be on disaster preparedness and mitigation rather than curative measures.
- Establishing Earthquakes monitoring centres/ seismological centres for regular monitoring and information among the people in the vulnerable areas.
- Preparing a vulnerability map of the country and dissemination of vulnerability risk information among the people and educating the, about the ways and means minimising the adverse impact of disasters.
- Modifying house type and buildings design in the vulnerable areas.
- Discouraging construction of high rise buildings, large industrial establishments and big urban centres in such areas.
- Enhancing the safety of dams and reservoirs
- Scientific Seismic Zonation and seismic micro zonation is needed.
- Focus should be more on non structural measures and inter agency cooperation.
- Investing in DRR : structural and non structural measures
- Need safety audit
- In terms of capacity development training and awareness generation is needed.

- Mock drills , community based disaster managements needed
- Empowering women, marginalised and persons with disabilities.

OPINIONS FOR EARTHQUAKE MITIGATION

- Seismic and Vulnerability map at micro level must be prepared , which will help the state to be better prepared for all the disasters.
- Integration of development plans with disaster mgmt plans is must.
- Mock drills, strict Implementation of Building codes, Professional accountability for certification of building safety with architect and safety of critical building like school, hospitals are needed at all levels to ensure preparedness and readiness.
- Media needs to be sensitised and made partner in mitigation activities
- Capacity building of community and vulnerable to enhance their capability to cope with disaster, as they are first responders
    - → Bhongas in Kutch
    - → Dhajji Diwari in Jammu and Kashmir

Designed by the people of Kutch in Gujarat after the devastating 1819 earthquake, these circular walled houses have thatched roofs and thick walls made using clay mixed with the dung of cows or camels.

Known for their structural stability, Bhungas keep the interiors cool in the summer and warm in the winter. They also protect the inhabitants from sandstorms and cyclonic winds

DHAJJI DEWARI-Traditional Earthquake Resistant Construction of Kashmir

- As per ENVIS center on human settlements, Dhajji Dewari has been in practice for more than 200 years. As the name itself describe, the construction seems as patchwork done using different types of patterns and it is also referred in the Indian Standard Codes as brick nogged timber frame construction. During an earthquake, houses built with Dhajji technique proved to be more durable and sustained less damage than modern reinforced concrete buildings.
- This traditional construction is a skillful process which provides employment to the local artisans

Problem: Traditional Housing Construction in Rural Areas: A majority of the buildings constructed in India, especially in suburban and rural areas, are non-engineered and built without adhering to earthquake-resistant construction principles

Solution:

- Indigenous earthquake-resistant houses like the bhongas in the Kutch Region of Gujarat,
- dhajji diwari buildings in Jammu & Kashmir,
- brick-nogged wood frame constructions in Himachal Pradesh and

- ekra constructions made of bamboo in Assam are increasingly being replaced with modern Reinforced Cement Concrete (RCC) buildings

WAY FORWARD

1. Vulnerability Mapping by GSI
2. Establishing EQ Monitoring Centres
3. Modifying Building Designs using light materials, high-level platforms (Japan)
4. Earthquake Monitoring Centers
5. Preparing a Vulnerability Map of the country and dissemination of risk information
6. Early Warning System
7. Enforcement of National Building Code
8. Community Preparedness and Capacity Building
9. Indigenous EQ-Resistant Houses

- Discuss about the vulnerability of India to earthquake related hazards. Give examples including the salient features of major disasters caused by earthquakes in different parts of India during the last three decades. (Answer in 150 words) 10m

India is highly vulnerable to earthquake-related hazards due to its unique geological and tectonic setting. The country is situated on the boundary of the Indian Plate, which is colliding with the Eurasian Plate, leading to significant seismic activity. This tectonic interaction results in various earthquake-prone zones across the country, particularly in the Himalayan region, northeastern states, and parts of western India.

