

**INDIA METEOROLOGICAL DEPARTMENT**

**QUESTION BANK**

**OF**

**ADVANCED METEOROLOGICAL TRAINING**

**COURSE (AMTC)**

**SEMESTER-II EXAMINATION**

**ELECTIVE SUBJECT**

**BASED ON 173-181 BATCHES**

**(2013-2021)**

**PAPER-VI:    ADVANCED**  
**HYDROMETEOROLOGY**

**PART B**

**India Meteorological Department  
Meteorological Training Institute  
Advanced Meteorological Training Course,  
SEMESTER II (ELECTIVE SUBJECT) Final Examination**

**PAPER VI: ADVANCED HYDROMETEOROLOGY (PART B)**

**Q1. Fill in the gaps:**

1. ----- distribution function is used for Return period analysis of extreme rainfall series.
2. ----- Techniques used by Flood Meteorological Offices (FMOs) of IMD for computing river sub-basin-wise AAP.
3. \_\_\_\_\_ method is used when the rainfall is not uniform and ground surface have changes in topography.
4. .... process is the direct conversion of snow and ice to atmospheric water vapor.
5. ....is formed when snow is sufficient to persist till the next spell of snowfall.
6. A day is called rainy day if the rainfall of that day equals or exceeds \_\_\_\_\_.
7. A snow crystal is a ..... made of ice, water, air and impurities.
8. According to WMO (based on the data 1980-2007), Globally about 90% of economic losses is due to the -----Hazards (Hydro-meteorological/Earthquake/Epidemic, insects).
9. Albedo of old snow cover is \_\_\_\_\_ (more/less) than the fresh snow
10. All the meteorological sub-divisions of India received maximum rain during southwest monsoon season.
11. As per WMO, network density of raingauges in plain area is \_\_\_\_\_.
12. Contour of constant rainfall is called \_\_\_\_\_.
13. DRMS stands for .....
14. For optimum raingauge network design, the WMO recommended area per one non recording raingauge for the plain region is ..... and for the hilly region (msl > 1 km) is .....
15. Geological unit which can store and supply significant quantity of water is called\_\_\_\_\_.

16. Glacier is a snow deposition phenomena of \_\_\_\_\_ (seasonal scale/ century scale)
17. Historical Observation data is used for development of model while Numerical Weather Prediction Model Output is used for operational purpose is known as .....approach.
18. In 1989 the scheme named ..... got approved by Govt. of India for compiling rainfall summary for all the seasons and for Districts / met sub Divisions and Country as whole.
19. In Design Storm Studies by physical method, average areal rainfall is estimated by using ----- method.
20. In Districtwise Rainfall Monitoring Scheme (DRMS), category of rainfall situation is determined with respect to ----- rainfall for given period.
21. In terms of all India rainfall, Monsoon rainfall is about ..... % of the annual rainfall.
22. India Meteorological Department is providing Quantitative Precipitation Forecast (QPF) through 10 Flood Meteorological offices to ----- of Central Water Commission.
23. India Meteorological Department is providing Quantitative Precipitation Forecast (QPF) through 10 Flood Meteorological offices to ----- of -----.
24. Infiltration means transport of water from ----- to -----.
25. Loss of water of the plants to the air is known as \_\_\_\_\_.
26. Method used for finding the missing value of rainfall at a station when normals and rainfall values of nearby stations are known is called \_\_\_\_\_.
27. Model Output Statistics (MOS) approach relates a weather ----- (predictand) to variables forecast by ----- (predictors).
28. Percolation means transport of water from \_\_\_\_ to \_\_\_\_\_.
29. Percolation of water means ..... of water (surface flow/sub surface flow).
30. Probable Maximum Precipitation is ----- limit of rainfall over given catchment for given duration.
31. QPF is issued by \_\_\_\_ .( FMOs/ MCs).
32. Quantitative Precipitation Forecast (QPF) is the expected amount of rainfall accumulated over a specified ----- over specified area .
33. Quantitative Precipitation Forecast (QPF) is the expected amount of rainfall accumulated over a specified ----- over specified -----.

