

INDIA METEOROLOGICAL DEPARTMENT

QUESTION BANK

OF

ADVANCED METEOROLOGICAL TRAINING

COURSE (AMTC)

SEMESTER-I EXAMINATION

BASED ON 174-181 BATCHES

(2013-2021)

PAPER-III: CLIMATOLOGY AND

STATISTICS

INDIA METEOROLOGICAL DEPARTMENT
METEOROLOGICAL TRAINING INSTITUTE
ADVANCED METEOROLOGICAL TRAINING COURSE
FINAL EXAM
PAPER III – CLIMATOLOGY AND STATISTICS
SEMESTER-I

PART A:- CLIMATOLOGY

Q.1.Fill in the blanks or say yes or no

1. _____ are weak low pressure systems (Lows, Troughs or CYCIRs) which develop in the lower troposphere south of 30°N over Rajasthan and West M.P., under the influence of W.D.
2. _____ is the single greatest cause of temperature variation over the earth's surface.
3. _____, _____ and _____ are the three very important properties of sea water
4. _____ region of Tropical Cyclone is the most dangerous part.
5. _____ consists of the basic presentation of data and its verbal or cartographic description.
6. _____ is the most important greenhouse gas responsible for climate change.
7. causes vigorous monsoon conditions over the northern parts of the west coast of India.
8. A case is considered for declaring cold wave only when $WCT_n \leq$ _____ °C.
9. A narrow tongue of cold SST appears over Arabian Sea near the southern tip of India during south west monsoon season named as Cold Pool.
10. A strong stratospheric/mesospheric zonal circulation is observed during solstice seasons (January and July) with _____ in the summer and _____ in the winter hemisphere.
11. Aquatic Biomes cover about _____ % of Earth's Surface.
12. Below the mixed layer if a decrease in temperature with depth is responsible for the increase in density with depth, it is called _____ and if an increase in salinity is responsible for the increase in density with depth, it is known as _____
13. Besides winds, the other forces that affect the ocean current are the _____ _____ distribution, _____ _____ and gravitation.

14. Brahmaputra valley of Assam has highest frequency of _____ during winter season.
15. During break monsoon condition the low level jet flows south of India with its core between latitudes _____ and _____.
16. During break monsoon period the low level jet across Arabian Sea flows _____ of India with its core between latitude _____ and _____.
17. During break monsoon period the monsoon trough shifts to
18. During break monsoon period the monsoon trough shifts towards _____ from the normal position.
19. During Indian Summer monsoon, the surface winds over Indian Seas blow from _____ direction.
20. During monsoon break, monsoon trough lies along _____.
21. During southwest monsoon season, winds are stronger over _____ areas about _____ knots than over the _____ areas about _____ knots.
22. During SW monsoon we observe following rain producing systems. i) Monsoon Depression, ii) Cyclonic storms, iii) Mid Tropospheric cyclones (MTC), iv) Off shore troughs / vortices, State true or false.
23. Dust storm occurrence is maximum in _____.
24. Duststorm/Sandstorm over NW India are locally known as _____.
25. Each year on about January 3, our planet is about 147.3 million kilometers from the sun. This position is called the _____.
26. ENSO has _____ relationship with SW monsoon over India.
27. Equinox literally means " _____ " and vernal (spring) equinox occurs on _____.
28. Equinoxes occurs on _____ and _____.
29. From the winter season, _____ waves can be traced in the Indian Seas from the westward moving isallobaric centre at sea level and wind shift in the upper air.
30. Full form of UNFCCC is _____.
31. If the temperature contrast across a front is lost because the colder air is warmed (or warmer air is cooled), or because the atmospheric motion causes the transition zone to weaken, the front is said to undergo _____.
32. In the subtropics the water in the west sides of the ocean are _____ than those in the east sides, where as in the higher latitudes, it is _____ in the west side and _____ in the east.

