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. $(e^a - 1)(e^b - 1)(e^c - 1)$

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 $^\circ\rho$, the boiling and freezing points of water at one atmosphere are $100^\circ\ \rho$ and $300^\circ\rho$ respectively. Correlate this scale with the Centigrade scale. The reading of $0^\circ\rho$ 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

09 – AGRICULTURAL AND IRRIGATION ENGINEERING

(Answer ALL questions)

41. Which one of the following is not a movable pulley?
    a. Elevator
    b. Construction Crane
    c. Weight Lifting machine
    d. Pulley at the flag pole

42. Which Gear is used in conveyer systems to lock?
    a. Spur gear
    b. Worm gear
    c. Helical gear
    d. Bevel gear

43. Which type of mould board is used in sticky soils as primary tillage equipment?
    a. General purpose mould board
    b. Slat mould board
    c. Stubble mould board
    d. Sod mould board

44. While designing seed drill, the normal width of seed drill (w) is based on Number of furrow opener (N) and spacing between furrows. Then the relationship to determine width of seed drill is
    a. $W = N/S$
    b. $W = N \times S$
    c. $W = S/N$
    d. $S = W/N$

45. When energy expressed is 10 calorie, it is equal to
    a. 41.86 J
    b. 4.186 J
    c. 418.6 J
    d. 0.4186 J

46. How the connecting rod in a conventional mower which is pinned to crank shaft with a pin to transmits reciprocating motion to knife head is called?
    a. Ledger Plate
    b. Wearing Plate
    c. Pitman
    d. Grass board

47. Which of the following estimates the potential wind energy sites by power density of the site?
    a. $P = ½\ mv^2$
    b. $P = ½\ \rho v^3$
    c. $P = ½\ \rho A v^2$
    d. $P = ½\ \rho A v^3$

48. Which one of the following is the most efficient in energy storage as a rechargeable battery?
    a. Lead Acid
    b. Nickel – Cadmium
    c. Zinc – Air
    d. Lithium – Ion

49. What is the displacement volume for a four stroke engine, with 10 cm bore diameter and 8 cm stroke length?
    a. 2512 cm^3
    b. 25.12 cm^3
    c. 251.2 cm^3
    d. 25120 cm^3

50. What is the speed required if a tractor engine has constant hp, to get high torque at rear wheel?
    a. Very high
    b. High
    c. Low
    d. Constant

51. Which of the following anti freeze solution is mixed with water in cooling system of tractors under very cold condition?
    a. Sodium chloride
    b. Glycerine
    c. Caustic soda
    d. Sodium hydroxide

52. Which of the following is highly power intensive in farm operations?
    a. Plant protection
    b. Tilling
    c. Transplanting
    d. Weeding

53. Which of the following is **Not** a part of Dash board of a tractor?
    a. Main Switch
    b. Decompression Lever
    c. Water temperature
    d. Steering Wheel

54. How the horizontal distance between front and rear wheel measured at ground contact is called?
    a. Ground clearance
    b. Track
    c. Wheel base
    d. Turning space

55. In a power tiller, when main clutch transmits power to the transmission gear, the power is transferred to
    a. Steering clutch
    b. Tilling attachment
    c. Brakes
    d. Centre drive

56. How a real fluid in which shear stress is directly proportional to rate of shear strain is called?
    a. Ideal plastic
    b. Newtonian fluid
    c. Non- Newtonian fluid
    d. Ideal fluid

57. What is the Reynolds number for the flow with velocity 2 m/s, flowing through a 10 cm diameter pipe carry water with viscosity 1 centi poise?
    a. 2.00×10^3
    b. 2.00×10^4
    c. 2.00×10^5
    d. 2.00×10^6

58. In the downstream of spill ways hydraulic jump occurs mainly to
    a. Increase discharge
    b. Increase velocity of flow
    c. Dissipate energy
    d. Avoid siltation

59. The shear strength of soil is approximately 1.7 kN/m^2 when it is said to be at
    a. Liquid limit
    b. Plastic limit
    c. Shrinkage limit
    d. Extremely firm

60. Flow nets are constructed such that the head lost between successive ———— line remain the same
    a. Stream line
    b. Streak lines
    c. Equipotential line
    d. Stream tubes

61. Which one of the following is not a layout of tile drain?
    a. French drain system
    b. Herringbone system
    c. Grid iron system
    d. Intercepting drain system

62. Which of the following is a region above water table where water rises in a porous medium?
    a. Water table
    b. Capillary fringe
    c. Phreatic zone
    d. Aquifer

63. In a Darcy's equation, the constant K which is the property of the media is called
    a. Density
    b. Dynamic viscosity
    c. Kinematic viscosity
    d. Intrinsic permeability

64. In ground water hydrology, the term used to describe, saturated flow directed away from water table is called
    a. Discharge area
    b. Recharge area
    c. Midline
    d. Pathline

65. Which of the following occurs when Land surface dips to intersect the water table?
    a. Fault spring
    b. Sinkhole spring
    c. Fracture spring
    d. Depression spring

66. If i is intensity of rain in cm/hr, f is rate of infiltration in cm/hr and fc is infiltration capacity in cm/hr. Maximum rate at which, soil can absorb water is
    a. $f = i$ when $i < fc$
    b. $f \leq i$ when $i > fc$
    c. $f < i$ when $i > fc$
    d. $f \geq fc$ when $i = fc$

67. How Lumped hydrologic flow routing of flood, when flow is calculated as a function of time alone is called?
    a. Distributed routing
    b. Lumped routing
    c. Hydraulic routing
    d. Dynamic wave routing

68. Which of the following is **Not** a recording rain gauge?
    a. Tipping bucket type
    b. Weighing bucket type
    c. Symon's gauge
    d. Natural siphon type