34. Real time weekly rainfall summary is prepared based on station wise observed rainfall data from ---- day to ----day.
35. Snow cover area is expected to be maximum ----- ( during the winter season/ by end of winter season).
36. Snow cover area is expected to be minimum \_\_\_\_\_ (during the summer season / by end of summer season).
37. Snow surface temperature is measured at \_\_\_\_ below surface level/ at surface level.
38. Specific heat of snow is \_\_\_\_\_.
39. Sub-basin-wise QPF is issued by FMOs for the purpose of ----- Forecast. (Riverine Flood /Flash Flood/Urban Flood)
40. The accuracy of the rainfall measured in a raingauge is correct up to \_\_ decimal place.
41. The accuracy of the rainfall measured in ordinary raingauge is correct up to \_\_ decimal place.
42. The centre of the rainstorm is the ----- rainfall recorded over given area.
43. The contour of equal rainfall line is called-----.
44. The formula of rainfall percentage departure is \_\_\_\_\_.
45. The rainfall data of a particular station is known as \_\_\_\_\_ data.
46. The snowfall is recorded in terms of .....after deducting known quantity of warm water from total water collected in receiver.
47. The steepness of the mass curve indicates the \_\_\_\_\_ of rainfall.
48. The structures which have storage capacity .....M3 mtr are designed using PMP as Design storm.
49. The value of Moisture Adjustment Factor (MAF) for the computation of Probable Maximum Precipitation (PMP) is always ..... 1. (greater than/less than)
50. Three types of statistical series used in rainfall analysis are \_\_\_\_, \_\_\_\_, and \_\_\_\_.
51. Total No. of large dams in India is about .....
52. What are the conditions to be defined as large dams?
53. When the area of a basin is less than 25 sq. km..... data is sufficient for calculating SPS value.
54. WMO advocated that an optimum network for Interior plain area per station for Non recording is ----- km<sup>2</sup> and recording is ----- km<sup>2</sup>.

55. Which of the following is used to predict the missing data?

a) Hyetograph b) IDW c) Mass Curve d) All.

56. Aridity index (AI):

$$AI = \frac{PE - AE}{PE} \times 100$$

Where PE= ..... and AE= .....

**Q. 2. State with brief reasons whether the following are true or false:**

1. A network of one rain gauge station over an area in plains is more than the hilly regions.
2. All the meteorological sub divisions of India received maximum rain during south west monsoon season.
3. Annual rainfall of a station is the average of the rainfall occurred over the station of all the monthly rainfall of that year.
4. Any one of PMF, SPF or return period can be used for Inflow Design Flood (IDF) or Design storm for the safety of any size of dam.
5. Both Specific Heat and thermal capacity of snow are always constant.
6. Density of snow is constant for all type of snow.
7. Density of snow sample does not depend on relative volume of ice and air in the snow crystal.
8. Depth of snowfall can be obtained from the equivalent water.
9. During the monsoon months when the movement of western disturbances across the extreme north of the country synchronizes with the movement of some of the monsoon weather systems, exceptionally heavy falls of rain are experienced in the basin areas resulting in severe floods.
10. Evapotranspiration is the process by which the soil moisture is taken up by a plant root system and eventually evaporates through stomata.
11. For Arithmetic Mean Method, at least two rain gauge points are required for calculation of missing data using.
12. For snow cover estimation geostationary satellite is more useful than remote sensing satellite.

13. Formation of different shapes of ice crystal is not driven by any factors.
14. Hydrological cycle is often called the water cycle in the vertical direction only.
15. In IDW, the weightage of each index station is directly proportional the square of its distance from the missing station.
16. Infiltration capacity of soil always remain constant during the period of the rainstorm.
17. Isopercental technique for computation areal rainfall is suitable for which region and why?
18. Monthly rainfall of a station is the average of rainfall of all the days of that month.
19. Monthly rainfall of a station is the average of the rainfall occurred over the station of all the daily rainfall of that month.
20. Normal or Gaussian distribution is used extreme value analysis.
21. Rainfall – Runoff relation can be expressed by hyetograph.
22. Rainfall Hyetograph can be drawn by using rainfall mass curve.
23. Rainfall hyetograph can be obtained from rainfall mass curve and vice versa.
24. Return period analysis is calculated by using Gumble's Distribution.
25. Return period for rainfall event is calculated on the basis of Ordinary Rain gauge (ORG) data.
26. Return period of an extreme event is the time period within which the extreme event will be occurring.
27. River floods may occur in an area without experiencing rain in that area.
28. Snow cover area is expected to be maximum by end of August / September and minimum by end of February
29. Snowfall measurement is affected by drifting of past snow due to wind from neighboring area.
30. SPS value is greater than PMP value.
31. The shape of a hydrograph depends solely on the intensity of the rainfall.
32. Thermal capacity of snow is constant for all type of snow.
33. While drawing isohyets for analysis of rainfall, topography of the region is not considered.