33. IPCC established in year _____
34. IPCC published its First Assessment Report (FAR) in _____
35. -----is a long-term change in the statistical distribution of weather patterns over periods of time.
36. MTC is cold core below 600 hPa & Warm core above (Yes/No) Tick right choice.
37. Ocean Circulation due to change in density of sea water is called _____
38. Over NE-India, thunderstorm activities are moving from Northwest direction and hence locally are known as _____ or _____.
39. Over the continents _____ evaporation per year occurs in the equatorial belt over South America in the Amazon River valley and Indonesia mainly due to the higher _____ and higher _____ observed there.
40. Packing of mean maximum temperature isotherms during premonsoon season along the coasts is the effect of _____.
41. Precipitation normally occurs in the _____ sector of a WD as a thundershower.
42. Radiation Fog forms mainly due to _____ cooling of surface at night.
43. Ramage Criteria of wind reversal is found between Lat. _____ and _____ and Long. _____ and _____
44. Severe heat waves over East Uttar Pradesh, Madhya Pradesh, Chattisgarh are locally called as _____.
45. Solstices occur on _____ and _____.
46. Storm surge/Tidal wave is a disastrous weather associated with a _____.
47. Stronger cross equatorial low level jet flows along the Indian Peninsula during the _____ monsoon period which weaken considerably during the _____ monsoon situation.
48. Study of Pollen and spores as a proxy indicator of climate is called as -----
49. Sunlight that bounces off a surface is said to be _____ from the surface.
50. The ----- fog occurs mainly in the rear sector of a WD
51. The ----- fog occurs in the forward sector of WD
52. The _____ water is denser than _____ water and _____ water is _____ than fresh water.
53. The _____, _____ and _____ are the three very important properties of sea water.

54. The average surface temperature of earth is _____ Degree C.
55. The development of Siberian high in central Asia is the result of excessive _____ of the vast continent of Asia in _____ and the development of an extensive low over southeast Asia is the result of _____ of the vast south Asian land masses in _____.
56. The highest temperatures over the globes in both the seasons are found in the _____ regions.
57. The maximum in daytime surface temperature typically occurs _____ the earth receives its most intense solar radiation.
58. The mean position of the jet stream in winter lies near Lat. 26°N (Jodhpur, Allahabad, Guwahati) at _____ hPa level and the mean wind speed at the core is about _____ knots.
59. The most fundamental control of weather and climate is the -----in different parts of the earth.
60. The ocean circulation caused by the change in density is called _____.
61. The OLR value in the region bounded by the latitude 5°N to 10°N and longitude 70°E to 78°E should be less than _____ W/m².
62. The point where the warm front becomes the occluded front is called the _____ point.
63. The rainfall over the part of ----- India occurs in association with the passage of western disturbances and induced systems and in ----- due to the passage of Easterly Waves.
64. The subtropical highs are well developed over the _____ during northern summers.
65. The Thunderstorm over Northeast India are locally known as _____.
66. The Tropical Easterly jet is located at about latitude, at pressure level.
67. Thunderstorms in the NE India occur in association with _____ trough or _____ moving western disturbance or induced system.
68. Thunderstorms over central India are in association with _____.
69. Thunderstorms, dust storms, hails storms, intense convective activity are associated with ----- season.
70. Tibetan High is observed in _____ Troposphere during Southwest Monsoon.
71. Weather associated with Western disturbances are _____, _____ and _____.
72. Well-Marked seasonal trough passes across _____ during October.

73. When a decrease in temperature with depth is responsible for the increase in density with depth, the pycnocline is called _____ and when an increase in salinity of the sea water is responsible for the increase in density with depth, the pycnocline is known as _____.
74. When the Sea Surface Temperature increase the coral bleaching will _____.
75. During onset of monsoon, INSAT derived OLR values should be below 200 W/m² in the box confined by latitude _____ and longitude _____.
76. During active monsoon period the monsoon trough shifts _____ from its normal position.
77. Rainfall associated with Off-shore trough & Off-shore Vortex is along over _____.
78. The monsoon seasonal precipitation is highest in the _____ parts of the country.
79. The _____ type of annual variation of temperature is observed over Kolkata and that over Minicoy is of _____ type.
80. _____ precipitation zones can be defined in each hemisphere. And the dry condition prevails throughout the year over the zone _____.
81. An interruption of the normal westerly zonal flow is called
82. Thermohaline circulation is driven by temperature and
83. is a measure of the strength of the westerly winds of the middle
84. latitudes.
85. Indian Ocean Dipole (IOD) is a coupled phenomenon in the Indian
86. Ocean.
87. Walker Circulation is an example of circulation.
88. The process of dissipation of fronts is called.....
89. Fronts that show little or no movement are called fronts.
90. Thunderstorms over NE India are locally known as _____.
91. _____ region receives highest rainfall during winter season under the influence of W.D.
92. In October, a low-pressure area is established over the central and adjoining south Bay of Bengal with the trough line along _____.
93. Rainfall associated with Off-shore trough & Off-shore Vortex is along _____.

