INDIA METEOROLOGICAL DEPARTMENT

QUESTION BANK

OF

INTEGRATED MET. TRAINING COURSE (IMTC)

FINAL EXAMINATION

BASED ON 1-11 BATCHES (2013-2021)

PAPER-IV: SATMET, RADAR AND SEISMOLOGY

PART : A, B AND C

INDIA METEOROLOGICAL DEPARTMENT

INTEGRATED MET. TRAINING COURSE (IMTC)

FINAL EXAMINATION

PAPER –VII : SATMET, RADAR AND SEISMOLOGY

TIME; 1030-1330 **MAX. MARKS: 60**

PART A : SATMET **(Maximum Marks: 20)**

Q 1. Fill in the blanks

1. IAPP stand for …….
2. Carbon dioxide **(**CO2**)** spectral bands at ------ and -------- microns give us information on the temperature structure of the atmosphere**.**
3. The point where the satellite is closest to earth is called _____
4. The Advanced Microwave Sounding Unit **(**AMSU**)**, a 20-channel radiometer, provides information on the ---------- and ---------- structure of the atmosphere**.**
5. The data rate is ……. and RF frequency is …… of VHRR of Kalpana-l**.**
6. Satellite instruments measure _____ that the Earth and the atmosphere _____.
7. The term _____ refers to the orientation of the satellite in space.
8. DRT a Payload of Kalpana 1 stands for _____ and has uplink frequency _____ MHz.
9. INSAT 3D has advanced payloads of 6 channel _____ and 19 channel _____.
10. Water vapour imageries _____ electromagnetic radiations in the absorption band _____ micrometer.
11. Cloud top temp. obtained from _____ imagery is valuable parameter to assess the _____ of the cloud.
12. INSAT 3D has advanced payloads of _____ channel imager and _____ channel sounders.
13. MODIS scan the earth in _____ spectrum region.
14. Ku band scattero-meter is an example of _____ sensors.
15. Advanced Technology Microwave Sounder (ATMS) is payload on ---------- satellite.
16. Visible channel of INSAT-3D sounder is used for ----------identification.

17. MADRAS is ---------- type payload on Megha-tropiques
18. Day time fog is clearly identified in ____imagery.
19. _____layer moisture is observed in WV imagery.
20. MODIS stands for_____.
21. _____ layer moisture is observed in WV imagery.
22. Insat 3D Sounder has …… visible and ……..infrared channels.
23. IASI stands for _____.
24. ROSA stands for _____.
25. MODIS is pay load of _____ and _____ satellites.
26. There are _____ numbers of channels on INSAT 3D satellite.
27. Fog is identified using _____ channel imagery.
28. After getting the INSAT-3D/3DR images in staggering mode we will get the frequent images in every ___ minutes.
29. Night time fog is mainly derived using channel differencing techniques using the difference of _____
30. Height of cloud can be roughly estimated by observing _____ imagery.
31. Geostationary satellite has _____ inclination angle.
32. IASI stands for _____
33. INSAT 3DR is _____type of satellite.
34. Sea Surface Temperature (SST) from INSAT-3D /3R is estimated by applying the _____ (moisture /albedo) correction
35. Information on water vapour content can be gained from two water vapour (H2O) lines at ……. and …….GHz
36. ATOVS stands for----------
37. Snow on ground/mountains can be detected suing _____ channels.
38. In the early stages of tropical cyclone, _____ pattern is generally observed.
39. _____ clouds are not detected by Visible channel.
40. Temporal resolution of INSAT 3D and INSAT 3DR when used in staggering mode is ____(30 / 15) minutes.
41. Time required for a satellite to complete one scan is called _____ resolution of satellite.
42. _____ type of satellites are useful in tracking thunderstorm events.
43. Shear pattern of cyclone is observed when the cyclone is at _____ (mature / early) stage of life cycle.

44. Polar satellites are useful in .....
45. In SWIR channel, clouds with higher ice particle content appears _____ . (dark/bright).

