PAPER CODE: 30 to 35

SECTION – A (PHYSICS)

[Section – A is **Compulsory** for all al the candidates]

Question numbers 81–110 carry 1 mark each:

1. Why the tyres are circular in shape?

[A] They require less material
[B] Rolling friction is smaller than the sliding friction
[C] It is easy to enflate the circular tyres
[D] None of these

2. If range is doubled of the maximum height of a projectile, then angle is

[A] $\tan^{-1} 4$
[B] $\tan^{-1} 1/4$
[C] $\tan^{-1} 1$
[D] $\tan^{-1} 2$

3. When a p-n junction diode is reverse-biased, the flow of current across the junction is mainly due to

[A] Diffusion of charges
[B] Drift of charges
[C] Both drift and diffusion of charges
[D] Depends upon the nature of materials

4. An x-ray photon has a wavelength of 0.02 Å. It's momentum is

[A] 3.3×10^{-22} kg m/s
[B] 6.626×10^{-21} kg m/s
[C] 6.626×10^{-24} kg m/s
[D] 1.65×10^{22} kg m/s

5. An A.C. supply may be used directly for all these except for one. Identify the one, for which it cannot be used

[A] Heating
[B] Lighting
[C] Transforming voltage
[D] Electroplating

6. A straight wire of diameter 0.5 mm carrying a current of 1 A is replaced by another wire of 1 mm diameter carrying the same current. The strength of the magnetic field far away is

[A] Twice the earlier value
[B] One half the earlier value
[C] One quarter of the earlier value
[D] Same as the earlier value

7. A convex lens of power +6 D is placed in contact with a concave lens of power -4 D. What will be the nature and focal length of this combination?

[A] Concave, 25 cm
[B] Convex, 50 cm
[C] Convex, 20 cm
[D] Concave, 100 cm

8. A Carnot's engine works between 200^0C and 0^0C and another Carnot's engine works between 0^0C and -200^0C. The ratio of their efficiencies will be

[A] 5.77
[B] 0.577
[C] 57.7
[D] 0.0577

9. Two metal wires of identical dimensions are connected in series. If K_1 and K_2 are the conductivities of the metal wires respectively, the effective conductivity of the combination is

[A] $\frac{K_1 + K_2}{2K_1K_2}$
[B] $\frac{K_1 + K_2}{K_1K_2}$
[C] $\frac{2K_1K_2}{K_1 + K_2}$
[D] $\frac{K_1K_2}{K_1 + K_2}$

10. Two wires of same material have lengths L, 2L and radii 2r, r, equal weights are applied on them. The ratio of alongation production in two wires is

[A] 1/2
[B] 1/8
[C] 1/6
[D] 1/4

11. The time taken by the spherical object to reach the terminal velocity in a viscous liquid is (if the symbols have their usual meaning)

[A] $\frac{\eta R^2}{\rho}$
[B] $\frac{\eta R}{\rho}$
[C] $\frac{\rho R}{\eta}$
[D] $\frac{\rho R^2}{\eta}$

12. A rod of refractive index 1.42 is immersed in a liquid of refractive index 1.42. The rod will

[A] Appear slightly raised inside the liquid
[B] Appear slightly bent
[C] Become invisible
[D] None of the above

13. A uniform wire of length 5 m is carrying steady current. The electric field inside it is 0.2 V/m. The potential difference across the ends of the wire is

[A] 1 Volt
[B] 0.1 Volt
[C] 0.5 Volt
[D] 5 Volt

14. A ball is thrown vertically downwards from a height of 20 m with an initial velocity u. It collides with the ground, looses 50% of its energy in collision and rebounds to the same height. The initial velocity u is (Take $g = 10\ m/s^2$)

[A] 20 m/s
[B] 28 m/s
[C] 10 m/s
[D] 14 m/s

15. The radius of earth is 6400 km. Its capacitance will be

[A] 7.1×10^{-4} F
[B] 6.4×10^{-4} F
[C] 6.4×10^{6} F
[D] Zero

16. A rectangular film of liquid is extended from (4 cm × 2 cm) to (5 cm × 4 cm). If the work done is 3×10^{-4} J, the value of the surface tension of the liquid is

[A] 8.0 N/m
[B] 0.250 N/m
[C] 0.125 N/m
[D] 0.2 N/m

17. A coil having number of turns N and area A rotated in a uniform magnetic field B with an angular velocity ω. The maximum emg induced in it is given by

[A] B ω/NA
[B] NA ω/B
[C] NAB/ ω
[D] NAB ω

18. A source of sound frequency 600 Hz is placed inside water. The speed of sound in water is 1500 m/s and in air is 300 m/s. The frequency of sound detected in air is

[A] 200 Hz
[B] 3000 Hz
[C] 600 Hz
[D] 750 Hz

19. Ferromagnetic substances own their properties to

[A] Vacant inner shells
[B] Filled inner subshells
[C] Partially filled inner subshells
[D] None of the above

20. If I_0 is the intensity of principal maximum in the single slit diffraction pattern then what will be its intensity when the slit width is doubled?

[A] $2I_0$
[B] $4I_0$
[C] I_0
[D] $I_0/2$

21. 32 cells each of emf 3Vare connected in series and kept in a box. Externally the combination shows 84 V. The number of cells reversed in the connection is

[A] 0
[B] 2
[C] 8
[D] 16

22. Resistivity of a conductor in which a current density 2.5 Am^{-2} is found to exist, when an electric field 15 V/m is applied to it

[A] 6 Ω m
[B] 7 Ω m
[C] 4 Ω m
[D] 8 Ω m

23. If the ratio of change in emitter current and corresponding change in the collector current is 1.013, then the value of α is .