94. According to Ramage criteria, Average frequency of prevailing wind direction in January and July exceeds _____ percent.
95. Easterly Waves generally attain maximum intensity at around _____ hPa.
96. Source regions of air masses are mostly dominated by winds
97. Walker circulation is an example of circulation
98. An interruption of the normal westerly zonal flow, by anticyclones, depressions, and individual ridges and troughs, usually for several days is called
99. Cryosphere is composed of
100. Majority of significant extra tropical cyclones form along the front.

Q.2. State whether the following statements are true or false. If true give reason why?

And if false give the correct answer with reason

1. A strong zonal circulation is observed in the mesosphere during solstice seasons with easterlies in the summer and westerlies in the winter hemisphere.
2. Air mass maritime source region is large, especially true for Southern Hemisphere.
3. Analysis of latitudinal mean zonal winds in the latitude-height cross sections for all seasons show that a strong stratospheric/mesospheric zonal circulation exist during solstice seasons (January and July) with westerlies in the summer and easterlies in the winter hemisphere with maximum velocities generally occur in the mid-latitude mesosphere.
4. Assam experiences maximum thunderstorm activity during post monsoon season.
5. Bay of Bengal experiences more number of storms than the Arabian Sea.
6. Climate change is short term fluctuations in the climate.
7. Coastal areas or small islands generally do not experience cold waves/ Heat waves.
8. Colder sea surface temperature anomalies in the western Arabian Sea increase evaporation over the Arabian Sea, decrease surface pressure downstream, increase the cross-equatorial flow and hence the cross equatorial moisture flux over the region and therefore increase monsoon rainfall over India.

9. Comparing both sides of the oceans, we find that in the subtropics the water in the west sides of the ocean are colder than those in the east sides, where as in the higher latitudes the opposite tends to occur, it is warmer in the west side and colder in the east.
10. Conditions favorable for Radiation fog is a stable layer with inversion above ground.
11. Convergence behind the easterly wave trough is associated with intense convective activity.
12. Define Climate change. Enlist any five indicators of Climate change
13. Define Global warming. Enlist causes of global warming
14. Definition Paleoclimatology. Enlist theories to study climatic fluctuations.
15. During the El Nino years more rainfall will get during summer monsoon season over South Asia. (True/False) Give reason.
16. Easterly Jet stream is a global phenomenon.
17. Extremely high salinity is observed in the Arctic Ocean compared to that near Antarctica.
18. Geopotential heights at 900 hPa are higher over the Oceans than over the land in the hemisphere experiencing the summer.
19. Heat low is very shallow and extends upto 850 hPa.
20. Highest values of evaporation occur over the subtropical oceans between 15° and 40° latitudes in both the hemisphere and are known as oceanic deserts.
21. In general, temperatures decrease from equator to poles.
22. In the Brahmaputra valley of Assam fog formation is frequent more than 20 days a month in winter season.
23. In the subtropics the water in the west sides of the ocean are colder than those in the east sides, where as in the higher latitudes the opposite tends to occur, it is warmer in the west side and colder in the east.
24. In the tropics and subtropics the water in the west sides of the ocean are colder than those in the east sides, where as in the higher latitudes the opposite tends to occur, it is warmer in the west side and colder in the east
25. K type of airmass leads to instability.
26. Low level Jet has no relationship with SW monsoon season.
27. Maximum number of Cyclones develops during the post monsoon season.
28. Monsoon depressions generally develop into Cyclonic storms.

