Answer key

18CEO307T- Disaster mitigation and management

Part A (ONE MARK)

1) C
2) D
3) D
4) D
5) B
6) D
7) A
8) A
9) B
10) D
11) A
12) B
13) A
14) D
15) A
16) B
17) D
18) C
19) A
20) B
21) C
22) B
23) B
24) A
25) A

PART B

26.a. DISASTER MANAGEMENT CYCLE

Disaster Risk Management includes sum of all activities, programmes and measures which can be taken up before, during and after a disaster with the purpose to avoid a disaster, reduce its impact or recover from its losses. The three key stages of activities that are taken up within disaster risk management are as follows:

1. *Before a disaster (pre-disaster).*

Pre-disaster activities those which are taken to reduce human and property losses caused by a potential hazard. For example, carrying out awareness campaigns, strengthening the existing weak structures, preparation of the disaster management plans at household and community level, etc. Such risk reduction measures taken under this stage are termed as mitigation and preparedness activities.

2. *During a disaster (disaster occurrence).*

These include initiatives taken to ensure that the needs and provisions of victims are met and suffering is minimized. Activities taken under this stage are called emergency response activities.

3. *After a disaster (post-disaster).*

There are initiatives taken in response to a disaster with a purpose to achieve early recovery and rehabilitation of affected communities, immediately after a disaster strike. These are called as response and recovery activities. The Disaster risk management cycle diagram (DRMC)

highlights the range of initiatives which normally occur during both the Emergency response and Recovery stages of a disaster. Some of these cuts across both stages (such things as coordination and the provision of ongoing assistance); whilst other activities are unique to each stage (e.g. Early Warning and Evacuation during Emergency Response; and Reconstruction and Economic and Social Recovery as part of Recovery).

The DRMC also highlights the role of the media, where there is a strong relationship between this and funding opportunities. This diagram works best for relatively sudden-onset disasters, such as floods, earthquakes, bushfires, tsunamis, cyclones etc, but is less reflective of slow-onset disasters, such as drought, where there is no obviously recognizable single event which triggers the movement into the Emergency Response stage.

According to Warfield (2008) disaster management aims to reduce, or avoid the potential losses from hazards, assure prompt and appropriate assistance to victims of disaster, and achieve rapid and effective recovery. The disaster management cycle illustrates the ongoing process by which governments, businesses, and civil society plan for and reduce the impact of disasters, react during and immediately following a disaster, and take steps to recover after a disaster has occurred. Appropriate actions at all points in the cycle lead to greater preparedness, better warnings, reduced vulnerability, or the prevention of disasters during the next iteration of the cycle. The complete disaster management cycle includes the shaping of public policies and plans that either modify the causes of disasters or mitigate their effects on people, property, and infrastructure.

The mitigation and preparedness phases occur as disaster management improvements are made in anticipation of a disaster event. Developmental considerations play a key role in contributing to the mitigation and preparation of a community to effectively confront a disaster. As a disaster occurs, disaster management actors, humanitarian organizations become involved in the immediate response and long-term recovery phases.

The four disaster management phases illustrated here do not always, or even generally, occur in isolation or in this precise order. Often phases of the cycle overlap and the length of each phase greatly depends on the severity of the disaster.

- ***Mitigation*** - Minimizing the effects of disaster.

Examples: building codes and zoning; vulnerability analyses; public education.

- ***Preparedness*** - Planning how to respond.

Examples: preparedness plans; emergency exercises/training; warning systems.

- ***Response*** - Efforts to minimize the hazards created by a disaster.

Examples: search and rescue; emergency relief.

- ***Recovery*** - Returning the community to normal.

Examples: temporary housing; grants; medical care.

To analyse the scope of disaster management in the revised context, it should be studied the cycle of the phenomenon (Figure 3). Disasters are as old as human history, but the dramatic increase and the damage caused by them in the recent past have become a cause of national and international concern. Over the past decade, the number of natural and manmade disasters has climbed inexorably. From 1994 to 1998, reported disasters average was 428 per year but from 1999 to 2003, this figure went up to an average of 707 disaster events per year. Figure 4 presents the deadliest disasters of the decade (1992-2001).

26.b.Examine the roles and responsibilities of the various committees of national disaster management.