[A] 0.987
[B] 0.100
[C] 0.900
[D] Zero

24. In an ac circuit, a resistance of R Ω is connected in series with an inductance L. If phase angle between voltage and current be 45^0, the value of inductive reactance will be

[A] R/4
[B] R/2
[C] R
[D] Cannot be found with given data

25. A nuclear reactor delivers a power of 10^9 watt. What is the amount of fuel consumed by the reactor in one hour?

[A] 0.04 gm
[B] 0.08 gm
[C] 0.72 gm
[D] 0.96 gm

----------Physics Paper Ends----------

SECTION–B (CHEMISTRY)

[Section B is **Compulsory** for all al the candidates]

Question numbers 26-50 carry 1 mark each:

26. All electrons in a d-subshell must have the quantum number

[A] n = 2 [B] m = 2
[C] s = +1/2 [D] l = 2

27. Sodium atom crystallizes in body centered cubic (bcc lattice) will cell edge (a) = 4.29A°. The radius of sodium atom is

[A] 18.6 A° [B] 1.86 A°
[C] 1.86pm [D] 1860pm

28. The molarity of pure water is

[A] 18 [B] 5.56
[C] 55.6 [D] 100

29. If 18 g of glucose are present in 1000 g of solvent, then the concentration of solution is

[A] 0.1 molar [B] 0.1 molal
[C] 10 molal [D] 1.0 molar

30. Besides CO_2, other green-house gas is

[A] N_2 [B] N_2O
[C] Ar [D] O_2

31. According to law of mass action, the rate of reaction is directly proportional to

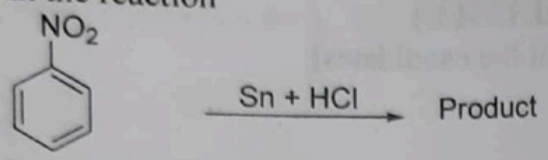
[A] volume of the container [B] equilibrium constant
[C] nature of reactants [D] molar concentration of reactants

32. At a certain temperature, pure distilled water has H_3O^+ concentration equal to 1×10^{-6} M. The value of K_w at the temperature will be

[A] 1.0×10^{-8} [B] 1.0×10^{-12}
[C] 1.0×10^{-14} [D] 1.0×10^{-6}

(Space for rough works)

33. In the reaction



The product formed is

[A] Nitrosobenzene [B] Aniline

[C] Phenylhydroxylamine [D] Benzene diazonium Chloride

34. If copper is kept open in air, it loses its color and gains green coating, it is due to formation of

[A] CuO [B] $CuSO_4$

[C] Cu_3N_2 [D] $CuCO_3$

35. The molecule having highest percentage ionic character is

[A] HI [B] HBr

[C] HCl [D] HF

36. The halogen with highest electron affinity is

[A] F [B] Cl

[C] Br [D] I

37. In the metallurgy of iron, when limestone is added to the blast furnace, the calcium ions end up in

[A] Slag [B] Gangue

[C] Metallic calcium [D] Calcium oxide

38. Which of the following products is obtained, when methyl magnesium chloride is decomposed by water

[A] Methane [B] Ethane

[C] Ethene [D] Ethyne

39. The radioactive isotope of hydrogen is

[A] Hydrogen [B] Protium

[C] Deuterium [D] Tritium

40. Ortho-nitrophenol is more volatile than para-nitrophenol, due to

[A] Higher molecular mass [B] Pressure of intramolecular hydrogen bonding

[C] Absence of intramolecular hydrogen bonding [D] Resonance

41. Many properties of aldehydes and ketones are similar because both
[A] are unsaturated [B] have similar structure
[C] are very reactive [D] contain carbonyl group

42. Which of the following acids has the smallest dissociation constant?
[A] $CH_3CHFCOOH$ [B] FCH_2CH_2COOH
[C] $BrCH_2CH_2COOH$ [D] $CH_3CHBrCOOH$

43. Among the following, the ion which have five unpaired electrons in its ground state is
[A] Cr^{+3} [B] Mn^{+3}
[C] Fe^{+3} [D] Ni^{+2}

44. Among the following, the strongest base is
[A] $C_6H_5CH_2NH_2$ [B] m-NO_2-$C_6H_4NH_2$
[C] o-NO_2-$C_6H_4NH_2$ [D] $C_6H_5NH_2$

45. The IUPAC name of CH_2=CHCN is
[A] Ethenenitrile [B] Vinyl cyanide
[C] Cyanoethane [D] 2-propenenitrile

46. The correct order of acidic strength is
[A] $HClO_4 > HBrO_4 > HIO_4$ [B] $HIO_4 > HBrO_4 > HClO_4$
[C] $HBrO_4 > HClO_4 > HIO_4$ [D] $HBrO_4 > HIO_4 > HClO_4$

47. Natural rubber is a polymer of
[A] Butadiene [B] Ethyne
[C] Styrene 4[D] Isoprene

48. Which of the following factor does not influence the rate of reaction?
[A] Nature of the reactants [B] Concentration of the reactants
[C] Molecularity of the reaction [D] Temperature

49. Hard water contains
[A] Ca^{2+} and Mg^{2+} [B] NO_3^- and PO_3^{3-}
[C] Na^+ and K^+ [D] Dissolved gases

50. Element (M) with atomic number 13, will form its sulfate salt with chemical formula
[A] MSO_4 [B] M_2SO_4
[C] $M_2(SO_4)_3$ [D] $M_3(SO_4)_2$