29. NE monsoon rainfall generally associated with fairly widespread rainfall over Tamil Nadu and adjoining areas.
30. Noctilucent clouds are seen in the troposphere near the tropopause in winter
31. Over the continents in the equatorial belt over South America in the Amazon River valley and Indonesia evaporation per year is minimum.
32. Position of low level jet does not change during the monsoon season.
33. Precipitation normally occurs in the backward sector of a WD and sometimes associated with thundershower and hails over north India N of 30° N.
34. Rainforests are characterized by low rainfall.
35. South Kerala gets good rainfall during the premonsoon season.
36. The colder sea surface temperature over the Arabian sea may cause lower surface pressure and less evaporation over the Arabian Sea. This may reduce the north-south pressure gradient across the equator and thus strengthens the cross equatorial flow as well as the cross equatorial moisture flux. This may cause early onset of monsoon over Kerala.
37. The colder sea surface temperature over the Arabian Sea may delay the onset of monsoon over Kerala.
38. The global distribution of mean cloudiness shows high cloud cover in the equatorial belt (70-90%) and poleward over the subtropics (>70%) and minimum cloudiness in the subtropical latitudes (<30%).
39. The Mascarene high has no relation with the monsoon season.
40. The migration of isotherms are much greater over the oceans than over the continents.
41. The rainfall decreases sharply on the 'leeside' of the mountain and along the south peninsula south of about 17°N in regions called 'rain shadow zones'.
42. The subtropical anticyclones in each hemisphere have a tendency to move toward the cooler polar region during winter.
43. The temperature at the stratopause is highest near the summer pole (July in Northern Hemisphere and January in Southern Hemisphere) decreasing through equator to the winter pole.
44. The zone of maximum solar radiation shifts northward and southward during the course of the year, thereby producing seasons.

45. Thornthwaite climate classification does not help in agriculture patterns, crop combination and land management.
46. Tropical cyclones do not generally develop during the monsoon season.
47. Upwelling brings warm nutrient-rich water into the seafloor.
48. Variation of temperature at Kanpur is very small as compared to Visakhapatnam.
49. Warm SST anomalies near or south of the equatorial Indian Ocean may enhance the onset of monsoon over Kerala.
50. Water vapour is a greenhouse gas.
51. Weather over high pressure is generally cloudy
52. Western disturbance is mid latitude phenomenon originated over Indian region and generally associated with fine weather over the places.
53. What are the different components of Biosphere?
54. What is Greenhouse effect? Enlist the factors which causing climate change
55. When Salinity increase the sea water density will increase. (True/False) Give reason.
56. Windward side of a mountain receives less precipitation than the lee ward side.
57. Orography influences the spatial distribution of rainfall during monsoon season .
58. The Post-Monsoon Season is the principal rainy season for Tamil Nadu state of India.
59. Air temperature over the surface of the earth generally decreases from equator to pole.
60. In middle latitudes, precipitation is generally higher along west coast than along east coast.
61. The region of maximum cloudiness does not coincide with that of maximum precipitation.
62. It is easy to identify warm fronts than cold fronts.
63. Fronts that are passing over a station are called stationary fronts.
64. Deep ocean circulation depends on density.
65. Extra Tropical Cyclones move more directly eastwards in Southern Hemisphere as compared to those in Northern hemisphere.
66. Thornthwait's Climate Classification has a wider range than Koeppen's classification.
67. Generally break monsoon extends for a period of fifteen days.
68. Simultaneous formation of two fronts is called frontolysis.
69. Climate Change is different from Climate Variability.

70. Plains of North India experiences Cold Day situation during the winter.
71. Precipitation normally occurs in the forward sector of a WD as a thundershower.
72. The mascarene high has no relation with the monsoon season.
73. NW India experiences dust/sandstorms during pre-monsoon season.
74. Siberian High (45°N / 105°E) in the northern hemispheric winter is the most intense high pressure cell over the globe.

Q.3 Answer the following:

1. (i) What is an ocean gyre? (ii) Name the major gyres of the world oceans. (iii) Name the four ocean currents that complete the clockwise rotating gyre in the North Atlantic Ocean starting from the westward flowing warm current near the equator.(iv) Where is Beaufort Gyre located?
2. Briefly discuss monsoon depressions w.r.t. (1) Area of formation, (2) Frequency and Life span, (3) Movement, (4) Structure of MDS, (5) Associated clouds and Rainfall.
3. Briefly explain monsoon depressions w.r.t. area of formation, frequency, movement & associated weather (Or) Write short note on intra seasonal variability of southwest monsoon.
4. Define Air mass. Give the classification of Air mass. Give reason for (1) K type of air mass leads to instability, (2) W type of air mass leads to stability
5. Define Climate change. Enlist any five indicators of Climate change
6. Define Global warming. Enlist causes of global warming
7. Define Jet stream. What are the characteristics of the STWJ over India during winter?
8. Define thunderstorm. What are the favourable conditions for occurrence of thunderstorms? Discuss in brief the thunderstorm/ duststorm activities over NW India.
9. Definition Paleoclimatology. Enlist theories to study climatic fluctuations.
10. Describe the criteria for declaring Heat Wave over Indian stations.
11. Describe the tricellular model of General Circulation with its important characteristics (Or) Briefly describe classification of airmass.