Q 2. Write the statement whether True or false with justification

1. Cyclone warning dissemination system is a two way communication system**.**
2. Cb clouds appear as very bright in all three VIS, TIR and WV imagery**.**
3. Reflectances at VIS and IR wavelengths are the same**.**
4. Infrared sounding instruments can provide information below the cloud**.**
5. INSAT **-**3D Sounder is microwave Sounder**.**
6. Satellites with Low Earth Orbits provide global coverage and good ground resolution.
7. INSAT -3A is a geosynchronous satellite having 3 payloads.
8. Visible channel is used for determining CMV's in Kalpana-1.
9. Dvorak Technique directly measure wind and, pressure associated with TC intensity.
10. CTT is used to assess the height of the cloud.
11. Infrared sounders provide 50/50 kms resolution profile.
12. Microwave sounding instruments provide very high quality information in cloud-free areas.
13. INSAT -3D is a POS satellite having 3 payloads for atmospheric sounding.
14. Fog has high albedo than the fresh snow and best seen in WV imagery.
15. Clouds element can assume a variety of shapes.
16. Infrared sounding instruments provide vertical profiles in cloud-free areas.
17. Sounder Payload is used to drive profile of the atmosphere.
18. Convective clouds are seen in visible and also in IR imageries.
19. Albedo of large Cb cell is 40-60%
20. Visible image is available round the clock(24 hours).
21. SAPHIR pay load of MEGA TROPIQUES is a IR sounder used to derive temperature profile**.**
22. SEVIRI payload is on GOES-16**.**
23. OCM is a payload on RISAT-1 used for earth observation**.**
24. Polar satellites are useful in tracking thunderstorm events**.**
25. SWIR channel imagery is available during night-time**.**
26. Cloud Top Temperature is used to assess the height of the cloud.

27. Very Thin Cirrus clouds are not observed in Visible imagery.
28. Satellites with Low Earth Orbits provide global coverage and good ground resolution.
29. Because of their long wavelengths compared to the visible and infrared, microwaves have special properties that are important for remote sensing.
30. Early stages of Cyclones (T <2.5) are easy to analyze using Dvorak technique.
31. Colder clouds appear brighter in inverted IR1 imagery.
32. Water vapour winds are available only over the region with presence of moisture.
33. Fog cannot be detected using IR1 imagery at night.
34. The difference in IR1 and WV channel is used for the detection of fog at night time.
35. IR imagery is inverted for easier interpretation.
36. Spatial resolution of WV channel is best among all the channels available on INSAT 3D.
37. SWIR channel is based on the emission property of the object.
38. IR1 channel can detect the cloud base temperature.
39. RGB technique based images can be used only during day time.
40. Sea surface Temperature is detected using Visible channel.
41. Infrared sounding instruments provide very high quality information in cloud-free areas.

Q 3. Answer the following

1. Difference between geostationary and Polar Orbital satellites**.**
2. Explain the difference between Infrared and Microwave radiometers**.**
3. Write characteristics features of satellite imageries
4. What are the image interpretation of satellite imageries**.**
5. Write the names of the different derived products derived from INSAT data**.**
6. What are the principles of remote sensing.
7. Name the types of remote sensors used in satellite observations.
8. Differentiate the Geo- synchronous and Sun - synchronous satellites.
9. What are the merits of Geo- synchronous
10. What are the merits of Sun - synchronous satellites
11. What are the demerits of Geo- synchronous
12. What are various satellite derived products derived from INSAT data?

13. Describe any one of satellite derived products derived from INSAT data them with their utility.
14. Write characteristics features of satellite imageries and image interpretation.
15. Write the names of the different derived products derived from INSAT data. Describe any two.
16. What is various satellite derived products derived from INSAT data? Describe any two of them with their utility.
17. Discuss the principle used in obtaining the different satellite imageries. Give suitable examples of their utility.
18. Explain the various resolution terms used in satellite meteorology.
19. Explain the Classification of Satellites on the basis of Orbits with diagram, mentioning the details of their altitude, period, inclination, shape and uses.
20. Describe the six basic characteristic features to identify clouds in satellites imageries.
21. What is Remote Sensing? What are major components of Remote sensing? Give one example for each LEO, MEO, HEO, GEO satellites.
22. What are the types of Cyclones? Which technique is used to measure the intensity of cyclone? Draw a flowchart explaining this technique. What are the limitations of this technique?
23. Name the types of remote sensing based on the source of energy. Give examples of each.
24. Write 4 elements of satellite image interpretation.
25. Explain the Dvorak technique using a flowchart. Write the limitations associated with Dvorak technique.
26. Write a note on Basic principles of Satellite Imagery interpretation.
27. What are the important points to be followed while interpreting Satellite imagery?
28. What properties of clouds are used for their detection using satellite based remote sensing. How different cloud types (low/med/high) are identified using Vis and IR channel imagery.
29. What are the advantages and limitations of Polar and Geostationary orbits?

Q 4. Write short note on

1. Difference between geostationary and Polar Orbital satellites.
2. Explain the difference between Infrared and Microwave radiometers.

