NG 24 (GROUP B)

PART I — ENGINEERING MATHEMATICS

(Common to all Candidates)

(Answer ALL questions)

1. If A is a 3×3 matrix and determinant of A is 6, then find the value of the determinant of the matrix $(2A)^{-1}$

   a. $\frac{1}{12}$

   b. $\frac{1}{24}$

   c. $\frac{1}{36}$

   d. $\frac{1}{48}$

2. If $3x+2y+z=0$, $x+4y+z=0$, $2x+y+4z=0$, be a system of equations, then

   a. it is inconsistent

   b. it has only the trivial solution $x=0,\ y=0,\ z=0$

   c. it can be reduced to a single equation and so a solution does not exist

   d. the determinant of the matrix of coefficients is zero

3. Let $M=\begin{pmatrix}1&1&1\\0&1&1\\0&0&1\end{pmatrix}$. The maximum number of linearly independent eigen vectors of M is

   a. 0

   b. 1

   c. 2

   d. 3

4. The shortest and longest distance from the point $(1, 2, -1)$ to the sphere $x^2+y^2+z^2=24$ is

   a. $\left(\sqrt{14}, \sqrt{46}\right)$

   b. (14, 46)

   c. $\left(\sqrt{24}, \sqrt{56}\right)$

   d. (24, 56)

5. The solution of the given ordinary differential equation $x\frac{d^2y}{dx^2}+\frac{dy}{dx}=0$ is

   a. $y=A\log x+B$

   b. $y=Ae^{\log x}+Bx+C$

   c. $y=Ae^{x}+B\log x+C$

   d. $y=Ae^{x}+Bx^2+C$

6. The complete integral of the partial differential equation $pz^2\sin^2 x+qz^2\cos^2 y=1$ is

   a. $z=3a\cot x+(1-a)\tan y+b$

   b. $z^2=3a^2\cot x+3(1+a)\tan y+b$

   c. $z^3=-3a\cot x+3(1-a)\tan y+b$

   d. $z^4=2a^2\cot x+(1+a)(1-a)\tan y+b$

7. The area between the parabolas $y^2 = 4 - x$ and $y^2 = x$ is given by

a. $\frac{3\sqrt{2}}{16}$

b. $\frac{16\sqrt{3}}{5}$

c. $\frac{5\sqrt{3}}{16}$

d. $\frac{16\sqrt{2}}{3}$

8. The value of the integral $\int_0^a \int_0^b \int_0^c e^{x+y+z}\, dz\, dy\, dx$ is

a. e^{a+b+c}

b. $e^a + e^b + e^c$

c. $\left(e^a - 1\right)\left(e^b - 1\right)\left(e^c - 1\right)$

d. e^{abc}

9. If $\nabla\phi = 2xyz^3\,\vec{i} + x^2z^3\,\vec{j} + 3x^2yz^2\,\vec{k}$, then $\phi(x, y, z) =$

a. $\phi = xyz^2 + c$

b. $\phi = x^3yz^2 + c$

c. $\phi = x^2yz^3 + c$

d. $\phi = x^3yz + c$

10. The only function from the following that is analytic is

a. $F(z) = \mathrm{Re}(z)$

b. $F(z) = \mathrm{Im}(z)$

c. $F(z) = z$

d. $F(z) = \sin z$

11. The value of m so that $2x - x^2 + my^2$ may be harmonic is

a. 0

b. 1

c. 2

d. 3

12. The value of $\int_C \frac{1}{z} dz$, where C is the circle $z = e^{i\theta}$, $0 \le \theta \le \pi$ is,

a. πi

b. $-\pi i$

c. $2\pi i$

d. 0

13. The Region of convergence of the signal $x(n) = \delta(n - k),\ k > 0$ is

a. $z = \infty$

b. $z = 0$

c. Entire z-plane, except at $z = 0$

d. Entire z-plane, except at $z = \infty$

14. The Laplace transform of a signal $X(t)$ is $\frac{4s+1}{s^2+6s+3}$. The initial value $X(0)$ is

a. 0

b. 4

c. 1/6

d. 4/3

15. Given the inverse Fourier transform of $f(s)=\begin{cases} a-|s|, & |s|\le a \\ 0, & |s|>a \end{cases}$ is $\frac{a^2}{2\pi}\left[\frac{\sin\frac{ax}{2}}{\frac{ax}{2}}\right]^2$. The value of $\int_0^\infty\left[\frac{\sin x}{2}\right]^2 dx$ is