12. Describe with the help of diagram the meridional profile of zonal mean precipitation rate for the ocean area, the land area separately and for the entire global belt as a whole for annual, winter (DJF) and summer (JJA) mean conditions.
13. Discuss the main features of the temperature profiles in the stratosphere and mesosphere through the mean meridional distribution of temperature from pole to pole in the vertical
14. Enlist the synoptic features of post monsoon season. Explain the significant features associated with this season with suitable diagrams.
15. Enlist the synoptic features of winter season. Elaborate the significant features associated with this season with suitable diagrams.
16. Explain briefly semi-permanent components of Southwest monsoon (Or) What is meant by Front? Explain different types of Front.
17. Explain briefly the different components of the Indian Summer Monsoon.
18. Explain climatological features of the thunderstorm over Peninsular India (Or) Write note on climatology of heat waves.
19. Explain how the convective heat source in the Bay of Bengal and the lowlevel jet through peninsular India grows in a positive feedback process taking the monsoon to an active spell.
20. Explain salient features of MJO.
21. Give a brief explanation on how air mass is modified with the help of few examples.
22. Give a working rule for declaration of the onset of monsoon in IMD. How further advance of monsoon over the country is declared?
23. Illustrate with help of a diagram the interaction between the atmospheric and oceanic circulations and their effects on evaporation, cross equatorial moisture flux and monsoon rainfall over India.
24. Shortly explain climatology of Cold waves over India.
25. What are the criteria for declaration of the onset of monsoon over Kerala? How further advance of monsoon over the country is declared?
26. What is Greenhouse effect? Enlist the factors which causing climate change
27. What is Jet Stream? What are the characteristics of Jet Streams?
28. What is meant by Monsoon Intraseasonal Oscillations (MISO)? Explain the role of MISO and MJO on the rainfall activity over India.

29. What is Ocean Gyre? What are the forces responsible for the formation of ocean gyres?
Name the 5 major ocean gyres of the world ocean. What is Beaufort gyre?
30. What is Thermohaline Circulation? What is its role on climate?
31. What are the common synoptic features during winter season? Mention weather associated with the western disturbances. What are the conditions favorable for Radiation fog? Give reason why in the Brahmaputra valley of Assam fog formation is frequent more than 20 days a month in winter season?
32. When W.D is referred as Western depression? Discuss W.D. w.r.t. (a) origin, (b) movement, (c) life period, (d) frequency and (e) weather associated briefly.
33. With help of neat diagram, explain Sea level Pressure & wind pattern during July.
34. Write a short note Blocking Anticyclone.
35. Write a short note on Tropical storms w.r.t favourable conditions, areas of formation, frequency and movement.
36. Write an essay on the ocean-atmosphere interaction in the active-break cycle of Indian summer monsoon
37. Write briefly the Ocean Role on climate in various time scale?.
38. Write short note on Deep water current
39. Write short note on monsoon depression w.r.t. movement, frequency, associated rainfall.
40. Write short note on Upwelling and downwelling
41. Mention any three points about break monsoon.
42. Mention some principal zones of Frontogenesis.
43. What is Zonal Index ?
44. Climate change and climate variability
45. Density and salinity of oceans.

Q.4. Write short notes.

1. Climatic controls
2. Climatology of Thunderstorms over NW India
3. Criteria of cold wave
4. Describe briefly Role of ocean on Climate?.

5. Discuss the interaction between the atmospheric and oceanic circulations and their effects on evaporation, cross equatorial moisture flux and rainfall over Indian region.
6. Easterly waves
7. Ekman transport;
8. Global Conveyor Belt,
9. Life cycle of extra Tropical cyclones
10. LLJ and TEJ
11. M.T.C.
12. Norwesters and Andhis
13. Ocean's Vertical Structure
14. Onset & advance of SW monsoon
15. Ramage's monsoon criteria for the region
16. The criteria for warm night and for describing heat wave for coastal stations
17. Upwelling and downwelling
18. Weather and Climate
19. What are the major Climate feedback processes in the climate system?
- 20.** The components of South West Monsoon
- 21.** Distribution of wind and pressure systems during January and July over the earth's surface.
22. What is an air mass? Discuss the climatology of source regions of air masses.
23. Describe the mean distribution of Pressure and Wind over Asia during January or July
24. Variability of Indian Summer Monsoon.
25. Subtropical westerly jet and easterly waves
26. Weather associated with western disturbances
27. Synoptic systems in Indian Monsoonal area.
28. What is an air mass? Give an account of different types of fronts.
29. Distinguish between Thornthwaite and Koppen's classification of Climate.