3. Describe the principles of remote sensing. Briefly discuss the types of remote sensors used in satellite observations.
4. Differentiate the Geo- synchronous and Sun - synchronous satellites. Discuss their merits and demerits.
5. Discuss and differentiate the features of currently operational INSAT geostationary satellites.
6. How many types of imageries are used in Dvorak's technique?
7. Describe briefly the calculation of Data T. No using digital IR imagery.
8. Write the difference between Passive and Active Remote Sensing and write two examples of active and passive sensors.
9. Discuss the identification of snow, fog and low clouds in visible imageries.
10. Imager Channels of Insat-3D.
11. Difference between passive and active remote sensor with examples.
12. Write the advantages of Imager payload of INSAT 3D over the VHRR payload? What are the basic principles of satellite imagery interpretation?
13. What are the important points to be remembered while interpreting satellite imagery?
14. Dvorak technique and its limitations.
15. Principles of satellite soundings.
16. Physical Retrieval method.

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FINAL EXAMINATION

PAPER –VII : SATMET, RADAR AND SEISMOLOGY

TIME; 1030-1330 **MAX. MARKS: 60**

PART B : RADAR **(Maximum Marks: 20)**

Q 1. Fill-in-the blanks

1. The unit of radar reflectivity factor (Z) is ……
2. Wave length of C-band Radar Radiation is _____
3. _____ approximation is used in Weather Scattering cross-sections in Radar observations
4. _____ products from Doppler Weather radars are useful for aviation safety
5. _____ are used for transporting RF energy from Transmitter to Antenna.
6. Generally Electro-magnetic waves in radar are _____ polarized
7. _____ is the RF generating sub-unit of Radar.
8. _____ are severe weather events that can be identified in weather radar.
9. When CB cells are aligned in a long row nearly continuously it is known as _____.
10. _____ Band Radars are used in Cyclone Detection Radar Network.
11. The maximum range of the radar is given by the expression rmax = _____ .
12. The device used for power transmission in DWR is _____ .
13. The range of PRF used in DWR is from _____ To _____Hz.
14. The expression of Doppler Dilemma is _____ .
15. Limitation of Radar observations beyond Range of 500 kms is mainly due to _____.
16. _____ is the base velocity product generated by every Doppler weather radar.
17. The range of PRF used in DWR is from _____To _____ Hz
18. _____is a forecasting technique valid for 2 to 4 hours duration.

19. General cloud height of CB cell is beyond _____ kms as seen in radars.
20. PPI (V) product displays _____ of target at maximum range of _____
21. MAX (Z) displays _____, _____ & _____ in a single product.
22. The maximum unambiguous velocity in DWR is given by _____
23. The range of radar for the time traverse of 2 micro second is _____
24. The unit of radar reflectivity factor (Z) is _____ .
25. The device used for power transmission in DWR is _____ .
26. The ON/OFF switch of radar is known as _____ .
27. The linear unit of radar reflectivity factor (Z) is_____

    (a) dBZ (b) mm6/m3 (c) 1/m (d) dBm
28. The gain of an isotropic antenna is_____

    (a)0dBi (b)1 dBi (c) 45 dBi (d) None of these
29. Radar Back Scattering cross-sections in Radar observations is presumed to be _____ Scattering.

    (a)Bragg's (b) Mie (c) Optical (d) Rayleigh
30. The range resolution of radar for a pulse width of 2 micro second is _____

    (a) 300m (b) 300km (c) 150m (d) 150km
31. The product used to represent 24 hours rain fall in DWR is _____
32. The radar receiver is of _____(Heterodyne/Super-Heterodyne) type.
33. The DWR product representing vertical profile of wind is _____

    (a)Vertical Velocity Product (b) Volume Velocity Processing

    (c)Variation Velocity Product (d) Volume Velocity Product
34. S-Band radars are chosen for cyclone detection because_____

    (a)Better sensitivity (b) Lesser Attenuation (c) Rugged to withstand cyclone (d) All of the above
35. For better rain estimates

    i. Dual wavelength radars can be used

    ii. Dual polarization radars can be used

    (a) only (I) applies (b)only (II) applies (c) Both (I) & (II) is applicable (d) Neither (I) nor (II) applies
36. Microburst signature can be identified by regions of higher _____ (Azimuth/ Radial) Shear.