National Disaster Management Authority Vision

"To build a safer and disaster resilient India by a holistic, pro-active, technology driven and sustainable development strategy that involves all stakeholders and fosters a culture of prevention, preparedness and mitigation."

Functions and Responsibilities

NDMA, as the apex body, is mandated to lay down the policies, plans and guidelines for Disaster Management to ensure timely and effective response to disasters. Towards this, it has the following responsibilities:-

- Lay down policies on disaster management
- Approve the National Plan
- Approve plans prepared by the Ministries or Departments of the Government of India in accordance with the National Plan
- Lay down guidelines to be followed by the State Authorities in drawing up the State Plan
- Lay down guidelines to be followed by the different Ministries or Departments of the Government of India for the Purpose of integrating the measures for prevention of disaster or the mitigation of its effects in their development plans and projects
- Coordinate the enforcement and implementation of the policy and plans for disaster management
- Recommend provision of funds for the purpose of mitigation

- Provide such support to other countries affected by major disasters as may be determined by the Central Government
- Take such other measures for the prevention of disaster, or the mitigation, or preparedness and capacity building for dealing with threatening disaster situations or disasters as it may consider necessary
- Lay down broad policies and guidelines for the functioning of the National Institute of Disaster Management.

From the national vision and the theme mentioned earlier, the objectives guiding the policy formulation have evolved to include:

Promoting a culture of prevention and preparedness – by centre-staging DM as an overriding priority at all levels and at all times.

Encouraging mitigation measures based on state-of-the-art technology and environmental sustainability.

Mainstreaming DM concerns into the development planning process.

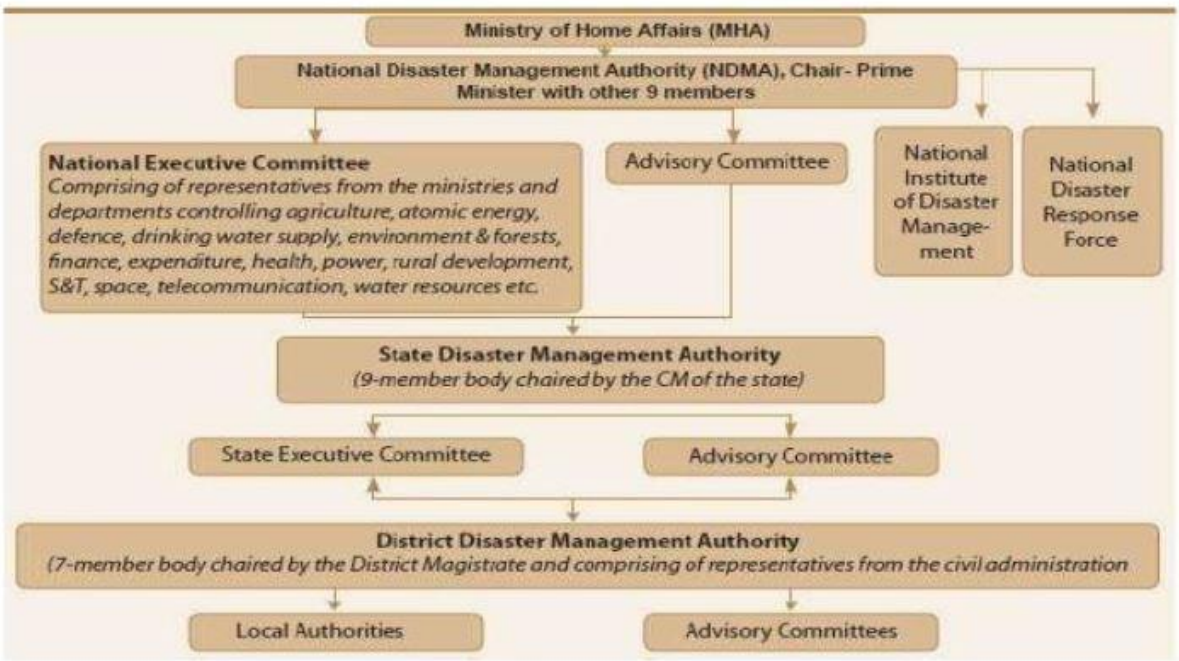
Putting in place a streamlined institutional techno-legal framework in order to create and preserve the integrity of an enabling regulatory environment and a compliance regime.