**Q3. Answer the following:**

1. Albedo of Dry Snow is approximately:
2. Define Flood.
3. Define form factor, density of drainage?
4. Define hydrograph and unit hydrograph. What is the importance of unit hydrograph?  
State and explain the five components that influence in rainfall runoff relation.
5. Define Hydrological cycle with a brief diagram.
6. Define hydrological cycle? Explain with neat sketch each components of it.
7. Define meteorological and hydrological floods. Explain various types of floods.
8. Define QPE and QPF. State and discuss various methods of QPF in details.
9. Define runoff. State and explain the factors on which runoff is depended. Also discuss different components of runoff.
10. Define series. State and describe the type of series used in hydrological data analysis with example for each of the type.
11. Define snow cover. Mention the three factors on which snow cover properties are classified. All classify snow cover based on each of these three factors.
12. Define unit hydrograph, hydrograph with its components explained.
13. Discuss details about Standardized Precipitation Index along with its strength and weakness, key points in monitoring dry/wet condition of a region.
14. Explain Thiessen Polygon method for estimation of areal rainfall.
15. For calculation of average rainfall for a state the which method is more appropriate: (i) Arithmetic Mean of all station rainfall data available in the state, (ii) District Area weighted average rainfall, (iii) Both the above method will lead to same results.
16. For estimation of snow cover Polar Orbiting Satellites are always preferred over
17. Geostationary Satellites: True/False
18. Give an example for Man Made Flood.
19. How is Snow measured? State new developments in the field of snow measurements.
20. If the reservoir level rises in  $\Delta t$  by 2cm, what model is applied to it?
21. In DRMS, how we estimate meteorological sub divisional rainfall from District rainfall?

22. In statistical approach of network design what are the main parameters which determine the network density.
23. Latent Heat of snow:
24. Rainfall resolution of India came in year:
25. Snow surface temperature is measures at:
26. Snow to water ratio is always 10:1 : True/False
27. Spatial resolution of CARTOSAT1 is:
28. Spatial resolution of CARTOSAT2 is:
29. Specific Heat of snow:
30. State and explain in brief five major hydro meteorological disasters.
31. State definition of Snow and ice crystal. Explain its properties in detail with respect to shape/type of ice crystals.
32. The Normal Rainfall of District A for given period is 50 cm and category of rainfall is Large Deficient. What will be the inference about Actual Rainfall in quantitative terms (range of expected rainfall)?
33. Thermal Capacity of snow:
34. What are the advantages and limitations of estimation of average areal rainfall by Arithmetic averaging method.
35. What are the factors affecting run off?
36. What are the methods for getting areal rainfall from point rainfall? Explain any two of them.
37. What is drought? State and describe all the types of drought.
38. What is GLOF?
39. What is QPE? Discuss various methods of QPE along with their advantages and disadvantages.
40. What is return period? State the probability distribution most commonly used for extreme value analysis. Write the expression of return value ( extreme value for a period of n years with describing each of the term obtained from the probability distribution.
41. What is SPS and PMP and what is the relation between them?
42. What is the difference between event- based and continuous modeling?
43. What is watershed divide? What is run-off co-efficient?



44. Whether remote sensing observation technique can be used for computing rainfall estimation or not. If yes, give example.
45. Which one would be more likely to activate as an ice nuclei; Silver Iodide (AgI) or Clay particle.
46. Write a brief note on conversion of point rainfall to areal rainfall.
47. Write down the equation for estimation of 'Snow melt' based on 'Energy Balance Approach'.
48. Write down the equation for estimation of 'Snow melt' based on 'Linear Degree-Day' Approach.
49. Write short notes on QPF and flood management.
50. What are the assumptions made while working out Moisture Adjusting Factor for given Rainstorm?

Work out areal rainfall for 5000 km<sup>2</sup> area in the vicinity of rainstorm centre from following data

Isohyte From	To in cm	Area between Isohyets km <sup>2</sup>		
0	15	1000		
15	25	4000		
25	35	3000		
35	45	2000		

51. Define return period. The one day annual maximum rainfall (in mm) data series of Colaba Mumbai, are given below. Find the return period of the event 30 cm or more rainfall.