a. π

b. $\frac{2\pi}{3}$

c. $\frac{\pi}{2}$

d. $\frac{\pi}{4}$

16. If $A=[a_{ij}]$ is the coefficient matrix for a system of algebraic equations, then a sufficient condition for convergence of Gauss-Seidel iteration method is

a. A is strictly diagonally dominant

b. $|a_{ii}|=1$

c. $\det(A)\neq 0$

d. $\det(A)>0$

17. Which of the following formula is used to fit a polynomial for interpolation with equally spaced data?

a. Newton's divided difference interpolation formula

b. Lagrange's interpolation formula

c. Newton's forward interpolation formula

d. Least- square formula

18. For applying Simpson's $\frac{1}{3}$ rule, the given interval must be divided into how many number of sub-intervals?

a. odd

b. two

c. even

d. three

19. A discrete random variable X has the probability mass function given by $p(x)=cx,\ x=1,2,3,4,5$. The value of the constant 'c' is

a. 1/5

b. 1/10

c. 1/15

d. 1/20

20. For a Binomial distribution with mean 4 and variance 2, the value of 'n' is

a. 2

b. 4

c. 6

d. 8

PART II — BASIC ENGINEERING AND SCIENCES

(Common to all candidates)

(Answer ALL questions)

21. Speed of the processor chip is measured in
    a. Mbps
    b. GHz
    c. Bits per second
    d. Bytes per second

22. A program that converts Source Code into machine code is called
    a. Assembler
    b. Loader
    c. Compiler
    d. Converter

23. What is the full form of URL?
    a. Uniform Resource Locator
    b. Unicode Random Locator
    c. Unified Real Locator
    d. Uniform Read Locator

24. Which of the following can adsorb larger volume of hydrogen gas?
    a. Finely divided platinum
    b. Colloidal solution of palladium
    c. Small pieces of palladium
    d. A single metal surface of platinum

25. What are the factors that determine an effective collision?
    a. Collision frequency, threshold energy and proper orientation
    b. Translational collision and energy of activation
    c. Proper orientation and steric bulk of the molecule
    d. Threshold energy and proper orientation

26. Which one of the following flows in the internal circuit of a galvanic cell?
    a. atoms
    b. electrons
    c. electricity
    d. ions

27. Which one of the following is not a primary fuel?
    a. petroleum
    b. natural gas
    c. kerosene
    d. coal

28. Which of the following molecules will not display an infrared spectrum?
    a. CO_2
    b. N_2
    c. Benzene
    d. HCCH

29. Which one of the following behaves like an intrinsic semiconductor, at the absolute zero temperature?
    a. Superconductor
    b. Insulator
    c. n-type semiconductor
    d. p-type semiconductor

30. The energy gap (eV) at 300K of the material *GaAs* is
    a. 0.36
    b. 0.85
    c. 1.20
    d. 1.42

31. Which of the following ceramic materials will be used for spark plug insulator?

a. SnO_2

b. α-Al_2O_3

c. TiN

d. $YBaCuO_7$

32. In unconventional super-conductivity, the pairing interaction is

a. non-phononic

b. phononic

c. photonic

d. non-excitonic

33. What is the magnetic susceptibility of an ideal super conductor?

a. 1

b. –1

c. 0

d. infinite

34. The Rayleigh scattering loss, which varies as _____ in a silica fiber.

a. λ^0

b. λ^{-2}

c. λ^{-4}

d. λ^{-6}

35. What is the near field length *N* that can be calculated from the relation (if D is the diameter of the transducer and λ is the wavelength of sound in the material)?