Developing contemporary forecasting and early warning systems backed by responsive and fail-safe communications and Information Technology (IT) support.

Promoting a productive partnership with the Media, NGOs and the Corporate Sector in the areas of awareness generation and capacity development.

Ensuring efficient response and relief with a caring humane approach towards the vulnerable sections of the society.

Making reconstruction an opportunity to rebuild back better and construct disaster-resilient structures and habitats



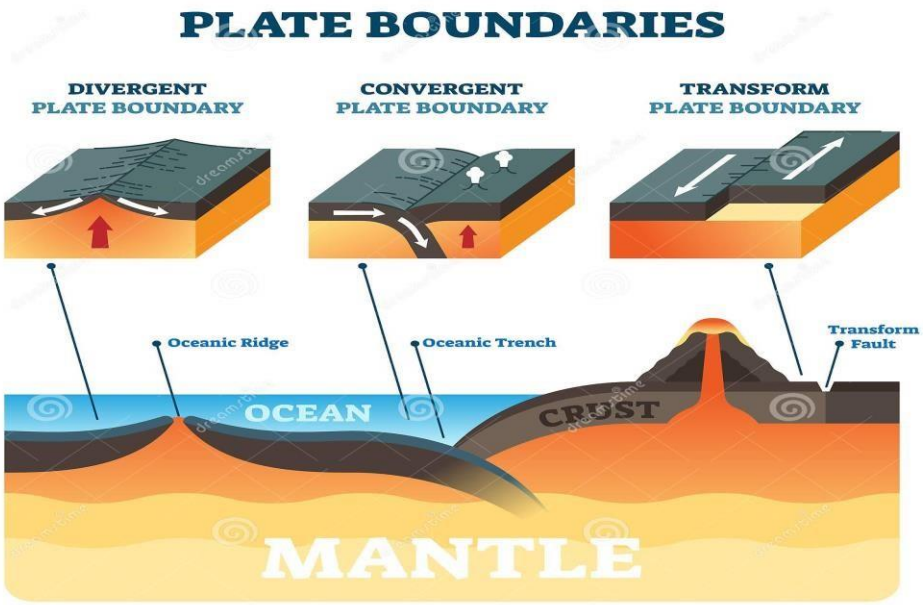
27.a. Earthquakes

Earthquake is one of the most destructive natural hazards. They may occur at any time of the year, day or night, with sudden impact and little warning. They can destroy buildings and infrastructure in seconds, killing or injuring the inhabitants. Earthquakes not only destroy the entire habitation but may de-stabilize the government, economy and social structure of the country.

What is an earthquake? It is the sudden shaking of the earth crust. The impact of an earthquake is sudden and there is hardly any warning, making it impossible to predict.

Cause of Earthquake:

The earth's crust is a rocky layer of varying thickness ranging from a depth of about 10kilometers under the sea to 65 kilometers under the continents. The crust is not one piece but consists of portions called 'plates' which vary in size from a few hundred to thousands of kilometers. The 'theory of plate tectonics' holds that the plates ride up on the more mobile mantle, and are driven by some yet unconfirmed mechanisms, perhaps thermal convection currents. When these plates contact each other, stress arises in the crust. These stresses can be classified according to the type of movement along the plate's boundaries:

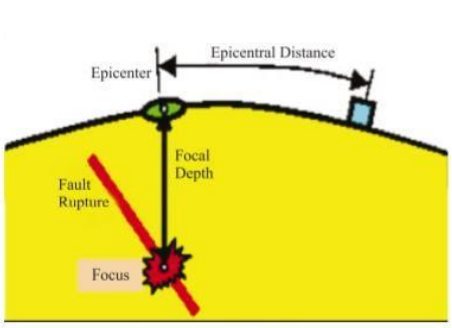


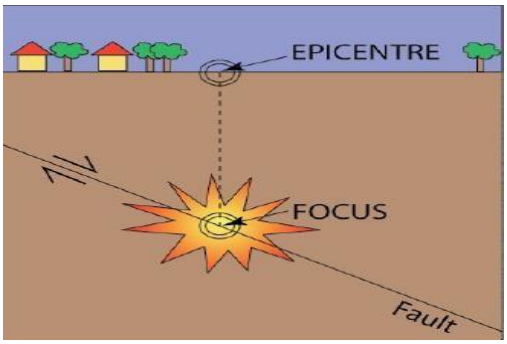
a) pulling away from each other - Divergent