India can be divided into several seismic zones based on the level of earthquake risk:explain about seisimic zone II to Zone V

Several significant earthquakes have occurred in India over the past thirty years, causing extensive damage and loss of life:

1993 Latur Earthquake-The earthquake highlighted vulnerabilities in construction practices and emergency preparedness

2001 Gujarat Earthquake: On January 26, 2001, a devastating earthquake measuring 7.7 struck Bhuj in Gujarat. The disaster led to significant infrastructural damage with thousands of buildings collapsing. The response included massive relief efforts but also revealed gaps in disaster management strategies.

2004 Indian Ocean Tsunami: While primarily an oceanic event triggered by an undersea earthquake off Sumatra (magnitude 9.1), it had severe impacts on India's coastal regions including Tamil Nadu and Andhra Pradesh on December 26, 2004. Approximately 10,000 lives were lost along India's coast due to tsunami waves generated by this distant quake.

2010 Sikkim Earthquake: A magnitude 6.9 earthquake struck Sikkim on September 18, causing landslides that blocked roads and disrupted communication lines. highlighted the vulnerability of mountainous regions to both seismic activity and secondary hazards like landslides.

2015 Nepal Earthquake: Although centered in Nepal (magnitude 7.8), this earthquake affected northern India significantly as well. States like Bihar experienced tremors that led to structural damages;

2022 Joshimath Land Subsidence: While not a direct result of an earthquake but related to seismic vulnerability issues exacerbated by geological instability following tremors from nearby seismic events; it raised concerns about urban planning in seismically active zones.

Several factors contribute to India's vulnerability to earthquakes:

- Population Density: Urban areas such as Delhi are densely populated; hence any significant seismic event could lead to catastrophic consequences.

- Building Practices: Many structures do not adhere to modern building codes designed for seismic resistance due to lack of enforcement or awareness among builders.
- Geological Conditions: Certain regions have soft soil conditions that amplify seismic waves leading to greater shaking during an earthquake.
- **Lack of Public Awareness:** Limited public awareness about earthquake preparedness and safety measures hinders effective response and recovery efforts
- **Rapid Urbanization:** Unplanned and rapid urbanization has led to the construction of numerous buildings that are not earthquake-resistant, particularly in high-risk areas
- **Inadequate Infrastructure:** Critical infrastructure, such as transportation networks, hospitals, and communication systems, may not be adequately prepared to withstand strong earthquakes

To mitigate the risks associated with earthquakes, India needs to implement a comprehensive strategy that includes:

- **Strengthening Building Codes and Enforcement:** Ensuring strict adherence to earthquake-resistant building codes in both new and existing construction.
- **Investing in Seismic Retrofitting**: Retrofitting older structures to improve their seismic resilience.
- **Raising Public Awareness**: Conducting public awareness campaigns to educate people about earthquake safety and preparedness.
- **Improving Early Warning Systems**: Developing and implementing reliable early warning systems to provide timely alerts.
- **Strengthening Emergency Response Capabilities:** Enhancing the capacity of emergency responders to effectively handle earthquake disasters.
- **Promoting Community-Based Disaster Preparedness**: Empowering local communities to take proactive measures to reduce their vulnerability to earthquakes.
- By addressing these challenges and implementing effective mitigation measures, India can significantly reduce the risks associated with earthquakes and build a more resilient society.

Multi-Hazard Situation in Coastal States/UTs The following natural hazards are seen to occur in the coastal areas of India:
1. Earthquakes
2. Cyclonic wind
3. Storm surge in cyclones
4. Coastal erosion
5Flooding by cloudburst rain in low lying coastal regions
6 Tsunami

Tsunami:

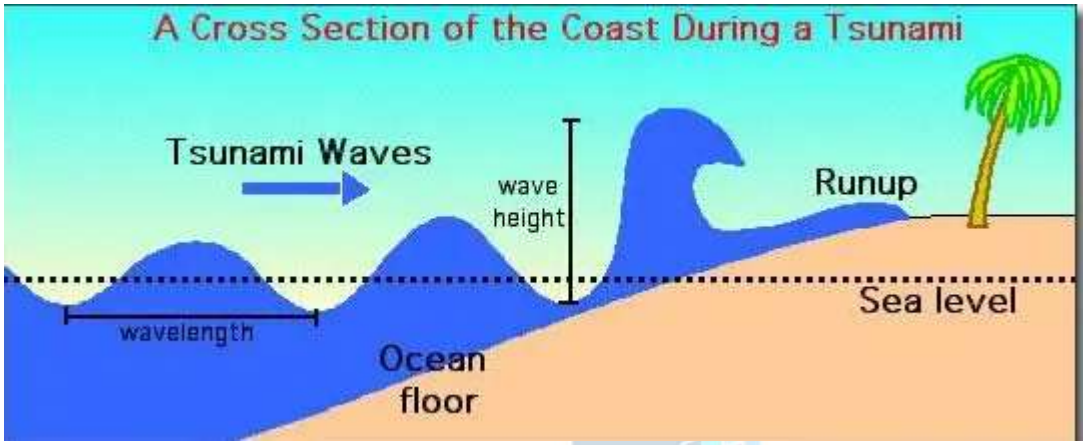
- A Japanese term meaning "harbour wave
- Tsunamis are among the most destructive natural disasters on Earth
- They are series of multiple vertical waves caused by a large and sudden displacement of the ocean due to tectonic activity, earthquakes, volcanic eruptions or underwater landslides
- Earthquake generate tsunamis by vertical movement of the sea floor as in normal faulting or thrust faulting. If the sea floor movement is horizontal, tsunamis are not generated as in strike slip earthquake
- They are seismic sea waves.
- In India - The Ministry of Earth Sciences (MoES) as the Nodal Ministry, will prepare a detailed Action Plan for management of tsunami

CAUSES OF TSUNAMI

- The vertical movement of the seafloor generates Tsunami. Earthquakes are the main cause
- related with convergent plate- subduction zone and shallow earthquake
- The majority of tsunamis are caused by large, shallow earthquakes (magnitude larger than 7.0)
- The size of the Tsunami is related to the size of the earthquake.
- More than 80% of world's occurrences happen in the Pacific along its Ring of Fire subduction zones

- Eg. Chile (1960), Indian Ocean Tsunami (2004)
- Underwater explosion – A Nuclear Testing by the US generated Tsunami in 1940 and 1950s in Marshall Island.
- Volcanic eruption – Volcanoes that occur along the Coastal waters can cause several effects that can cause a tsunami.
- Landslides – Earthquake and volcanic eruptions generally generate landslides, these landslides when moving into the Oceans, bays and lakes can generate Tsunami.
- Anthropogenic Factors: Underwater nuclear explosions can generate tsunamis Eg. Nuclear Testing by the US generated Tsunami in 1940 and 1950s in Marshall Island