---------------Chemistry Paper Ends---------------------------

SECTION – C (MATHEMATICS)

[Section C is **Compulsory** for all al the candidates]

Question numbers 51–80 carry 1 mark each:

51. If the vertices of a triangle are $(2,4),(6,4)$ and $(2,0)$, then the coordinate of in-centre is

[A] $(5,4)$
[B] $(-5,-4)$
[C] $(6+2\sqrt{2}, \quad 2\sqrt{2})$
[D] $(6-2\sqrt{2}, \quad 2\sqrt{2})$

52. The value of k for which the points $(1,4)$, $(k,-2)$ and $(-3,16)$ are collinear is

[A] 1
[B] 2
[C] 3
[D] 4

53. The harmonic mean of $\frac{a}{1-ab}$ and $\frac{a}{1+ab}$ is

[A] $\frac{a}{\sqrt{1-a^2b^2}}$
[B] $\frac{a}{1-a^2b^2}$
[C] a
[D] $\frac{1}{1-a^2b^2}$

54. The number of lines drawn through six points lying on a circle is

[A] 12
[B] 15
[C] 24
[D] 30

55. If $cos^{-1}\left(\frac{3}{5}\right) - sin^{-1}\left(\frac{4}{5}\right) = cos^{-1}(x)$, then x is equal to

[A] 0
[B] 1
[C] -1
[D] none of these

56. The solution of the differential equation $y\,dx + (x + x^2y)dy = 0$, is

[A] $-\frac{1}{xy} = C$
[B] $\log y = Cx$
[C] $-\frac{1}{xy} + \log y = C$
[D] $\frac{1}{xy} + \log y = C$

57. The points $(0, 8/3)$, $(1,3)$ and $(82,30)$ are the vertices of

[A] an obtuse angled triangle
[B] an acute angled triangle
[C] an right angled triangle
[D] none of these

58. The value of k for which the line $x + y + 1 = 0$ touches the parabola $y^2 = kx$, is
[A] -4
[B] 4
[C] 2
[D] -2

59. The mean and variance of a random variable having a binomial distribution are 4 and 2 respectively, then $P(X = 1)$ is
[A] 1/16
[B] 1/32
[C] 1/8
[D] 1/4

60. Two numbers have arithmetic mean 9 and geometric mean 4. Then these numbers are the roots of the quadratic equation
[A] $x^2 - 18x + 16 = 0$
[B] $x^2 + 18x - 16 = 0$
[C] $x^2 - 18x - 16 = 0$
[D] $x^2 + 18x + 16 = 0$

61. A husband and wife appear in an interview for two vacancies in the same post. The probability of the husband's selection is 1/7 and that of wife's selection is 1/5. Then the probability that only one of them will be selected is
[A] 4/7
[B] 12/35
[C] 3/7
[D] 2/7

62. The Binomial distribution whose mean is 10 and standard deviation is $2\sqrt{2}$, is
[A] $\left(\frac{4}{5}+\frac{1}{5}\right)^{50}$
[B] $\left(\frac{4}{5}+\frac{1}{5}\right)^{1/50}$
[C] $\left(\frac{4}{5}+\frac{5}{1}\right)^{50}$
[D] none of these

63. The complementary function of the differential equation $\frac{d^2y}{dx^2} - 2k\frac{dy}{dx} + k^2y = 0$, is
[A] $(C_1x + C_2)\ e^{kx}$
[B] $(C_1)\ e^{kx}$
[C] $(C_1)\ e^{-kx}$
[D] none of these

64. The value of $2\ tan^{-1}\frac{1}{3} + tan^{-1}\frac{1}{7}$ is equal to
[A] $\pi/6$
[B] $\pi/3$
[C] $\pi/4$
[D] None of these

65. The directional derivative of the function $f(x, y, z) = xy^2 + yz^3$ at the point $(2, -1, 1)$ in the direction of the vector $\hat{\imath} + 2\hat{\jmath} + 2\hat{k}$ is
[A] $-8/3$
[B] $11/3$
[C] $8/3$
[D] $-11/3$

6. If the curl of a vector field is zero, then the vector field is
[A] rotational
[B] irrotational
[C] both rotational and irrotational
[D] cannot decide

67. The value of $\iint_S \vec{r}.\hat{n}\ dS$, where S is a close surface is
[A] 0
[B] $6V$
[C] V
[D] $3V$

68. Distance between two planes $2x + y + 2z = 8$, $4x + 2y + 4z + 5 = 0$ is
[A] $7/2$
[B] $9/2$
[C] $5/2$
[D] $3/2$

69. If the maximum value of $y = a\cos x - \frac{1}{3}\cos 3x$ occurs when $x = \pi/6$ then the value of a is
[A] -2
[B] 2
[C] $2/\sqrt{3}$
[D] $-2/\sqrt{3}$

70. The two curves $y^2 = 4x$ and $x^2 + y^2 - 6x + 1 = 0$ at the point $(1,2)$
[A] intersect or orthogonality
[B] intersect at an angle $\pi/3$
[C] touch each other
[D] None of these

71. The area of the region bounded by the curves $y = |x - 2|$, $x = 1$, $x = 3$ and the x-axis is
[A] 1 sq unit
[B] 2 sq units
[C] 3 sq units
[D] 4 sq units