b) pushing against one another - Convergent

c) sliding sideways relative to each other - Transformational

All these movements are associated with earthquakes. The areas of stress at plate boundaries which release accumulated energy by slipping or rupturing are known as 'faults'. The theory of 'elasticity' says that the crust is continuously stressed by the movement of the tectonic plates; it eventually reaches a point of maximum supportable strain. A rupture then occurs along the fault and the rock rebounds under its own elastic stresses until the strain is relieved. The fault rupture generates vibration called seismic waves, which radiates from the focus in all directions. The point of rupture is called the 'focus' and may be located near the surface or deep below it. The point on the surface directly above the focus is termed as the 'epicenter' of the earthquake. The distance of the building from the epicenter decides the impact of ground vibration on that particular building during earthquake.





General characteristics:

Earthquake vibrations occur in a variety of frequencies and velocities. The actual rupture process may last for a few seconds to as long as one minute for a major earthquake. The ground shaking is caused by ‘body waves’ and ‘surface wave’. Body waves penetrate the body of the earth and vibrate fast whereas surface waves vibrate the ground horizontally and vertically. Surface waves cause swaying of tall buildings and slight waves motion in bodies of water even at great distances from the epicenter.

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

1. Deep Earthquake - 300 to 700 kms from the earth surface
2. Medium - 60 to 300 kms
3. 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.

Earthquakes can be described by the use of two distinctively different scales of measurement demonstrating magnitude and intensity. Earthquake magnitude is measured by using seismograph that continuously records ground vibration. Earthquake intensity scale measures the effects of an earthquake where it occurs and Modified Mercalli Scale is used. Modified Mercalli Scale expresses the intensity of earthquake effect on people, structure and earth's surface in values from I to XII.

Adverse effects of earthquake:

Physical damage**:**Damage occurs to human settlement, buildings, structures and infrastructure, especially bridges, elevated roads, railways, water towers, pipelines, electrical generating facilities. Aftershocks of an earthquake can cause much greater damage to already weakened structures. Secondary effects include fires, dam failure and landslides which may block water ways and also cause flooding. Damage may occur to facilities using or manufacturing dangerous materials resulting in possible chemical spills. There may also be a breakdown of communication facilities. The effect of an earthquake is diverse. There are large number of casualties because of the poor engineering design of the buildings and close proximity of the people. About 95 per cent of the people who are killed or who are affected by the earthquake is because of the building collapse. There is also a huge loss to the public health system, transport and communication and water supply in the affected areas.

Earthquakes in India:

India falls quite prominently on the 'Alpine - Himalayan Belt'. This belt is the line along which the Indian plate meets the Eurasian plate. This being a convergent plate, the Indian plate is thrusting underneath the Eurasian plate at a speed of 5 cm per year. The movement gives rise to tremendous stress which keeps accumulating in the rocks and is released from time to time in the form of earthquakes. The seismic zoning map of India is divided into four zones namely Zone II, III, IV and V.

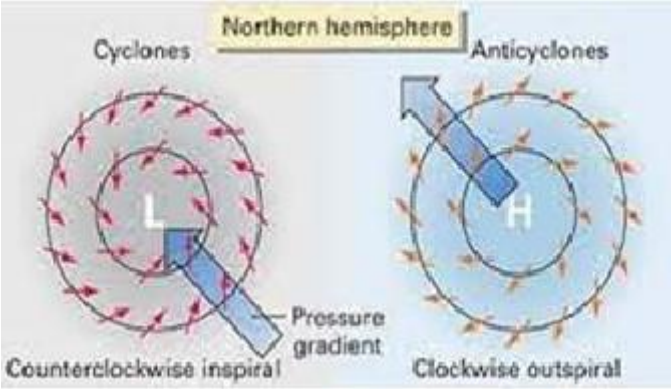
Two Important Scales:

The Modified Mercalli scale is designed to describe the effects of an earthquake, at a given place, on natural features, on industrial installations and on human beings. The intensity differs from the magnitude which is related to the energy released by an earthquake.