1901	1902	1903	1904	1905	1906	1907	1908	1909	1910
144.3	151.6	127.8	86.4	82.3	119.1	254.5	129.3	120.1	304.0

1911	1912	1913	1914	1915	1916	1917	1918	1919	1920
111.3	164.3	201.9	178.1	248.9	165.6	148.6	135.6	277.4	182.4

1921	1922	1923	1924	1925	1926	1927	1928	1929	1930
216.2	215.1	304.8	85.6	116.8	147.1	216.9	250.7	170.9	548.1

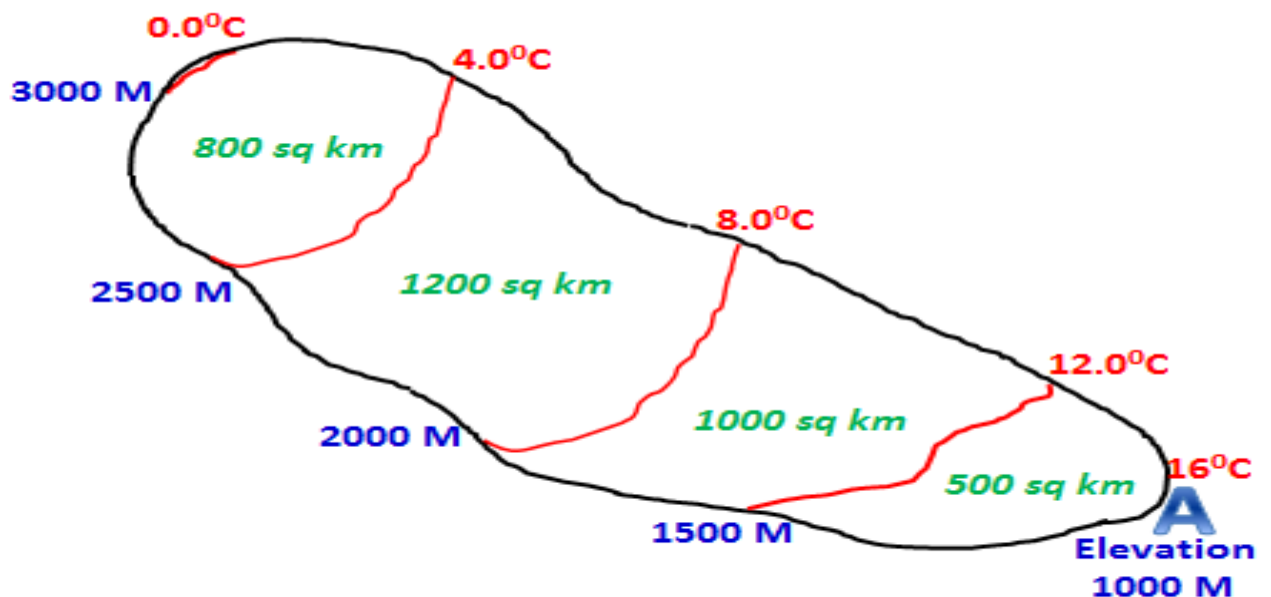
1931	1932	1933	1934	1935	1936	1937	1938	1939	1940
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242.8	174	153.2	118.9	148.3	133.9	93.5	181.1	231.6	163.1
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1941	1942	1943	1944	1945	1946	1947	1948	1949	1950
105.2	178.6	203.5	181.1	246.4	217.4	265.4	172.7	432.8	147.8

61. Estimate the snowmelt volume at a base station A shown in the following diagram by linear Degree-Day method from a glacier of 3500sq. km, assuming that:

- The mean density of glacier snow is  $0.5 \text{ gm/cm}^3$
- Degree-Day factor is 1.1
- Mean Temp. at base station is  $16^\circ\text{C}$  and
- Average lapse rate is  $8^\circ\text{C}$  per km.



Elevation (m)	Area Sq. (km)	Mean Temp. ( $^\circ\text{C}$ )	Snow Melt (cm)	Snow Melt Volume
1000-1500	500			
1500-2000	1000			

2000-2500	1200			
2500-3000	800			
Total Flow Volume				

**Q4. Write Short Note:**

1. Any two techniques for computation of areal rainfall from point rainfall
2. Causes of Flood.
3. Define Hydrologic /water cycle.
4. Design storm studies for medium and large hydraulic structures
5. Drought
6. Flood Early Warning system in India.
7. Hydrologic Cycle
8. Hydromet Bulletin
9. Hydromet Forecasting for Flood Forecasting
10. Meteorological aspects of Flood
11. Rainfall Monitoring in India
12. Synoptic Analogue Model.
13. Water cycle
14. Write a short note on SPS & PMP
15. Write a short note on Statistical series of data with example.