72. The value of $\int_{-2}^{3} |1 - x^2|\, dx$ is
[A] $14/3$
[B] $1/3$
[C] $28/3$
[D] $7/3$

73. If $z = f(y/x)$, then the value of $x\frac{\partial z}{\partial x} + y\frac{\partial z}{\partial y}$ is
[A] 0
[B] 1
[C] -1
[D] none of these

74. The function $f(x) - \frac{x}{2} + \frac{2}{x}$ has a local minimum at
[A] -2
[B] 2
[C] 0
[D] 1

75. If $A^2 - A + I = 0$, then the inverse of A is
[A] $A + I$ [B] A
[C] $I - A$ [D] $A - I$

76. The diagonal elements of skew symmetric matrix are always
[A] non-zero [B] Zero
[C] of unit modulus [D] none of these

77. The coefficient of the middle term in the binomial expansion in powers of x of $(1+\alpha x)^4$ and of $(1-\alpha x)^6$ is the same then α equals
[A] $3/5$ [B] $-5/3$
[C] $-3/10$ [D] $10/3$

78. If the value of k so that $\frac{x-1}{-3} = \frac{y-2}{2k} = \frac{z-3}{2}$ and $\frac{x-1}{3k} = \frac{y-1}{1} = \frac{z-6}{-5}$ may be perpendicular is given by
[A] $-7/10$ [B] $-10/7$
[C] -10 [D] $10/7$

79. If A be square matrix of type 4 by 4 and its determinant is 2. Then the determinant of $adj\, A$ is
[A] 8 [B] 4
[C] 16 [D] 2

80. The system of linear equations: $x + y + z = 6$, $x + 2y + 3z = 10$, $x + 2y + \lambda z = \mu$ has no solution, then the value of λ and μ are

[A] $\lambda = 3,\ \mu \neq 10$ [B] $\lambda = 3,\quad \mu = 10$
[C] $\lambda \neq 3,$ for any value of μ [D] $\mu \neq 3,$ for any value of λ

---------------Mathematics Paper Ends----------------------------

CANDIDATE HAS TO ATTEMPT QUESTION NUMBERS 81-130 OF SECTION-D FROM APPROPRIATE ENGINEERING BRANCH AS SHOWN IN THE ADMIT CARD OF NEE-2018

SECTION – D (Agricultural Engineering)
[Candidate who has opted for AE (Code-30) in NEE - 2018]

Question numbers 81–110 carry 1 mark each:

81. The magnitude of the force of friction between two bodies, one lying above the other, depends upon the roughness of the
[A] upper body
[B] lower body
[C] both the bodies
[D] the body having more roughness

82. Which of the following statement is correct for the IC engine?
[A] Fuel for the SI engine is cheaper than the CI engine
[B] Torque characteristics of the SI engine is more uniform than the CI engine
[C] Expansion ratio of the SI engine is higher than the CI engine
[D] Reliability of the SI engine is much lower than that of the CI engine

83. Which of the following is hand operated sowing equipment?
[A] Broadcaster
[B] Dibbler
[C] Planter
[D] Seed drill

84. When the flow in an open channel is gradually varied, the flow is said to be
[A] Steady uniform flow
[B] Steady non-uniform flow
[C] Unsteady uniform flow
[D] Unsteady non-uniform flow

85. A bar of length L meters extends by l mm under a tensile force of P. The strain produced in the bar is
[A] l/L
[B] 0.1 l/L
[C] 0.01 l/L
[D] 0.001 l/L

86. Normal speed of power-take-off (pto) shaft is
[A] 440 rpm
[B] 540 rpm
[C] 640 rpm
[D] 650 rpm

87. Mowers are used to cut
[A] grasses
[B] mustard
[C] wheat
[D] peas

88. Poise is the unit of
[A] Surface tension
[B] Buoyancy force
[C] Viscosity
[D] Kinematic viscosity

89. The rise and fall method of leveling provides a complete check on
[A] Back sight
[B] Intermediate sight
[C] Fore sight
[D] All of these

90. Average firing interval for 6-cylinder, 4 cycle engine is
[A] 120^0
[B] 180^0
[C] 240^0
[D] 360^0

91. Mole drain is the most suitable drainage system for
[A] Heavy clay soil
[B] Loamy soil
[C] Sandy soil
[D] Silty soil

92. Capillary water is held in the soil due to
[A] Absorption force
[B] Surface tension
[C] Gravitational force
[D] Osmotic force

93. Hydraulically most efficient cross section of open channel is
[A] triangular
[B] rectangular
[C] semi-circular
[D] trapezoidal

94. The phenomenon occurring in an open channel when a rapidly flowing stream abruptly changes to slowly flowing stream causing a distinct rise of liquid surface, is
[A] water hammer
[B] hydraulic jump
[C] critical discharge
[D] critical depth

95. The minimum wind velocity required to initiate movement of soil particle is known as
[A] critical velocity
[B] threshold velocity
[C] extrinsic velocity
[D] intrinsic velocity

96. Drip irrigation is not suitable for cultivation of
[A] paddy
[B] orchard
[C] vegetable
[D] flower

97. From psychrometric chart, the following parameter cannot be determined
[A] relative humidity
[B] air temperature
[C] barometric pressure
[D] wind velocity

98. Size of mould board plough is expressed in terms of its
[A] width of cut
[B] depth of cut
[C] length of share
[D] number of mould board

99. Tractors are generally fitted with
[A] sliding mesh gear box
[B] constant mesh gear box
[C] Both A & B
[D] Synchromesh gear box

100. Most popular equipment for rice milling is
[A] dehusker
[B] sheller
[C] huller
[D] polisher

101. The centre of the knife section must stop in the centre of guard on each stroke is called
[A] Alignment
[B] Adjustment
[C] Registration
[D] Transmission