37. Antenna typically scans in constant elevation mode (elevation is incremented to scan a volume) under PPI (plan position indicator) scan strategy, while ……..… scan strategy scans the volume in constant azimuth mode.
38. A wind profiler is a sensitive Doppler radar, designed to point (nearly) vertically and operate on …….
39. The most common wavelength used for RF transmission in S-band Radars is ……. Centimeter.
40. dBm is …… measure of power ratio with reference to one milli-watt (mW).
41. IMD has installed a number of S-band Radars in entire coastline to observe and track ….....
42. If the bright colour patch (dBZ > 40) is seen in maxZ product of any Doppler Weather Radar up to 8 km height, the cloud being observed is most probably ….....cloud.
43. Warm, dry air advection over cooler water surface leads to bending of EM waves below the travelling path and referred as _____
44. A wind profiler is a sensitive Doppler radar, designed to point (nearly) vertically and operate on _____
45. Rayleigh scattering approximation is used in Weather Radars detecting atmospheric waves, while _____approximation is used in Oceanic Radars detecting sea surface waves.
46. _____is a forecasting technique valid for 2 to 4 hours duration.
47. …….. product of Doppler Weather Radar can be used to identify veering or backing in the wind near the Radar station.
48. Considering the wavelength of X-band radar as 3 cm, the most probable size of the antenna would be …….…… meter.
49. ……..…… approximation is used in Oceanic Radars detecting sea surface waves.
50. Pulse width of long pulse in Radar is …… micro seconds.

Q 2. State with brief reason whether following statements are True or False

1. Radar signal processing algorithms takes care of the earth curvature correction before height information in is presented in radar echoes.
2. Radar products in DWR cannot be generated after the raw data is collected. It has to be generated on-line only.
3. IRIS software is used in Chinese Metstar Radar.
4. X-Band radar can be used for the tracking of cyclones at coastal stations.
5. The diameter of the antenna of radar does not depend upon the wavelength
6. Klystron does not need magnetic field for operation.
7. Z, V, W are secondary products produced by DWRs.
8. Large water droplets in rain showers absorb X-band RF Radiation
9. Uniform scan strategy is adopted by all IMD DWRs for regular data collection.
10. DBm is an absolute unit of power.
11. DWR's can detect the clouds at a distance of 800 kms.
12. DWR can measure true velocity of the target.
13. The velocity of the target can be measured in clear weather system.
14. S-band radars cannot be used for thunderstorm studies.
15. DWRs take a photograph of cloud and present it as Reflectivity product image.
16. Weather radars generally have beam width of 10 degrees or more.
17. The velocity of the target cannot be measured in clear weather system.
18. DWR's can detect clouds at a distance of 800 km.
19. Conventional (non DWR) radar can track the cyclones.
20. S band radars have a wavelength range of 3.8 cm to 7.5 cm
21. DWR can measure true velocity of the target.
22. The gain of the radar antenna is independent of operating wavelength.
23. Ka-Band radar can be used for tracking of cyclones at coastal stations.
24. Dual PRF technique overcomes range and velocity ambiguities
25. VIL product can be used as a Hail indicator
26. IMD radars operate in surveillance scan mode and migrates to volume scan during weather
27. Cyclone Monitoring using weather radar comprises of
    a. Fixing the center using PPI(Z) imageries through Meigen Technique if eye visible
    b. Fixing the center using PPI(Z) imageries through Meigen Technique even if eye is not visible

c. Fixing the center using PPI(Z) imageries using animation technique if eye visible
d. Fixing the center using PPI(Z) imageries using Spiral fixing technique even if eye is not visible
e. Fixing center using 'D' Signature in PPI(V) images following Zero isodop
f. Estimating maximum radial winds at Eye-wall region
g. Estimating maximum reflectivity at Eye-wall region
h. Providing tendency & movement of the system correlating with earlier observations

28. Weather Radar equation .

a. presumes point targets and has inverse dependency to fourth power of target range

b. presumes distributed targets and has inverse dependency to fourth power of target range

c. presumes point targets and has inverse dependency to square of target range

d. presumes distributed targets and has inverse dependency to square of target range