PART B :- STATISTICS

Q.1. Fill in the blanks

1. 5% level of significance means ---
2. A single number that represents an entire mass of data is called an ---.
3. At mode, value of probability density function is least. [T/F]
4. Autocorrelation is also called _____.
5. Binomial distribution is a ----- distribution.
6. Coefficient of skewness is zero for _____ distribution
7. Dependent variable = _____ plus parameter multiplied by an independent variable (IV).
8. Dew point and minimum temperature of a station is an example of ---- correlation.
9. During the period 1 June-28 September, it rained for 40 days over a particular station, hence the probability of no-rain is _____ (0.33, 0.44, 0.55, 0.66)
10. Explain the notations $r_{12.3}$ and $R_{1.23}$ = _____.
11. For a best test power of a test is least. [T/F]
12. For a best test power of the test is _____.
13. For a binomial distribution the mean is 4 and variance 2, hence n =_____ (6, 8, 10, 12)
14. For a rarely occurred event _____ distribution is used.
15. For a regression equation $Y = a + bX$; “a” denotes the intercept on ---
16. For a time series the mean is 5 and the standard deviation is 2 hence the coefficient of variation is ----
17. For a time series the mean is 5 and the standard deviation is 2, hence the coefficient of variation is _____ (20%, 40%, 60%)
18. If two events, ‘A’ & ‘B’ are independent, then $P(AB)$ -----.
19. In statistics a large sample means N greater than ---
20. Poisson distribution is preferably valid for _____ occurred event.
21. Probability distribution function is a decreasing function. [T/F]
22. Probability of an event is varies between ----- & ----- .
23. Second Quartile is also known as _____.

24. The correlation coefficient between two variables is -0.4, hence the variance explained is _____ (-40%, +40%, -16%, +16%)
25. The correlation coefficient between two variables is 0.9, hence the variation explained is _____.
26. The relation between standard deviation and coefficient of variation is _____.
27. Trends are consecutive increases or decreases in a measurement over _____.
28. Two non-isomorphic graphs are said to be cospectral, if they have the same _____.
29. Value of correlation coefficient is lies between ----- & ----- .
30. Variance of a standard Binomial distribution is -----.
31. With the help of Ogives (cumulative frequencies) we can determine the value of --- graphically.
32. The correlation coefficient between two variables is -0.4, hence the variance explained is _____ (-40%, +40%, -16%, +16%)
33. For a time series the mean is 5 and the standard deviation is 2, hence the coefficient of variation is _____ (20%, 40%, 60%)
34. During the period 1 June-28 September, it rained for 40 days over a particular station, hence the probability of no-rain is _____ (0.33, 0.44, 0.55, 0.66)
35. For a binomial distribution the mean is 4 and variance 2, hence $n=$ _____ (6, 8, 10, 12)
36. Mean deviation is about _____ ($2/5^{\text{th}}$, $4/5^{\text{th}}$, $6/5^{\text{th}}$) of the standard deviation.
37. The correlation coefficient between two variables is -0.4, hence the variance explained is _____ (-40%, +40%, -16%, +16%)
38. For a time series the mean is 5 and the standard deviation is 2, hence the coefficient of variation is _____ (20%, 40%, 60%)
39. During the period 1 June-28 September, it rained for 40 days over a particular station, hence the probability of no-rain is _____ (0.33, 0.44, 0.55, 0.66)
40. For a binomial distribution the mean is 4 and variance 2, hence $n=$ _____ (6, 8, 10, 12)
41. Mean deviation is about _____ ($2/5^{\text{th}}$, $4/5^{\text{th}}$, $6/5^{\text{th}}$) of the standard deviation