102. Seasoning of timber is done by keeping it in
[A] water
[B] oil
[C] soil
[D] wood paint

103. Ripening of some of the fruits gets enhanced by __________ gas
[A] Oxygen
[B] Nitrogen
[C] Carbon dioxide
[D] Ethylene

104. In a gas solid mixture, average particle size of the solid particle is 250μm. The equipment used to separate the solid particle from the gas is
[A] Tubular Centrifuge
[B] Cyclone Separator
[C] Disk Bowl Centrifuge
[D] Gravity Setting separator

105. For uniform value of temperature in the air conditioning room, essential control is of
[A] temperature gradient
[B] air velocity
[C] humidity
[D] vapour

106. The Reynolds number is the ratio of
[A] dynamic force to weight
[B] inertial force to surface tension
[C] inertial force to surface tension
[D] inertial force to viscous force

107. Centrifugal discharge is used in ....
[A] Belt Conveyor
[B] Chain conveyor
[C] Screw Conveyor
[D] Bucket elevator

108. Thermodynamic is the study of
[A] energy, equilibrium and entropy
[B] energy, equilibrium and enthalpy
[C] energy, equilibrium and process
[D] process, enthalpy and entropy

109. The size of clay particle is
[A] less than 0.002 mm
[B] less than 0.02 mm
[C] less than 0.2 mm
[D] less than 2 mm

110. The maximum bending moment occurs in a beam where
[A] shear force is maximum
[B] shear force is minimum
[C] shear force is zero
[D] none of the above

Question numbers 111–130 carry 2 marks each:

111. The length of a line was found to be 500 m while measured with 20 m chain. It was found that the chain was 0.02 m too long. What is the actual length of line?

[A] 499 m
[B] 499.5 m
[C] 500.5 m
[D] 501 m

112. Diameter and stroke length of the piston of a 4 stroke 4-cylinder diesel engine are 10 cm and 12 cm, respectively. The speed of the crank shaft is 2000 rpm. What will be the brake power of the engine, if the brake mean effective pressure is 7×10^5 N/m^2? (Assume friction power 25 kW)

[A] 11.00 kW
[B] 18.98 kW
[C] 43.98 kW
[D] 68.98 kW

113. A cantilever beam of span 3 m carries a point load 100 N at the free end. The maximum B.M in the beam will be

[A] 100 N-m
[B] 150 N-m
[C] 300 N-m
[D] 600 N-m

114. A four stroke diesel engine delivers 35 kW with a mechanical efficiency of 80%. Power lost in friction in the engine is

[A] 8.75 kW
[B] 35 kW
[C] 43.75 kW
[D] 78.75 kW

115. A 2-WD 35 hp tractor has 1.5 m diameter rear wheel diameter. The engine runs at 1200 rev/min. The total reduction of the speed is 30:1. The travelling speed of the tractor will be

[A] 0.56 km/h [B] 11.3 km/h
[C] 22.6 km/h [D] 45.2 km/h

116. A 2 m combine is operating at 4 kmph with a field efficiency of 75%. The actual field capacity will be

[A] 0.6 ha/h [B] 0.8 ha/h
[C] 1.066 ha/h [D] none of these

117. Water delivered to the canal is 100 m^3 while only 60 m^3 water is available at the farm head and only 25 m^3 is stored in the root zone. Conveyance efficiency will be

[A] 25% [B] 35%
[C] 60% [D] 85%

118. The peak of a flood hydrograph due to a 6 h storm is 470 m^3/s. The mean depth of rainfall is 8.0 cm. Assuming an average infiltration loss of 0.25 cm/h and a constant base flow of 15 m^3/s, what is the effective rainfall?

[A] 0.25 cm [B] 8 cm
[C] 6.5 cm [D] 455 m^3/s

119. What will be the draft requirement to pull a four bottom 30 cm plough working at a depth of 15 cm? The soil resistance is 0.7kg/cm^2

[A] 84 kg [B] 120 kg
[C] 630 kg [D] 1260 kg

120. For a given location if R = 310, K = 0.1 t/ha, L = 100 m, S = 12%, C = 0.18, LS = 3.2, P = 0.6. Soil loss will be

[A] 0.01071 t/ha [B] 10.71 t/ha
[C] 89.25 t/ha [D] 1071 t/ha

121. The corrugated plastic tiles are used to carry the design flow from 1000 m of tile spaced 30 m apart. The drainage requirement for optimum plant growth is to lower ground water table by 250 mm/day uniformity over the entire area. The drainage porosity of the soil is 4%. Drainage coefficient will be

[A] 0.00033 m/day [B] 0.01 m/day
[C] 0.25 m/day [D] 0.3 m/day

122. A rectangular canal has a bottom width of 5.0 m. The canal is carrying a discharge of 20 m^3/s. The critical depth, in m, is

[A] 1.09
[B] 1.18
[C] 2.12
[D] 2.62

123. Which of the following are the advantages of hammer mill?

a. Product may be relatively uniform
b. Freedom from significant damage due to foreign object
c. Freedom from damage when operating empty
d. Hammer wear does not materially reduce its efficiency

[A] a, b and c
[B] a, b and d
[C] a, c and d
[D] b, c and d

124. Which of the following are physical properties of agricultural material?

a. angle of repose
b. specific gravity
c. moisture content
d. coefficient of friction