The Richter scale is used to rate the magnitude of an earthquake, that is the amount of energy released during an earthquake.

27.b.i Compare cyclone and anti-cyclone with a neat diagram.

Cyclone	Anticyclone
A cyclone is an area of low pressure where air masses meet and rise.	An anticyclone is an area of high pressure where air moves apart and sinks.
It indicates bad weather, like rain and clouds.	It indicates fair weather
Winds in a cyclone blow counterclockwise in the Northern Hemisphere and clockwise in the Southern Hemisphere.	Winds in an anticyclone blow clockwise in the Northern Hemisphere and counterclockwise in the Southern Hemisphere.
In a cyclone, air near the ground is pushed toward the low-pressure centre of the cyclone and then rises upward, expanding and cooling as it moves.	Air at the centre of an anticyclone is forced away from its area of high pressure and replaced by a downward blast of air from higher altitudes.
As it cools, the rising air becomes more humid, leading to cloudiness and high humidity within the cyclone.	The air compresses and heats up as it moves downward, reducing its humidity and leading to fewer clouds within the anticyclone.



27.b.ii Causes for flood:

There are several causes of floods and differ from region to region. The causes may varyfrom a rural area to an urban area. Some of the major causes are: a. Heavy rainfall

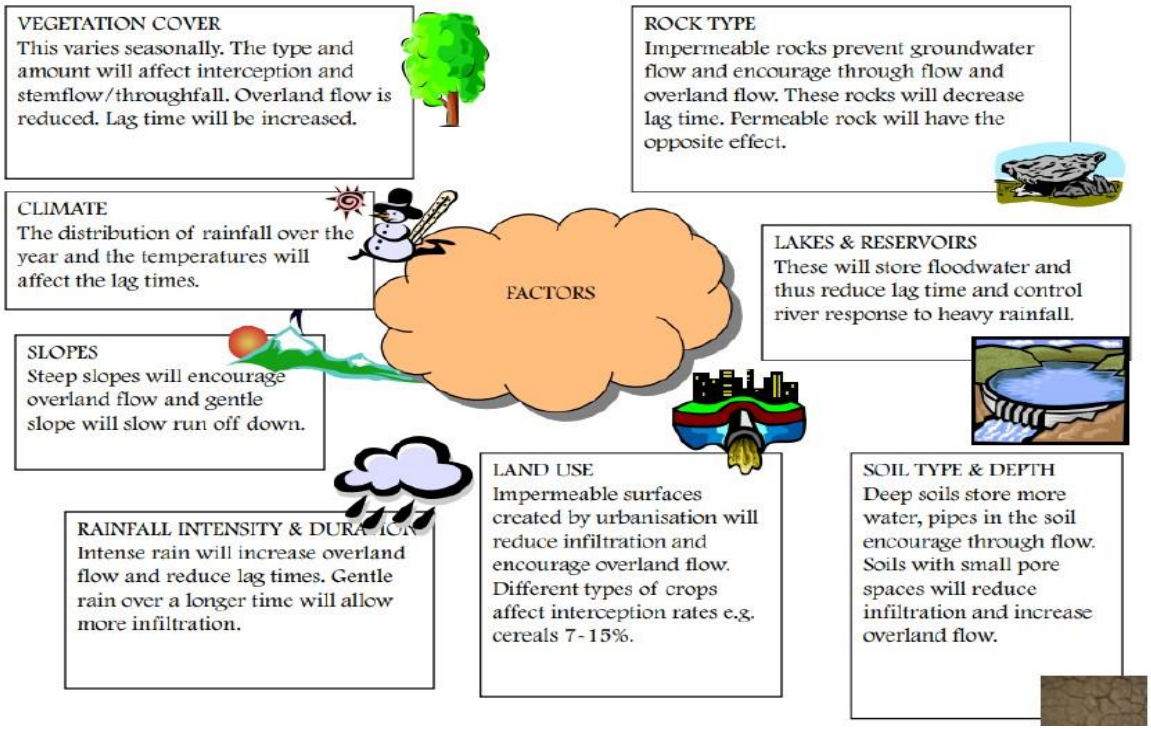
b. Heavy siltation of the river bed reduces the water carrying capacity of the rivers/stream.

c. Blockage in the drains lead to flooding of the area.

d. Landslides blocking the flow of the stream.

e. Construction of dams and reservoirs

f. In areas prone to cyclone, strong winds accompanied by heavy down pour along with storm surge leads to flooding.