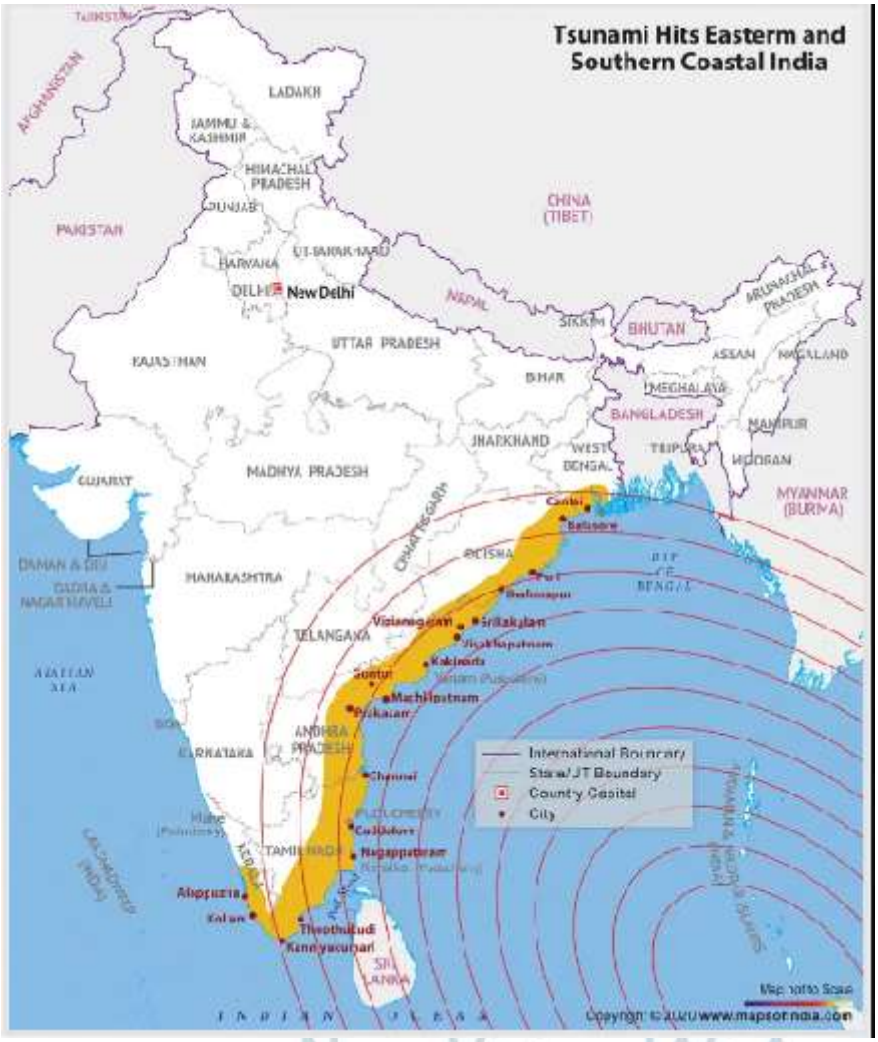
FEATURES :



- the Impact of tsunami is less over the ocean and more near the coast where they cause large scale destructions
- Long Wavelengths: They can span hundreds of kilometres from one wave crest to another
- As they approach shallow water near the coast, their height grows because of their long wavelengths.
- Their amplitude increases when events approach shallow water
- They cause more destruction near the coast
- Speed : 700 to 800 kmh
- Non-Periodic Nature: These waves are not periodic unlike regular ocean waves.
- Series of Waves: They occurs in multiple waves with periods ranging from minutes to hours
- Generally, the subsequent waves are more dangerous than the first wave

Tsunami-Prone Regions: Hotspots of Earth's Most Destructive Waves and Natural Disasters

- These are certain areas in the world which are particularly prone to tsunamis and the devastation they can bring.
- 78% Pacific Ocean (around the geologically active "Ring of Fire")
- 9% Atlantic Ocean and Caribbean Sea
- 6% Mediterranean Sea
- 5% Indian Ocean
- 1% Other Seas
- This is a map showing Tsunami prone areas in India



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Two location : Near India

- The possible zones are Andaman – Sumatra or Makran (Pakistan).

Key Nodal Agency :

- Indian National Centre for Ocean Information Services (INCOIS)
- Established in 1999
- Under the Ministry of Earth Sciences.
- INCOIS through Indian Tsunami Early Warning Centre (ITEWC) is the nodal agency to provide tsunami advisories to India.
- The Indian Tsunami Early Warning Centre (ITEWC) established in 2007 at Indian National Centre for Ocean Information Services (INCOIS), Hyderabad under the Ministry of Earth Sciences
- It is the national authority to issue advisories for India
- Indian scientists are able to issue a warning 10 to 20 minutes after a big underwater earthquake happens in the Indian Ocean.
- Indian Early Warning Centre (ITEWC) has been accredited as Tsunami Service Provider for 28 Indian Ocean Rim (IOR) countries, along with Indonesia and Australia, for issuing regional warnings by the Intergovernmental Oceanographic Commission (IOC) of UNESCO.

Other Org : It is an **integrated effort** of different organizations including the

- Department of Space (DOS),

- Department of Science and Technology (DST),
- The Council of Scientific and Industrial Research (CSIR),
- Survey of India (SOI) and
- National Institute of Ocean Technology (NIOT).