a. $D^2 / 2\lambda$

b. $D^2 / 4\lambda$

c. $2D^2 / \lambda$

d. $4D^2 / \lambda$

36. Which one of the following represents open thermodynamic system?

a. Manual ice cream freezer

b. Centrifugal pump

c. Pressure cooker

d. Bomb calorimeter

37. In a new temperature scale say $°\rho$, the boiling and freezing points of water at one atmosphere are $100°\ \rho$ and $300°\rho$ respectively. Correlate this scale with the Centigrade scale. The reading of $0°\rho$ on the Centigrade scale is:

a. 0°C

b. 50°C

c. 100°C

d. 150°C

38. Which of the cross-section of the beam subjected to bending moment is more economical?

a. Rectangular cross-section

b. I - cross-section

c. Circular cross-section

d. Triangular cross-section

39. The velocity of a particle is given by $V = 4t^3 - 5t^2$. When does the acceleration of the particle becomes zero?

a. 8.33 s

b. 0.833 s

c. 0.0833 s

d. 1 s

40. What will happen if the frequency of power supply in a pure capacitor is doubled?

a. The current will also be doubled

b. The current will reduce to half

c. The current will remain the same

d. The current will increase to four-fold

PART III

14 – GEO-INFORMATICS

(Answer ALL questions)

41. Chaining along a straight line, the leader of the party has 4 arrows in his hand while the follower has 6 arrows. Distance of the follower from the starting point is

a. 4 Chains

b. 5 Chains

c. 6 Chains

d. 10 Chains

42. In a closed traverse ABC, the following readings were taken: If station A is free from local attraction, correct bearing of CB is

Line	Fore bearing	Back bearing
AB	19°	200°
BC	100°	277°
CA	227°	49°

a. 280°

b. 279°

c. 276°

d. 277°

43. The following readings were taken on a uniformly sloping ground 0.500m, 1.000m, 1.500m, 2.000m, 1.200m, 1.700m, 2.200m, 2.700m. The difference in elevation between the first and last station is

a. 3.000m (fall)

b. 3.000m (rise)

c. 2.200m (fall)

d. 2.200m (rise)

44. The coordinate of A is 100m, 100m. The coordinate of B is 50m, 50m. The bearing of line AB is

a. 45°

b. 135°

c. 225°

d. 315°

45. How much time is required by GPS satellites to make one complete revolution around the Earth?

a. 12 hours (Standard Time)

b. 12 hours (Solar Mean Time)

c. 12 hours (Solar apparent Time)

d. 12 hours (Sidereal Time)

46. Two straight lines intersect at an angle of 120°. The radius of curve joining the straight lines is 500m. The length of long chord and mid ordinate in metres of the curve are

a. 250, 33.493

b. 500, 66.987

c. 866.025, 250

d. 500, 250

47. The star's hour circle coincides with the observer meridian, the star said to be

a. Culminate

b. Prime vertical crossing

c. Elongation

d. Nutation

48. The maximum spectral radiant exitance from earth features occurs at a wavelength of

a. about 0.7 μm

b. about 1.7 μm

c. about 9.7 μm

d. about 19.7 μm

49. Plant reflectance in the range of 0.7 to 1.3 μm caused generally by the

a. water content in the plant

b. cell structure of the plant

c. age of the plant

d. chlorophyll in the plant

50. The orbital period of geo-synchronous satellite is

a. one sidereal day

b. one solar day

c. 28 sidereal days

d. 28 solar days

51. (Green reflectance – SWIR reflectance)/ (Green reflectance + SWIR reflectance) is known as

a. NDSI

b. NDVI

c. EVI

d. GARI

52. The constructive and destructive interference from the multiple scattering returns that occur within each resolution cell is called

a. Surface roughness

b. Speckle

c. Volume scattering

d. Facet backscatter

53. The first experimental space borne SAR satellite is named as

a. JERS-1

b. ERS-1

c. SEASAT-A

d. RADARSAT-1

54. NISAR can be expanded as

a. NASA-ISRO Synthetic Aperture Radar

b. NASA-Indian Synthetic Aperture Radar

c. NASA Interferometric Synthetic Aperture Radar

d. NASA Indian Space Atmospheric Radar

55. End member in hyper spectral remote sensing is known as

a. Pure Pixel

b. Mixed Pixel

c. Linear Pixel

d. Non linear pixel

56. Which of the following is not the hyperspectral sensor?

a. Hyperion

b. HIRS

c. CHRIS

d. HYDICE

57. Which of the following equipments is used to determine the sensor position in aerial and satellite based LIDAR platforms?