Adverse Effects of flood

- The most important consequence of floods is the loss of life and property.
- Structures like houses, bridges; roads etc. get damaged by the gushing water, landslides triggered on account of water getting saturated, boats and fishing nets get damaged. There is huge loss to life and livestock caused by drowning.
- Lack of proper drinking water facilities, contamination of water (well, ground water, piped water supply) leads to outbreak of epidemics, diarrhoea, viral infection, malaria and many other infectious diseases.
- Flooding also leads to a large area of agricultural land getting inundated as a result there is a huge crop loss. This results in shortage of food, and animal fodder.
- Floods may also affect the soil characteristics. The land may be rendered infertile due to erosion of top layer or may turn saline if sea water floods the area.

Methods to reduce impact of floods:

- Introduce better flood warning systems
- Modify homes and businesses to help them withstand floods
- Construct buildings above flood levels
- Tackle climate change
- Increase spending on flood defences
- Protect wetlands and introduce plant trees strategically
- Restore rivers to their natural courses
- Introduce water storage areas

- Improve soil conditions
- Put up more flood barriers

28.a. Chernobyl nuclear power plant accident

- The Chernobyl disaster is the worst nuclear power plant accident in the history in the terms of cost and resulting deaths, and is one of only two classified as level 7 event on the international nuclear event scale.
- The battle to contain the contamination and avert a greater catastrophe ultimately involved over 500,000 workers and cost an estimated 18 billion.
- During the accident itself 31 people died, and long – term effects such as cancer and deformities are still being accounted for.

Consequences of Nuclear Disaster

- Nuclear explosions produce both immediate and delayed destructive effects. Immediate effects (blast, thermal radiation, prompt ionizing radiation) are produced and cause significant destruction within seconds or minutes of a nuclear detonation.
- The delayed effects (radioactive fallout and other possible environmental effects) inflict damage over an extended period ranging from hours to centuries, and can cause adverse effects in locations very distant from the site of the detonation.
- Nuclear disaster can produce climate issues because the high temperatures of the nuclear fireball cause large amounts of nitrogen oxides to form from the oxygen and nitrogen in the atmosphere (very similar to what happens in combustion engines).
- Each megaton of yield will produce some 5000 tons of nitrogen oxides. The rising fireball of a high kiloton or megaton range warhead will carry these nitric oxides well up into the stratosphere, where they can reach the ozone layer.
- A series of large atmospheric explosions could significantly deplete the ozone layer.

28.b. Causes and effects of the Bhopal gas tragedy.

• The Bhopal disaster, also referred to as the Bhopal gas tragedy was a gas leak incident on the night of 2–3 December 1984 at the Union Carbide India Limited (UCIL) pesticide plant in Bhopal, Madhya Pradesh, IndiaUnion Carbide Corporation.

• Over 500,000 people were exposed to methyl isocyanate (MIC) gas.

• Release of Methyl Isocyanate –

• Clear, colorless, sharp smelling liquid

• Highly flammable

• Extremely toxic

• Volatile reaction with water in about 10 minutes

• Social Effects –

• No or little earnings reduced self esteem

• Heavy loans to pay for medicines

• Children future destroyed

• Children could be affected for life

• Forgotten by media.

• Among the 500,000 people exposed to the gas: – 20,000 have died till date – 120,000 continue to suffer

• Out of every 3 children born after the Bhopal disaster, only 1 survived.

Environmental Impact :

• Over 2,000 animals were killed by the gas that night, most of them livestock that people relied on for food.

• The heavy gas was absorbed into local rivers, making the water undrinkable and poisoning the fish.

29.a. Land Use Zoning

Objectives of Land-use zoning

■ Understand the relationship between land-use zoning and disasters.

■ Know how faulty allocations of land-use can often become the cause of disasters, both man-made and natural.

■ Describe how judicious land-use zoning can help not only in disaster mitigation, but also in disaster relief operations.