EFFECTS: ELEMENT AT RISK

- **Loss of life and property:** large displacement of water destroys housing and infrastructure in the areas affected by it. Also electrocution, gas leakage and explosions, damaging of tanks and floating of debris that further causes injury and death.
- **Disease:** Flooding and contamination caused due to the destruction of sewage systems cause outbreaks of diseases, infections and illness thus causing more death.
- **Effect on environment and biodiversity** – Tsunamis not only affect human beings but also cause harm to insects, animals, plants, and natural resources. Plants are uprooted due to violent waves of a tsunami, nesting sites are destroyed, land animals get killed by drowning and marine life is harmed by the flow of toxic chemicals into the water body. Solid waste and disaster debris are other critical environmental problems faced by a disaster-hit area.
- **Economic cost** – Tsunami causes contamination of soil and water. It increases the salinity of the soil. The mixing up of disaster debris with the soil and high salinity makes the soil infertile and unfit for cultivation thus adding to financial loss to the farmers and raising the chances of food insecurity.
- Post-tsunami reconstruction also requires a huge amount of financial investment. Thus, tsunami has a huge economic cost for an economy.

Impact on Coastal Areas

- After reaching the Coast, the tsunami waves release enormous energy stored in them and water flows turbulently onto the land destroying Port - cities and towns , structures, buildings and other settlements.
- Since the Coastal Areas are densly populated the world over , so the loss of life and property likely to be much higher by Tsunami as compared to other natural hazards in the coastal areas.
- The Extent of Devastation is much large, so it is beyond the capacity of Individual state or government to mitigate the damage.
- Hence Combined efforts at the International Levels are possible way of dealing with these disasters
  Ex: 26 Dec 2004 tsunami in which more than 3 lakh people lost their lives.

MEASURES : FOCUS ON

- The key factors to reduce potential losses due to tsunami are AWARENESS and PREPAREDNESS
- It is made up of two equally important components:- A network of sensors to detect tsunamis and A communications infrastructure to issue timely alarms to permit evacuation of the coastal areas.
- TSUNAMI RISK = TSUNAMI HAZARD x EXPOSURE x VULNERABILITY.

MITIGATION MEASURES

1. Effective Planning
2. The building of walls was done by Japan.
3. Planting trees as done in Tamil Nadu by a village
4. Proper relief and rehabilitation preparedness
5. Awareness among the masses

M.S. Swaminathan Committee Report has further recommended that:

- Mangrove wetlands should be regenerated.
- Coral reefs, grass beds, and coastal forests should be preserved and conserved for both short-term and long-term ecological and livelihood benefits.
- Raising coastal plantations like casuarinas, saliconia, palm, bamboo, etc. will act as an effective bio-shield and provide protection to the coastal communities.
- Geomorphologic features like sand dunes, beaches, coastal cliffs should be protected.
- Impact of natural hazards in the coastal and marine areas should be taken into account while formulating coastal area management schemes.

In both quantitative and qualitative terms, the practical applications of tsunami risk assessment for implementation of mitigation strategies of terrestrial and marine environments include:

STRUCTURAL AND NON STRUCTURAL MEASURES FOR REDUCING ELEMENT OF RISK

1. Building Codes (potential damage due to wave action and flooding)
2. GIS Mapping
3. Land-Use Planning (taking note of wave action & flooding)
4. Disaster Planning (in identified hazard zones)
5. Emergency Management
6. Emergency Personnel Training (necessary aspects relevant to marine situations)

7. Rescue and Response (cargo, tourist, inter-islands fishing community, (marine situations related recreational boating) to shipping)
8. Insurance Needs
9. Community Education
10. Simulated Tsunami Exercises

Global initiatives

- The Sendai Framework on Disaster Risk Reduction adopted in 2015 has put forward the following efforts to address tsunami-related hazards. These include
  - Hazard warning;
  - Mapping; and
  - Risk assessment.