29. Various bands used in Radars and applications are
    a. Ka band radar for cloud studies
    b. L band radar for air surveillance
    c. S band radar for weather surveillance
    d. HF radar for Ocean/sea wave observations
    e. W/V band radar for Police hand-held Doppler guns
    f. C band for fog detection
    g. VHF radar for satellite borne platform
30. X band radar for Cyclone detection and surveillance 3.4 Scanning methods adopted in Radars are
    a. PPI – Scan where the elevation angle is constant
    b. PPI – Scan where the azimuth angle is constant
    c. RHI – Scan where the elevation angle is constant
    d. RHI – Scan where the azimuth angle is constant
31. For a S band radar operating at 450/600 Dual PRF operation the following holds
    a. The wavelength is approximately 5 cm
    b. The wavelength is approximately 10cm

c. The maximum unambiguous range is 333km

d. The maximum unambiguous range is 500km

e. The maximum unambiguous Velocity is 45 m/s

f. The maximum unambiguous Velocity is 22.5 m/s

g. An echo at true location 300km would be shown as such at 300km

h. An echo at true location 300km would be shown at 50km

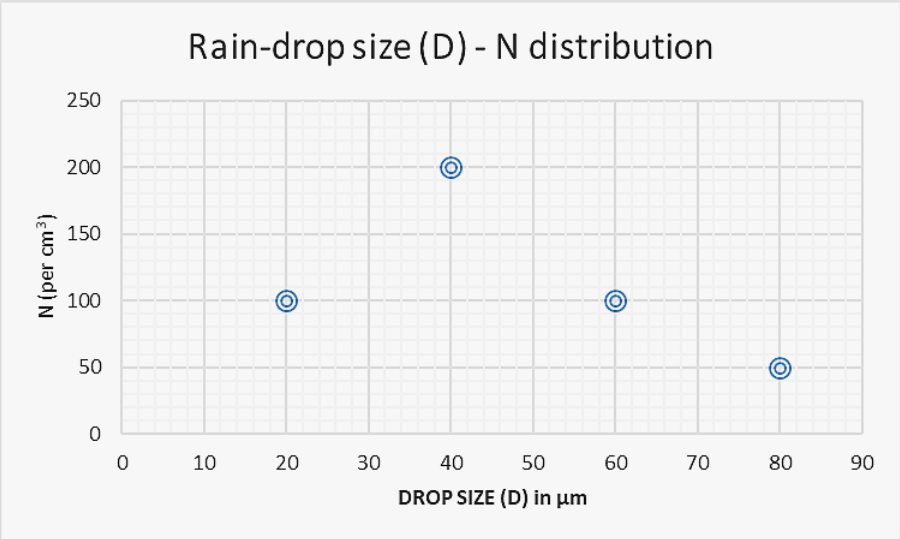
32. Cloud patch observed in DWR with 50 dbZ or more reflectivity indicates the formation of hail in cumulonimbus clouds.
33. An increase in gain is accompanied by a decrease in beam-width and is achieved by increasing the antenna size relative to the wavelength.
34. Unambiguous radar range increase with increase in pulse repetition frequency (PRF).
35. In a RADAR system the transmitter of the radar is more sensitive than the receiver.
36. S-band radar are economic than C-band radar.
37. Range Height Indicator product (RHI) is in which reflectivity, radial velocity or spectral width is presented on a conical surface of a constant elevation as an output image
38. S-band radars cannot be used for thunderstorm studies.
39. Radar products in DWR cannot be generated after the raw data is collected. It has to be generated on-line only.
40. Rotational couplet identification is not affected by azimuth resolution.
41. Shorter wavelength radar cannot yield rain rate values precisely.
42. In a RADAR system the transmitter of the radar is more sensitive than the receiver.
43. Shorter wavelength radar cannot yield rain rate values precisely.
44. Non-polarimetric radars measure only the vertical dimension of cloud and precipitation particles.
45. Rotational couplet identification is affected by elevation resolution.
46. SWIRL is short-range forecast model.
47. If the obstruction is happened due to a cloud of water droplets, then their antenna electrical characteristics will be independent of drop size, which is the positive aspect of Doppler RADAR.