a. DIAL

b. LRA

c. IMU

d. Doppler LIDAR

58. The process of extracting information from the image is called as

a. Image enhancement

b. Image restoration

c. Image Analysis

d. Image compression

59. When linearly enhancing an image to higher radiometry, the count of unique digital numbers of the image

a. Increases

b. Decreases

c. Remain the same

d. Made to 1

60. Which of the following indices is generally used for yield forecast model?

a. NDVI

b. SAVI

c. Soil brightness index

d. None of the above

61. Resampling is done to apply correction on a pixel with respect to its

a. Value

b. Location

c. Both

d. None of the above

62. Fourier transform operates in which of the following domain?

a. Chromacity Plot

b. Band spectral scatter Plot

c. Frequency spectrum

d. None of the above

63. Mixel refers to

a. Combination of two or many pixels

b. Combined value for the same pixel at different bands

c. Combined reflection values from different land cover features

d. Combined reflection atmospheric effect with land cover features

64. Wavelet transform decomposes image into ———— number of components

a. 2

b. 1

c. 4

d. 3

65. Which is a colour attribute that describes a pure colour?

a. Saturation

b. Hue

c. Brightness

d. Intensity

66. Which of the following is not univariate statistical parameter?

a. mean

b. standard deviation

c. variance

d. correlation

67. The truth values of traditional set theory is ———— and that of fuzzy set is ————

a. Either 0 or 1, between 0 & 1

b. Between 0 & 1, either 0 or 1

c. Between 0 & 1, between 0 & 1

d. Either 0 or 1, either 0 or 1

68. Aerial photographs were taken with a camera having a 210-mm-square format and a 305mm focal length of the field of view of camera is

a. 103^{o} 50'

b. 77^{o} 53'

c. 51^{o} 55'

d. 25^{o} 58'

69. Metric cameras must have

1. Low lens distortions
2. Fixed focal length
3. Adjustable focal length
4. Reseau mark
5. Fiducial mark

a. 1, 2, 4 and 5

b. 1, 2 and 5

c. 1, 2 and 4

d. 1, 3, 4 and 5

70. A camera equipped with a focal length of 150mm is used to take a vertical photograph from a flying height of 2750m above mean sea level. If the terrain is flat and located at an elevation of 500m above mean sea level. The scale of the photograph will be

a. 1: 1500

b. 1: 1833

c. 1: 15000

d. 1: 18330

71. Minimal number of ground control points are required for

a. Analogue aerotriangulation

b. Analytical aerotriangulation

c. Automated aerotriangulation

d. GPS aerotriangulation

72. The operator measures the y-parallaxes at six or more points and the ———— relative orientation parameters are computed by least squares adjustment.

a. Four

b. Five

c. Six

d. Eight

73. ATM is to be carried out for a strip of 20 aerial photographs with an end lap of 81%. How many number of photographs will have a ground control point that exists in extreme lower right corner of the third photograph?

a. 4

b. 5

c. 8

d. 10

74. A square area flat on the surface of the earth with a side of 100 m appears as 100 mm^2 on a vertical aerial photograph. The topographic map shows that a contour of 750 m passes through the area. If focal length of the camera is 250 mm^2, the height from which the aerial photograph was taken, is

a. 3250m

b. 2500m

c. 1750m

d. 1000m

75. If the height of features like buildings and trees are subtracted from the digital surface model, then the result is known as

a. Digital Exterior Model

b. Digital Interior Model

c. Digital Height Model

d. Digital Elevation Model

76. Which of the following statements are relevant to Digital photogrammetry work station?

i. The ability to store, manage, and manipulate very large image files

ii. The ability to perform computationally demanding image processing tasks

iii. To provide smooth roaming across entire image files and supporting zooming at various resolutions

iv. Scanning facility

a. i and ii

b. i and iv

c. i, ii and iii

d. i, ii and iv

77. What is the travel time for laser pulse to reach an object with an elevation of 210m, when the flying height is 510m?