69. Wells which are excavated pits through the geological formation which needs lining only for a couple of meter from top are usually found in
    a. Alluvial formation
    b. Rocky formation
    c. Fracture zones
    d. Fault zones

70. Aquifer testing conducted to determine hydraulic parameter is
    a. Time draw down test
    b. Step – draw down test
    c. Step – injection test
    d. Time – ground water level rise test

71. An agricultural pump has lifting water from well has a discharge of 1,00,000 litres/hour against its head of 20 m, What is the water power in watts?
    a. 5.4936
    b. 54.936
    c. 549.36
    d. 5493.6

72. The Branch of Surveying, which takes into consideration the true shape of earth is called
    a. Plane surveying
    b. Compass Surveying
    c. Topographic Surveying
    d. Geodetic Surveying

73. Lines are first run around the perimeter of a plot, then details are fixed in relation to established lines. This process in Surveying is called
    a. Transverse Survey
    b. Plain table Survey
    c. Theodolite Survey
    d. Triangulation Survey

74. In surveying using a compass, _____ is the operation in which compass is kept exactly over the station from where the bearing is to be determined
    a. Levelling
    b. Focussing
    c. Centering
    d. Bearing

75. Which of the following soil structures impedes downward movement of water?
    a. Granular
    b. Columnar
    c. Platy
    d. Prismoidal

76. A soil sample has a mass of 20 g and the volume of the soil sample in 15 cm^3. The bulk density of soil is
    a. 1.1 g/cm^3
    b. 1.2 g/cm^3
    c. 1.3 g/cm^3
    d. 1.4 g/cm^3

77. At a given matric potential, ———— retains more water
    a. Clay soil
    b. Loam soil
    c. Silty soil
    d. Sandy soil

78. One of the erosion control measures for slope management is
    a. Conservation tillage
    b. Vegetative hedge
    c. Check dam
    d. Terraces

79. Tree wind breaks protects soil carrying capacity of wind for approximately ———— times the height of the tall tree on windward side
    a. 3-4
    b. 15-20
    c. 5-10
    d. 11-15

80. The design velocity of flow in grassed water way is 2.0 m/s, then the cover condition should be
    a. Good grass cover
    b. Sod of excellent cover
    c. Sparse grass cover
    d. No vegetation

81. If rice requires 10 cm depth of water at an average interval of about 10 days and if crop period of rice is 120 days. The delta for rice is
    a. 10 cm
    b. 12 cm
    c. 100 cm
    d. 120 cm

82. For which of the following crops Furrow irrigation is **Not** suited for?
    a. Cotton
    b. Rice
    c. Sugarcane
    d. Potato

83. Which one the following is **not** suitable for fertigation under drip irrigation because of its slow solubility in water?
    a. Urea
    b. Super phosphate
    c. Gypsum
    d. Muriate of potash

84. When the soil concentration in water extracted from saturated soil is found to be greater than 18 mmhos/cm . Then the soil is said to be
    a. Highly saline
    b. Medium saline
    c. Slightly saline
    d. Non saline

85. What is the drainage co-efficient in an agricultural watershed of 1500 ha is discharging through a drain at an average rate of 2.5 m^3/s?
    a. 1.22 cm/day
    b. 1.44 cm/day
    c. 1.66 cm/day
    d. 1.88 cm/day

86. In a subsurface drainage network of an agricultural watershed had 10 lateral drain laid at a spacing of 40 m and each is 150 m long, join a collector drain. If average discharge at the outlet of collector drain is 10 L/s, the water table drops 40 cm below the ground in 3 days. The average drainable porosity of soil is
    a. 5.8%
    b. 7.8%
    c. 10.8%
    d. 15.8%

87. For which of the following Magnetic separators equipment is used?
a. Sorting
b. Cleaning
c. Grading
d. Milling

88. Which component of rice, is rich in dietary fibre, essential fatty acids, starch, protein and vitamin?
a. Whole kernel
b. Husk
c. Bran
d. Oil

89. What is the main purpose of blanching vegetables before freezing?
a. to soften cellulose
b. to deactivate enzymes
c. to increase color
d. to prevent loss of vitamin C

90. Pantnagar process of milling is designed for
a. Black gram
b. Green gram
c. Green pea
d. Pigeon pea

91. Where Compression force is used as a means of size reduction?
a. In Hammer mill
b. In Disc attrition mill
c. In Roller mill
d. In Knife cutter

92. For transporting grains, bed speed recommend in a belt conveyor is
a. ≤ 1 m/s
b. 2.5 to 2.8 m/s
c. 3.5 to 3.8 m/s
d. ≥ 5 m/s

93. The portal for farmers to get information services/advisories by SMS is
a. Pusa Krishi
b. m Kisan
c. Farm Opera
d. Kisan Suvidha

94. FAO has used Google's earth engine to forecast and control occurrence of
a. H_5 N_i Virus
b. Avian influenza
c. Locust
d. Corona Virus

95. How Crop growth monitoring and management are possible?
a. By Remote sensing
b. By GIS
c. By Unmanned Aerial vehicle
d. By Modelling

96. Who has developed Linear programming?
a. George B.Dantzig
b. Richard Bellman
c. Narendra Karmarkar
d. Bolton

97. OFD works are part of
a. CADP
b. HADP
c. DPAP
d. RVP

98. Neerkatti is a water management institution of Tamil Nadu which is
a. Formal
b. Traditional
c. Informal
d. Official

99. How Voluntary contribution in rehabilitation of tanks in Tamil Nadu is called?
a. Erivariam
b. Kudimaramathu
c. Toorvaruthal
d. Ayacutudar Kuzhu

100. Shejpali system of irrigation is a water system practised in the state of
a. Bihar
b. Karnataka
c. Maharashtra
d. Andhra Pradesh