Q 3. Answer the following questions in Brief

1. Explain the products PPI (Z)

2. Explain the product CAPPI (Z).
3. What are the advantages of Max_Z product?
4. Write a list of various types of cloud echoes seen by a weather radar
5. Describe various types of cloud echoes briefly.
6. Derive Radar equation
7. Explain various terms in Radar equation
8. Describe the Rayleigh scattering applied in the radars.
9. What is the difference between Radar Reflectivity and radar reflectivity factor?
10. What are various bands of frequencies used in DWRs of IMD
11. Write applications of various bands used in DWRs briefly.
12. Write at least 3 major Sub-units used in Radar
13. Describe role of any Sub-units used in Radar briefly.
14. Write 5 derived DWR Products.
15. Draw the schematic block diagram of Doppler Weather Radar
16. Explain any sub-unit of Doppler Weather Radar.
17. Explain any DWR Products.
18. Explain the products, PPI (Z) and CAPPI (Z). What are the advantages of Max_Z product?
19. Write a list of various types of cloud echoes seen by a weather radar describe them briefly.
20. What are various bands of frequencies used in DWRs of IMD and write their applications briefly.
21. Write at least 3 major Sub-units used in Radar and describe their role briefly.
22. Write briefly on any 5 derived DWR Products.
23. Draw the schematic block diagram of Doppler Weather Radar and explain various sub-units.
24. Derive Radar equation and explain various terms in it.
25. Discuss the Rayleigh scattering applied in the radars. What is the difference between Radar Reflectivity and radar reflectivity factor?
26. What are the advantages of Max_Z product ?
27. Write radar range equation and explain the terms involved.
28. What is Doppler dilemma? Is it used in DWR Operation?
29. Write a short note on radar calibration.
30. Write briefly on any 5 derived DWR Products.

31. Describe some advantages of Doppler radar over other meteorological radars? Calculate maximum unambiguous velocity of S-band Radar of 800 PRF.
32. Explain the PPI and RHI scanning in DWR
33. Draw the block diagram of a Radar?
34. Discuss on the different types of transmitters used in radars and mention its merits and defects.
35. Write down the radar equation and explain the terms involved and discuss on radar reflectivity
36. Do you agree whether antennas with a large beam width are preferred over narrow beam antennas for any weather radar system? Justify your answer (yes or no).
37. Define radar cross section (σ).
38. What is Super and sub refraction?
39. Pulse radar operating at 10GHz frequency has an antenna with a gain of 28 dB and a transmitted power of 2kW. If it is desired to detect a target of cross section 12 sq. m and the minimum detectable signal is -90 dBm, then, what will be maximum range of the radar ?
40. Discuss the structure and evolution of Squall Lines in Doppler Weather Radar imageries to identify the squall lines and associated severe weather.
41. Derive Radar equation and explain various terms in it.
42. Discuss the VIL product of Doppler Weather Radar with its dependence upon different hydrometeors. Also, mention brief note on its limitations and strengths.
43. Compute the Radar reflectivity (dBZ) for a location for the raindrop size distribution (fig. size vs raindrop count).



44. Derive Radar equation for distributed target to compute Radar reflectivity and explain various terms in it.

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TIME; 1030-1330 **MAX. MARKS: 60**

PART C : SEISMOLOGY **(Maximum Marks: 20)**

Q1. fill in the blanks

1. The fastest traveling seismic wave is _____.
2. In terms of energy consideration, a 5-magnitude earthquake is _____times larger than a 3- magnitude earthquake.
3. National seismological network of India is presenting consisting of _____ field stations.
4. As per BIS code IS-1892 (part 1):2002, entire India is divided in _____ Seismic zones.
5. Propagation of tsunami wave in ocean is due to the interaction of _____ with the initial large disturbances in sea water.
6. _____ wave is the fastest amongst various seismic waves and hence recorded as first arrival on the seismogram.
7. For an earthquake, _____ changes with epicentral distance.
8. The inner most layer of the earth is called _____ .
9. Risk = Hazard **X** _____ **X** Exposure **X** Location**.**
10. The fastest traveling seismic wave is _____.
11. The inner most layer of the earth is called _____ .
12. The speed of S-type seismic wave in water is _____ Km/S.
13. The _____ is now considered as the best model for global earthquake locations.
14. Broadband sensor can record seismic wave in the frequency range of _____ .

15. National seismological network of India consists of _____ field stations
16. In terms of energy consideration, a 5-magnitude earthquake is _____times larger than a 3-magnitude earthquake.
17. Degree of shaking due to earthquake is called_____.
18. There are ……. numbers of Seismic zones in India as per IS (1893 (Part(I) : 2002) code.
19. The waves generated in Ocean due to big earthquake is know as ……..
20. The Series of Earthquakes of smaller magnitude occurs is a particular place and continued for few couple of days is called …… (Swarm/ Tsunami).
21. Seismo meters used to measure the ……. .
22. Generally ground motion of magnitude above …….. (3.5/4.0/2.5) can produce shaking in the surface.
23. The fastest travelling seismic wave is _____.
24. The inner most layer of the earth is called_____.
25. The speed of S-type seismic wave in water is _____ Km/S.
26. National Seismological Network of India consists of _____ field stations.
27. In terms of energy consideration, a 5.0 magnitude earthquake is _____ times larger than a 4.0 magnitude earthquake
28. The average P-wave velocity in the Crust is ----------
29. Low angle reverse fault is called----------
30. India has _____ seismic zones.
31. Intensity is measured in _____ scale.
32. ---------- times of energy will increase or decrease for 1 unit magnitude increase or decrease respectively.
33. The upper most layer of the earth is called----------
34. A large earthquake under the sea can produce ---------- waves
35. A local earthquake of its magnitude is measured in ---------- scale.
36. An instrument that records earthquake is called ----------
37. Till date National Seismological Centre has a total number of ---------- seismic monitoring stations in India.
38. National Seismic Network of India has about ---------- seismic monitoring stations across India.
39. A potential earthquake magnitude under Sea may generate ----------
40. India is broadly demarcated into ----------seismic zones.