Q.2. Answer the following

1. Define Deciles and Percentiles and express their relationship

2. Define Range, semi – Quartile Range, Quartile Deviation and express as mathematical formulae.
3. Define critical region and level of significance of a test.
4. Define conditional probability and State Baye's theorem of probability.
5. The probability of a tropical storm sticking the coast is 5%. Assuming that 40 storms have formed over the ocean, find the probability that at the most two will strike the coast (Use Poisson distribution, given $e^{-2} = 0.135$)
6. In a climate record for 60 winters at a given location, single storm snowfalls greater than 35 cms occurred in 9 of these winters (event A) and the coldest temperature was below -25°C in 36 of the winters (event B). Both events A and B occurred in 3 winters. Estimate the probability for the occurrence of 35 cm snowfalls, -25°C or both.
7. Find the binomial distribution if the mean is 12 and the standard deviation is 2.
8. Explain student 't' test for correlation coefficient. A random sample of 27 pairs of observations have a correlation coefficient, $r = 0.6$. Is it significant at 5% level? (Given: for 25 degrees of freedom t value of 5 % level = 2.06)
9. What is the difference between correlation and regression analysis. Write down the relation between regression coefficient and correlation coefficient and give its proof.
10. What do you mean by stationarity of a time series?
11. What do you understand by stochastic processes?
12. What is the difference between spectral and co-spectral analysis?
13. Simple procedure for spectral analysis (no equations required)
14. Simple method for Analysis of Variance
15. Correlation Maps
16. Consider two rainfall time series x and y with variance of 100 cm and 64 cm respectively. The covariance between x and y is 60. Estimate the correlation coefficient between x and y. What are the units of correlation coefficient? Whether x and y are directly or indirectly related?
17. Consider an Auto-regressive model of order one as follows: $(x_{t+1} - m) = r(x_t - m)$ where x_{t+1} is the value and time $t+1$; x_t at time t and m is the mean. r is the autocorrelation at lag-1 equal to 0.7 and the mean $m = 20$. Given $x_t = 28$, estimate the value x_{t+1} . If observed value of x_{t+1} is 28, find the error between the estimated and the observed value.

18. Explain Student 't' test for correlation coefficient. A random sample of 27 pairs of observations have a correlation coefficient, $r = 0.9$. Is it significant at 5% level? (Given: for 25 degrees of freedom t value of 5 % level = 2.06)
19. Write down the relation between regression coefficient and correlation coefficient and give its proof. Also explain the difference between correlation and regression analysis.
20. Mathematical properties of Arithmetic mean
21. What is the difference between a stochastic process and an auto-regressive process?
22. What do you understand by a Time Series?
23. What is the difference between correlation coefficient and auto-correlation function?
24. The AR(1) model is given as $x_{t+1} - m = Q(x_t - m)$
25. Suppose Q the auto-correlation function at lag-1 is 0.8 and the mean m is 25. Given that $x_t = 30$, estimate x_{t+1} . If observed value of x_{t+1} is 29, estimate the error.
26. In one sample (S1) based on 10 observations, the total variance is 12. In a second sample (S2) again of 10 observations the total variance is 40. In a third sample (S3) based on 12 observations the total variance is 10. Using F-test, check whether there is a significant difference between S1 and S3; S2 and S3. (Significant F-value for (9,11) degrees of freedom is 2.9)
27. Assume that the rainfall variability over Mumbai is 64cm and that over Pune is 100cm, and the co-variability between these two is 60cm. Compute the correlation coefficient.
28. Properties of Arithmetic Mean (Mathematical)
29. If for Station A, Variance = 16.0, A. M. =25.0, Find Coefficient of variability.
30. Define probability distribution function. Discuss its properties.
31. Define null hypothesis, critical region, level of significance
32. Enlist the components of time series
33. Examples of Nonlinear equation
34. Use of autocorrelation function
35. Define conditional probability. Using the concept of conditional probability, obtain expression for $P(A+B)$.
36. Define probability mass function. Discuss its properties
37. If a series is divided into 10 equal parts, how many deciles are there?
38. What is the relation between variance and standard deviation?