[A] a, b and c
[B] a, b and d
[C] a, c and d
[D] b, c and d

125. One tonne of carrot is dried from 24% moisture (wb) to 12% moisture (wb). How much water is removed in drying?

[A] 120 kg
[B] 136 kg
[C] 240 kg
[D] 864 kg

126. A material consisting of 20 mm particle is crushed to an average size of 5 mm and requires 18 kJ/kg energy for this size reduction. If other conditions are similar, how much energy will be required (kJ/kg) to crush the materials from 25 mm to 3 mm using Rittinger's law

[A] 5.82
[B] 16.43
[C] 35.16
[D] 61.53

127. Stationary mass of gas is compressed without friction from an initial state of 0.3 m^3 and 0.105 MPa to a final state of 0.15 m^3 with constant pressure during the process. The work done on the system will be

[A] 15.75 kJ
[B] 31.50 kJ
[C] 47.25 kJ
[D] 63.00 kJ

128. A ball mill of 1.5 m diameter is charged with balls each having of 7.0 cm diameter. The theoretical operating speed of rotation in rpm is

[A] 15
[B] 20
[C] 25
[D] 35

129. A soil sample has a porosity of 40%. The specific gravity of solid is 2.7. What will be unit weight of soil, if it is 50% saturated?

[A] 0.124 kN/m^3
[B] 17.85 kN/m^3
[C] 19.81 kN/m^3
[D] 66.7 kN/m^3

130. Water is flowing in a fire hose with a velocity of 1.0 m/s and a pressure of 200 kPa. At the nozzle the pressure decreases to atmospheric pressure (101.3 kPa). What will be velocity of the water exiting the nozzle, if there is no change in the height?

[A] 1.4 m/s
[B] 3.5 m/s
[C] 7 m/s
[D] 14 m/s

---------------Agricultural Engineering Paper Ends----------------------

PAPER CODE : 31

SECTION – D (Civil Engineering)

[Candidate who has opted for CE (Code-31) in NEE - 2018]

Question numbers 81–110 carry 1 mark each:

81. Pitched and sloping roof is suitable for
    - [A] Coastal regions
    - [B] Plain regions
    - [C] Covering large areas
    - [D] All of the above

82. Jumper is a tool used for
    - [A] Testing of stones
    - [B] Quarrying of stones
    - [C] Dressing of stones
    - [D] None of the above

83. The increase in the moisture content in concrete
    - [A] Reduces the strength
    - [B] Increases the strength
    - [C] Does not change the strength
    - [D] All of the above

84. For bars in tension, a standard hook has an anchorage value equivalent to a straight length of
    - [A] 8 times diameter of bar
    - [B] 12 times diameter of bar
    - [C] 16 times diameter of bar
    - [D] 24 times diameter of bar

85. The principal of 'working from whole to part' is used in surveying because
    - [A] Plotting becomes easy
    - [B] Survey work can be completely quickly
    - [C] Accumulation of errors is prevented
    - [D] All of the above

86. The length of the chain is measured from
    - [A] Center of one handle to center of the other handle
    - [B] Outside of one handle to the outside of the other handle
    - [C] Outside of one handle to inside of the other handle
    - [D] Inside of one handle to the inside of the other handle

87. The process of turning the telescope about the vertical axis in horizontal plane is called
    - [A] Transiting
    - [B] Reversing
    - [C] Plunging
    - [D] Swinging

88. To determine the length of a bridge proposed to be built across a wide river, the surveying method of choice would be
[A] Tacheometry
[B] Chain surveying
[C] Hydrographic surveying
[D] Triangulation

89. Void ratio of a soil mass can
[A] Never greater than unity
[B] Be zero
[C] Take any value greater than zero
[D] Can take values between zero and one

90. The shear strength of a soil
[A] is directly proportional to the angle of internal friction
[B] is inversely proportional to the angle of internal friction
[C] decreases with increase in normal stress
[D] increases with increase in normal stress

91. The major principal stress in an element of cohesionless soil within the backfill of a retaining wall
[A] is vertical if the soil is in an active state of plastic equilibrium
[B] Is vertical if the soil is in a passive state of plastic equilibrium
[C] Is inclined at 45^0 to the vertical
[D] Is inclined at $45^0+\varphi/2$ to the vertical

92. Coefficient of permeability of the soil
[A] Does not depend on temperature
[B] Increases with increase in temperature
[C] Increases with decrease in temperature
[D] None of the above

93. The neutral stress in a soil mass is
[A] force per neutral area
[B] stress taken up by both soil particles and pore water
[C] stress taken up by pore water alone
[D] stress taken up by soil particle alone

94. The suitable method of forecasting population for a young and rapidly increasing city is
[A] Arithmetic increase method
[B] Geometric increase method
[C] Incremental increase method
[D] Graphical method

95. On standard silica scale, the turbidity in drinking water would be limiting to

[A] 10 ppm [B] 20 ppm
[C] 30 ppm [D] 50 ppm

96. The dissolved oxygen level in natural untreated waters at normal temperature is found to be of the order of

[A] 1 mg/liter [B] 10 mg/liter
[C] 100 mg/liter [D] 1000 mg/liter

97. The biochemical treatment of sewage effluents is essentially a process of

[A] Oxidation [B] Dehydration
[C] Reduction [D] Alkalinization

98. Blue baby disease (methemoglobinemia) in children is caused by the presence of excess

[A] Chlorides [B] Nitrates
[C] Fluorides [D] Lead

99. Length of a vehicle affects

[A] Width of traffic lanes [B] Extra width of pavement and minimum turning radius
[C] Width of shoulders and parking facilities [D] Clearance to be provided under structures such as over bridges, under bridges etc.