a. 2000 second

b. 2000 millisecond

c. 2000 microsecond

d. 2000 nanosecond

78. An imaginary line drawn on a map joining places with the same rainfall is called
    a. Isohyet
    b. Isotherm
    c. Isobars
    d. Isopleth

79. Universal Transverse Mercator projection is
    a. Conical projection
    b. Cylindrical projection
    c. Zenithal projection
    d. Planner projection

80. What will be the ground distance, if map distance on 1 : 50,000 Scale map is measured as 5cm?
    a. 0.5 km
    b. 2.5 km
    c. 50 m
    d. 25 m

81. Projection most commonly used for mapping polar regions is
    a. Azimuthal
    b. Conic
    c. Oblique
    d. Cylindrical

82. Which of the following model is users Perception of Real World?
    a. Logical model
    b. Conceptual model
    c. Physical model
    d. Network model

83. A global mean sea level model used as reference surface for elevation is known as
    a. Datum
    b. Ellipsoid
    c. Geoid
    d. Sphere

84. Which one of the following is not a primary color in color wheel?
    a. Red
    b. Green
    c. Yellow
    d. Blue

85. What is meta data?
    a. Data about data
    b. Meteorology data
    c. Contour data
    d. Metamorphic data

86. Local operations can be applied on
    a. Single raster only
    b. Multiple raster only
    c. Single and multiple raster
    d. Vector

87. In OGC standards, OGC means
    a. Other Geoapatial consortium
    b. Open GIS Committee
    c. Open Geological Committee
    d. Open Geospatial Consortium

88. The third dimension used in GIS represents
    a. Latitude
    b. Altitude
    c. Magnitude
    d. Longitude

89. Which kind of data is mostly used in GIS?
    a. Numerical data
    b. Binary data
    c. Spatial data
    d. Boolean data

90. The abbreviation of TIN is
    a. Triangulated Irregular Network
    b. Temporal Information Network
    c. Traffic Internet Network
    d. Temperature Irregular Node

91. Which of the following is not a topological error?
    a. A gap between polygons
    b. Overlapped polygon
    c. Unclosed polygon
    d. Sliver polygon

92. Which of the following scale has absolute zero?
    a. Nominal Scale
    b. Ratio scale
    c. Interval scale
    d. Ordinal scale

93. Land cover in remote sensing corresponds to
    a. physical condition of ground surface
    b. physical condition of vegetation
    c. topography of the ground surface
    d. soil cover on land

94. SAR data is suitable for assessing the
    a. health of crop
    b. crop type
    c. phenology of crop
    d. moisture content of the crop

95. Barren rock will have NDVI of
    a. 0.1 or less
    b. 0.4 or less
    c. 0.1 or more
    d. 0.4 or more

96. Which of the following imagery can facilitate delineation and identification of local reliefs?
    a. Ortho imagery
    b. Stereo imagery
    c. PAN imagery
    d. Geocoded imagery

97. Identification and geo-location of anthropogenic features in x-y plane is called as
    a. Anthrometry
    b. Geo-anthrometry
    c. Planimetry
    d. Geo-planimetry

98. The spatial resolution of imagery recommended for assessing the damages of cultural features due to flood disaster is
    a. 20 m
    b. 30 m
    c. 60 m
    d. 90 m

99. Which of the following satellite data is useful for ocean monitoring?
    a. Sentinel – 1A
    b. Sentinel – 2B
    c. Sentinel – 3
    d. Sentinel – 5R

100. Satellite remote sensor captures the sea surface temperature upto a depth of
    a. 10 micron
    b. 50 micron
    c. 100 micron
    d. 150 micron