Major elements of Land-use Planning

■ Land-use policies and plans setting. out the social, economic and environmental goals of comprehensive land development and their stages of development;

■ Land ownership and land tenure patterns identifying the legal, social and economic basis of ownership and tenure

■ Land values and prices, reflecting the forces of supply and demand for land and

■ Land-use controls which may be subdivided into three broad categories, i.e., legal, fiscal and directive.

29.b Search and Rescue (SAR)

■ Termed as “helpful behavior in emergencies”.

■ Search and rescue is a technical activity rendered by a group of specially trained personnel.

1. Community Local Rescuers

2. Outside Community Resources

Objectives of SAR

■ To rescue the survivors trapped under the debris, from the damaged buildings or from a cyclonic storm surge, flood, earthquake and fire.

■ To provide First Aid services to the trapped survivors and to dispatch them for medical care.

■ To take immediate necessary actions, as necessary, for temporary support and protection to endangered collapsed buildings to structures.

■ To hand-over, recover and dispose-off the bodies of the deceased.

■ To train, demonstrate and raise awareness on how to use the local materials for self-rescue amongst the community people.

Team Composition

■ Physically and Psychologically sound volunteers could constitute a rescue team.

■ Above 18 years of age, with a minimum education level should be selected.

■ Preference would be given to ex-military or army personnel. Team leader: 1 Skilled persons: 2 Members: 5

Duties of the Rescuer 1. Assessment 2. Information 3. Observation – LLF – Look, Listen and Feel.

Plan for Rescue

■ Rescue is a team effort that needs coordination and planning amongst the members for an optimum response operation. 1. Manpower 2. Equipments 3. Methods

Rescue Stages

■ Stage 1 - Surface Causality (Emergency Rescue)

■ Stage 2- Search in Slightly Damaged Buildings (Immediate Rescue)

■ Stage 3- Search of Possible Survival Points (Specialised Rescue)

■ Stage 4 -Selected Debris Clearance (Specialised Rescue)

■ Stage 5 -General Debris Clearance (Specialised Rescue)

30.a Remote Sensing

"Remote sensing is the science (and to some extent, art) of acquiring information about the Earth's surface without actually being in contact with it. This is done by sensing and recording reflected or emitted energy and processing, analyzing, and applying that information."

Elements or Components of Remote Sensing

1. Energy Source or Illumination (A)

2. Radiation and the Atmosphere (B)

3. Interaction with the Target (C)

4. Recording of Energy by the Sensor (D)

5. Transmission, Reception, and Processing (E)

6. Interpretation and Analysis (F)

7. Application (G)

Flood – Remote Sensing Simulation

Earth observation satellites are also used extensively in the phases of preparedness/warning and response/monitoring.

• The use of optical sensors for flood mapping is seriously limited by the extensive cloud cover.

• Synthetic Aperture Radar (SAR) from ERS and RADARSAT have been proven very useful for mapping flood inundation areas, due to their all weather capability.

• In India, ERS -SAR has been used successfully in flood monitoring since 1993, and Radarsat since 1998.

• Colour composites are generated using SAR data during floods and pre-flood SAR images.

30.b. National Centre for Seismology

Background

• The first seismological observatory of the country was established at Alipore (Calcutta) on 1 December, 1898.

• The strong earthquakes, necessitated the need for national seismological network.

• Early 1960s marked a very important land mark in the history of seismic monitoring, when the WWSSN (World Wide Standardized Seismic Network) stations started functioning globally.

Mission and Vision

• Mission To work towards creating a seismic resilient society

• Vision Understanding the earthquake source processes and their effects through earthquake monitoring and seismological research for the cause of earthquake-safe society.

Need

• The National Center for Seismology (NCS) has been set up by bringing together all Seismology related activities of IMD (including those of EREC) under one umbrella.

• On creation of the NCS, all the ongoing activities and projects of IMD related to Seismology shall continue to be operated / implemented through the NCS.

• In addition, specific R&D activities will also be undertaken by NCS, using the data sets generated by various seismic and GPS networks.

National Centre for Seismology

• National Center for Seismology (NCS) is the nodal agency for monitoring of earthquake activity in our country.

• NCS maintains National Seismological Network of 115 stations.

• NCS monitors earthquake activity all across the country through its 24x7.

• NCS also monitors earthquake swarm and aftershock through deploying temporary observatory close to the affected region.