100. Bottom most layer of pavement is known as

[A] Wearing course [B] Base course
[C] Sub base course [D] subgrade

101. Minimum pitch of the rivets shall not be less than

[A] 1.5 d [B] 2.0 d
[C] 2.5 d [D] 3.0 d

102. If a composite material of steel and copper is heated, then the copper bar will be under

[A] Tension [B] Compression
[C] Shear [D] Torsion

103. The maximum bending moment in a simply supported beam of length 'L' subjected to a point load of magnitude 'W' at a distance of 'L/3' from the left hand support is

[A] WL/3 [B] 2WL/3
[C] WL/9 [D] 2WL/9

104. Due to rise in temperature in a three hinged arch, induced stress is

[A] Direct compression
[B] Direct tensile
[C] Shear
[D] None of the above

105. The shear stress distribution over a rectangular cross section of a beam follows

[A] A straight line path
[B] A circular path
[C] A parabolic path
[D] An elliptical path

106. Hydrograph is the graphical representation of

[A] Runoff and time
[B] Surface runoff and time
[C] Groundwater flow and time
[D] Rainfall and time

107. The probable maximum precipitation at a station is

[A] The greatest rainfall for a given duration that is physically possible
[B] The rainfall of a given duration with maximum probability of occurrence
[C] The rainfall for a given duration that is impossible to occur
[D] None of the above

108. An ideal fluid is

[A] One which obeys Newton's law of viscosity
[B] Frictionless and incompressible
[C] Very viscous
[D] Frictionless and compressible

109. Size of the venturimeter is specified by

[A] Pipe diameter
[B] Throat diameter
[C] Angle of diverging section
[D] Both pipe diameter as well as throat diameter

110. The discharge of the rectangular notch varies with the head to the power

[A] 1/2
[B] 3/2
[C] 5/2
[D] 5/4

Question numbers 111–130 carry 2 marks each:

111. For good bonding in brick masonry

[A] All brick need to be uniform in size
[B] Bats must be used in alternate courses
[C] The vertical joints in alternate courses should fall in plumb
[D] Cement mortor used must have surkhi as additive

112. For complete hydration of the cement the water cement ratio needed to be

[A] Less than 0.25
[B] More than 0.25 but less than 0.35
[C] More than 0.35 but less than 0.45
[D] More than 0.45 but less than 0.60

113. A single rolling load of 8 kN rolls along a girder of 15 m span. The absolute maximum bending moment will be

[A] 8 kN
[B] 15 kN
[C] 30 kN
[D] 60 kN

114. If the true bearing of a line AB is 270^0 then azimuth of the line is

[A] 270^0
[B] 90^0
[C] 45^0
[D] None of these

115. If the fore bearing of a line AB is 35^0 and that of line BC is 15^0, then the included angle is

[A] 20^0
[B] 50^0
[C] 160^0
[D] 230^0

116. If water content of a soil is 40%, specific gravity G is 2.7 and void ratio is 1.35, the degree of saturation is

[A] 70%
[B] 75%
[C] 80%
[D] 85%

117. A cylindrical sample of saturated soil failed under an axial vertical stress of 100 N/m^2 when tested in an unconfined compression test apparatus. The value of cohesion and angle of internal friction for the soil are respectively

[A] 50 N/m^2, 45^0
[B] 50 N/m^2, 0^0
[C] 100 N/m^2, 45^0
[D] 100 N/m^2, 0^0

118. If aggregate impact value is 20 to 30 percent, then it is classified as

[A] Exceptionally strong
[B] Strong
[C] Satisfactory for road surfacing
[D] Unsuitable for road surfacing

119. Softening point of bitumen to be used for road construction at a place where maximum temperature is 40^0C should be

[A] Less than 40^0C
[B] Greater than 40^0C
[C] Equal to 40^0C
[D] None of the above

120. The elongation of a conical bar under its own weight is equal to

[A] That of a prismatic bar of same length
[B] One half that of a prismatic bar of same length
[C] One third that of a prismatic bar of same length
[D] One fourth that of a prismatic bar of same length

121. The difference in ordinate of the shear curve between any two section is equal to the area under

[A] Load curve between these two sections
[B] Shear curve between these two sections
[C] Bending moment curve between these two sections
[D] Load curve between these two sections plus concentrated loads applied between the sections

122. A three hinged arch is carrying uniformly distributed load over the entire span. The arch is free from shear force and bending moment if its shape is

[A] Circular
[B] Parabolic
[C] Elliptical
[D] None of the above

123. Scour valves are provided

[A] At street corners to control the flow of water
[B] At every depression and deed ends to drain out the waste water that may collect there
[C] At the foot of rising main along the slope to prevent back running of water
[D] At every summit of rising mains

124. If the time of concentration is 9 minutes, then the intensity of rainfall according to British Ministry of health formula will be
[A] 4 mm/hr
[B] 10 mm/hr
[C] 20 mm/hr
[D] 40 mm/hr

125. Sewage sickness relates to
[A] Toxicity of sewage interfering with response to treatment
[B] Destruction of aquatic flora and fauna due to gross pollution of receiving bodies of water by sewage
[C] Reduction in the waste purifying capacity of the soil
[D] Clogging of pores in soil due to excessive application of sewage to land, obstructing aeration and leading to septic conditions