41. Seismic Zone Factor of 0.16 represents the seismic zone ----------.
42. Average velocity of P-Wave in the crust is ----------
43. Fastest travelling seismic wave is ----------wave.
44. Seismic zone ---------- is known as the highest seismic hazard (as per Bureau of Indian Standard).
45. For each magnitude increase or decrease there is about ----------times of energy would be increased or decrease respectively.
46. Impending earthquake in a region is called seismic----------.
47. The average P and S wave velocity (km/s) in the earth crust are ---------- and ---------- respectively.
48. India is divided into ---------- seismic zones.
49. There are ---------- numbers of seismic stations across the country.
50. Intensity is the degree of ---------- measured in MMI scale but peak ground acceleration is observed ground motion which can be recorded by strong motion instrumental.
51. Earthquake parameters are: Origin time, epicentre, magnitude and ----------
52. Magnitude of earthquake is the amount of ---------- release.
53. Local earthquakes are measured in ----------scale.
54. The Love and Rayleigh waves are the called ----------wave
55. Average thickness of the crust----------km.
56. One unit of increase or decrease in magnitude corresponding ----------times energy increase or decrease respectively.
57. The process of seismic hazard assessment in a city, the process is called----------.

Q.2. Write whether the statements are True/false with reasons.

1. Direct P-type seismic wave can reach at a distant between 104^{o} and 143^{o} from the epicenter.
2. All conventional types of magnitude estimations (ML, mb, Ms) of an earthquake have tendency to saturate at higher magnitude values.
3. Local magnitude (ML) is not used for estimation of the size of regional or distant earthquakes.
4. Taller buildings are safer than the smaller building.
5. Tsunami can be generated only by earthquakes.

6. Low frequency component of the seismic waves has high influence on rocky soils.
7. It is the buildings that kill people and not the earthquake.
8. Intensity of an earthquake at a place varies with distance from epicenter.
9. Seismograph with Electromagnetic sensor, records the ground acceleration.
10. Local magnitude (ML) is not used for estimation of the size of regional or distant earthquakes.
11. S- Wave can travel through the outer core of the earth.
12. Tsunami can be generated only by earthquakes.
13. A seismometer can record true ground motion if it's mass is without damping arrangement.
14. P-wave is the fastest travelling seismic wave.
15. Seismo graph is the paper use to measure the ground motion.
16. The velocity of s-wave in liquid is zero.
17. Epicentre distance is measure due to shallow earthquake between focus and the site of observation is also called the Hypocentre distance.
18. Broad band Seismo meter used for the short period and also way period ground motion measurement.
19. Degree of attenuation is increases with distance .
20. Particle motion in Rayleigh waves is parallel to the wave propagation
21. Earthquakes don't kill people, Buildings do.
22. Seismic risk is the product of the seismic hazard and vulnerability of the built environment.
23. Shear wave velocity is not zero in the liquid.
24. Geological faults are the sources of earthquakes.
25. Velocity of S-wave is faster than P-Wave.
26. Conversion of phases from P- to S- phase or S-to P- is found common when a seismic wave propagates from one medium to other anisotropic medium.
27. Dissipations of earthquake energy increases with distance (from epicentre to a distance sites) in the rock formation.
28. Tomography study could provide the information of earthquake source dynamics.
29. Average density of Earth Crust is 2.67gm/cc
30. Earthquake of magnitude 2.5 and above can be located (earthquake parameters) in
31. Delhi NCR due to close setup of seismic network in Delhi NC
32. Intensity is measured in Roman Number.