39. The correlation coefficient between two variables is -0.8 , how much is the variance explained in percentage?
40. What is the relation between the two regression coefficients b_{YX} and b_{XY} ?
41. For a regression equation of the form $y=a+bx$, what do the constants a and b represent?
42. What are the expressions for the mean and variance for a Binomial distribution?
43. A binomial variable has 6 as its standard deviation based on 100 trials. Both outcomes have equal probability. Is this statement valid or invalid? Justify.
44. What are the parameters of a Poisson distribution?
45. If a random variable X follows a Poisson distribution such that $P(X=1) = P(X=2)$, find the mean and variance of this distribution.
46. The mean and standard deviation for daily rainfall for a station over west coast of India is 12 mm and 4 mm respectively based on data for 6000 days. Assuming that the daily rainfall data for this station follows a normal distribution, estimate the percentage of rainy days above 16 mm (Area under the normal curve for $z=1$ is 0.34)
47. The average number of tropical storms per year hitting the east coast of India is 2.35 based on data records for the last 100 years. Using Poisson distribution find the probability that during the next one year there will be at the most 2 storms striking the coast (given $e^{-2.35} = 0.095$)
48. If a series is divided into 10 equal parts, how many deciles are there?
49. What is the relation between variance and standard deviation?
50. The correlation coefficient between two variables is -0.8 , how much is the variance explained in percentage?
51. What is the relation between the two regression coefficients b_{YX} and b_{XY} ?
52. For a regression equation of the form $y=a+bx$, what do the constants a and b represent?
53. What are the expressions for the mean and variance for a Binomial distribution?
54. A binomial variable has 6 as its standard deviation based on 100 trials. Both outcomes have equal probability. Is this statement valid or invalid? Justify.
55. What are the parameters of a Poisson distribution?
56. If a random variable X follows a Poisson distribution such that $P(X=1) = P(X=2)$, find the mean and variance of this distribution.

57. The mean and standard deviation for daily rainfall for a station over west coast of India is 12 mm and 4 mm respectively based on data for 6000 days. Assuming that the daily rainfall data for this station follows a normal distribution, estimate the percentage of rainy days above 16 mm (Area under the normal curve for $z=1$ is 0.34)

58. The average number of tropical storms per year hitting the east coast of India is 2.35 based on data records for the last 100 years. Using Poisson distribution find the probability that during the next one year there will be at the most 2 storms striking the coast (given $e^{-2.35} = 0.095$)

59. Based on small samples, following information was available

Storms striking coast	0	1	2	3	4
-----------------------	---	---	---	---	---

Observed Frequency	2	5	8	3	2
--------------------	---	---	---	---	---

Fit a Poisson distribution to this data (Given $e^{-1.9} = 0.15$)

60. The mean yield for a one-acre plot is 662 kilos with a standard deviation of 32 kilos. Assuming normal distribution, how many one-acre plots in a batch of 1000 plots would you expect to have yield over 700 kilos (Area under normal curve for 1.19 is 0.3830)

61. The Frequency Distribution of rainfall for a station is given as follows

Rainfall mm	Frequency
Less than 100	40
100-200	89
200-300	148
300-400	64
400 and above	39

Calculate a suitable mathematical average and a suitable positional average.

62. While examining the performance of AMTC batches, it was claimed that there was a significant difference in the mean grade point averages of successful male and female trainees. Assuming random samples of successful male and female trainees gave the following information

	n	xbar	s ²
males	45	2.10	0.64
females	50	2.45	0.70

Is there sufficient statistical evidence to support the above claim?

63. Based on small samples, following information was available

Storms striking coast	0	1	2	3	4
Observed Frequency	2	5	8	3	2

Fit a Poisson distribution to this data (Given $e^{-1.9} = 0.15$)

64. The mean yield for a one-acre plot is 662 kilos with a standard deviation of 32 kilos.

Assuming normal distribution, how many one-acre plots in a batch of 1000 plots would you expect to have yield over 700 kilos (Area under normal curve for 1.19 is 0.3830)

65. The Frequency Distribution of rainfall for a station is given as follows

Rainfall mm	Frequency
Less than 100	40
100-200	89
300-400	148
300-400	64
400 and above	39

Calculate a suitable mathematical average and a suitable positional average.

66. While examining the performance of AMTC batches, it was claimed that there was a significant difference in the mean grade point averages of successful male and female trainees. Assuming random samples of successful male and female trainees gave the following information

	n	xbar	s ²
males	45	2.10	0.64
females	50	2.45	0.70

Is there sufficient statistical evidence to support the above claim?

Q.3. Write short notes:

1. Analysis of Variance
2. Basic principles of ANOVA
3. Basic procedure of Power spectrum

4. Binomial distribution
5. Explain in brief the method / approach for Power Spectrum Analysis.
6. Explain in brief the procedure for ANOVA
7. Karl's Pearson's Coefficient of correlation
67. Note on Histogram.
8. Null hypothesis and its Testing
9. Procedure for Spectrum Analysis
10. Regression Equations
11. Spectral Analysis
12. Stochastic process
13. Time series analysis
14. What is the aim of sampling studies?

* * * * *