33. Shear wave velocity in the outer core is zero.
34. Surface waves are faster than Body waves.
35. Intensity of earthquake is estimated from the post-earthquake environment affect.
36. Faults are the weak zones for earthquake sources.
37. Seismic Gap theory is used for earthquake prediction research.
38. Shear wave velocity is zero in the outer core.
39. Body waves are faster than surface waves.
40. Analogy recording is better than digital recording system.
41. Seismic wave cannot be recorded at an epicentral distant between 105^{o} and 143^{o} on the earth surface.
42. Tsunami is the large sea waves, when a potential earthquake occurred under sea at shallow focal depth.
43. Earthquake Intensity varies with distance from epicenter.
44. The velocity of S-wave in liquid is not zero.
45. Inner core is solid.
46. P-wave is the fastest travelling seismic wave among the other waves generated due to earthquake.

Q. 3 Answer the following questions in brief

1. Draw various components of digital seismographs.
2. What are the advantages of digital seismograph over analog seismograph?
3. Define Seismic Hazard .
4. Define Risk Microzonation.
5. Describe briefly the relationship between Seismic Risk and Hazard.
6. What is fault
7. What are different types of faulting.
8. Working principle of seismometer.
9. Describe working principle of broadband seismometer.
10. Describe configuration of broadband seismometer
11. Differentiate between Intensity and magnitude of an earthquake.
12. Explain various types of commonly used magnitudes to measure the size of an earthquake.
13. Theory of Plate Tectonics.

14. Seismic Zonation of India.
15. Draw and explain various components of digital seismographs. What are the advantages of digital seismograph over analog seismograph?
16. Define Seismic Hazard and Risk Microzonation. Also describe briefly the relationship between Seismic Risk and Hazard.
17. What is fault and different types of faulting.
18. Discus working principle and configuration of broadband seismometer.
19. Differentiate between Intensity and magnitude of an earthquake. Explain various types of commonly used magnitudes to measure the size of an earthquake.
20. Commonly reported Earthquake Precursors.
21. Routine maintenance work done by an operator posted at a seismological observatory.
22. Briefly describe various common types of seismic wave that are generated during an earthquake.
23. Also mention the direction of particle motion in the media with respect to direction of propagation of seismic energy for each type of the seismic wave.
24. Define Seismic micro zonation and macro zonation.
25. With seismo meter recording systems and the data communication system used for field Analysis centre.
26. Principal of operation of seismo meter.
27. Present statures of the seismic network in India and routine mentainance of it.
28. What is fault and also describe different types of faulting with diagrams.
29. Briefly describe various common types of seismic wave that are generated during an earthquake. Also mention the direction of particle motion with respect to direction of propagation of seismic energy for each type of the seismic wave.
30. What is seismic microzonation? Why is it useful for city planning?
31. Draw the internal structure of Earth.
32. Define the term earthquake precursors. Write down any two important earthquake precursors.
33. Draw a seismograph and explain its working principle.
34. Soil structure interaction may cause differential damage due to earthquake.
35. Broad Band seismograph is better than short period and long period seismograph.
36. Seismic microzonation is a useful tool for earthquake disaster mitigation plan.
37. Earthquake precursors may be used to assess the early warning of earthquake prediction research

38. Write down the at least three differences between earthquake magnitude and intensity.
39. Draw in free hand the different types of geological Faults and level it
40. Draw in free hand the internal structure of earth and level it.
41. Draw in free hand the different component of a seismograph, and its communication systems.
42. Write down the status of earthquake early warning prediction research in India.
43. Define the terms, (a) Seismic hazard, (b) Vulnerability and (c) Seismic Risk assessment.
44. Draw in free hand the internal structure of the earth and level its different parts (Such as Crust, Mantel, Outer and Inner Core). How the P-wave, S-wave velocities and density are varied with internal structure of the Earth?
45. Draw the different components of a seismic instrument (starting from sensor, recorder and data communication system) and explain its different components.
46. What is Seismic Microzonation? How is it societal useful? Define the terms Seismic
47. Hazard, Vulnerability and Risk. Write down the different parameters which are measured in seismic microzonation study?
48. Define the term earthquake precursors. Write down any two important earthquake precursors. Define the term Tsunami. What do you mean by early warning of tsunami over Indian coast and the neighboring countries?
49. Write down in detail the different steps to setup a New Seismic Station. Define the terms micro-seismicity, foreshocks, aftershocks and main shock earthquake. Write down the earthquake parameters.
50. Write down the relationship between Seismic Hazard, Risk and Vulnerability.
51. Write down the name of four common types of geological faults.
52. Write down any two differences between intensity and magnitude.
53. Theory of Plate Tectonics.
54. Write any two parameters of earthquake Precursors.