126. Maximum percentage reinforcement in case of slabs is limiting to
[A] 2
[B] 4
[C] 6
[D] 8

127. The specific weight of mercury at 20^0C is in kN/m^3
[A] 13600
[B] 133.00
[C] 13.60
[D] 9.79

128. For a liquid at rest, the piezometric head
[A] Is constant at all points in the liquid
[B] Increases with the depth below the free surface
[C] Decreases with depth below the free surface
[D] Depends on the coefficient of viscosity

129. A streamline is a
[A] Line that represent the total energy of a stream
[B] Line so drawn that the velocity vector is normal to it at every point, at a given instant
[C] Line such that the velocity vector is tangent to it, at every point, at a given instant
[D] Line that represents the flow cross section

130. The standard symon's type rain gauge has a collecting area of diameter
[A] 5.08 cm
[B] 10 cm
[C] 12.7 cm
[D] 25.4 cm

-------------------------- **Civil Engineering Paper Ends**------------------------

SECTION – D (Computer Science and Engineering)

[Candidate who has opted for CSE (Code-32) in NEE - 2018]

Question numbers 81–110 carry 1 mark each:

81. What is the octal equivalent of $(111000111)_2$

[A] $(7071)_8$ [B] $(1617)_8$

[C] $(7074)_8$ [D] $(6171)_8$

82. To access the services of operating system, the interface is provided by the

[A] System calls [B] Library

[C] API [D] Assembly instructions

83. Which of the following expressions is in the sum-of-products (SOP) form?

[A] $(A + B)(C + D)$ [B] $(A)B(CD)$

[C] $AB(CD)$ [D] $AB + CD$

84. In Unix, which system call creates the new process?

[A] Fork [B] New

[C] Create [D] None of these

85. DeMorgan's theorem state that

[A] $(x+y)=x'+y'$ [B] $(x+y)'= x+y'$

[C] $(x+y)'=x'+y'$ [D] $(x+y)'=x'+y$

86. In the Round Robin (RR) scheduling; if the time quantum (q) is too large, then

[A] More context switches will occur [B] Scheduling is same as First Come First Served (FCFS)

[C] The average turnaround time decreases [D] No effect

87. Which page replacement policy sometimes leads to more page faults when size of the memory is increased?

[A] Optimal [B] LRU

[C] FIFO [D] None of these

88. A combinational circuit that selects one from many inputs

[A] Mux.
[B] Demux
[C] Decoder.
[D] Encoder

89. The computer architecture aimed at reducing the time of execution of instructions is ________

[A] CISC
[B] ANNA
[C] RISC
[D] ISA

90. How many buses are connected as part of the 8085A microprocessor?

[A] 3
[B] 5
[C] 8
[D] 2

91. Which of the following program combines two or more object codes

[A] Loader
[B] Linker
[C] Compiler
[D] Interpreter

92. Time sharing provides

[A] Disk management
[B] File system management
[C] Concurrent execution
[D] All of these

93. Belady's anomaly is related to

[A] Thrashing in paging
[B] Abnormal segmentation
[C] Abnormal page fault in FIFO
[D] Abnormal page fault in LRU

94. The data structure which is one ended is

[A] Queue
[B] Stack
[C] Tree
[D] Graph

95. A binary search tree whose left sub-tree and right sub-tree differ in height by at most 1 unit is called

[A] AVL tree
[B] Red-black tree
[C] Lemma tree
[D] None of these

96. Which of the following operation is commutative but not associative?

[A] AND
[B] OR
[C] NAND
[D] XOR

97. Which is not the keyword for Storage class

[A] External
[B] Static
[C] Auto
[D] Register

98. Flip flop is used to store

[A] Zero bit information
[B] Two bit information
[C] One bit information
[D] Four bit information

99. Which memory has the lowest access time?

[A] Cache
[B] Registers
[C] Main memory
[D] Disk

100. A 32 bit address bus allows access to a memory of capacity

[A] 64Mb
[B] 16Mb
[C] 1Gb
[D] 4Gb

101. The RST 7.5 interrupt in 8085 microprocessor executes service routine from interrupt vector location

[A] 0000h
[B] 0075h
[C] 003Ch
[D] 0034h

102. The system bus is made up of

[A] Data bus
[B] Data and address buses
[C] Data and control buses
[D] All of these

103. Vector address line for RST3 is?

[A] 0018H
[B] 0016H
[C] 0008H
[D] 0028H

104. Which one of the following is called self referential structure?

[A] Queue
[B] Stack
[C] Linked list
[D] Array

105. The CPU can perform read or write operations at any point of time in

[A] ROM
[B] PROM
[C] EPROM
[D] RAM

106. If a variable is a pointer to a structure, then which of the following operator is used to access data members of the structure through the pointer variable?

[A] .
[B] &
[C] ->
[D] *

107. As soon as a pointer variable in 'C' is freed, its value

[A] remains the same
[B] becomes unpredictable
[C] is set to 1
[D] is set to null

108. In the program given below, point out the error, if any, in the 'for' loop?

```
#include<stdio.h>
        main()
    {
        int i=1;
        for(;;)
      {
        printf("%d", i++);
        if(i>10) break;
    } }
```

[A] The condition in the for loop is a must
[B] The two semicolons should be dropped
[C] Error in for loop
[D] No Error

109. Which of the following cannot be checked in a switch - case statement?

[A] Character
[B] Integer
[C]. Float
[D] Enum

110. What is the output of the following code?

```
#include<stdio.h>
   main()
     {
      for(;;)printf("Hello");
     }
```

[A] Infinite loop
[B] Prints "Hello" once
[C] No output
[D] Compile error

Question numbers 111–130 carry 2 marks each:

111. If X, Y and Z are 3 boolean variables, then X (Y + Z) is not equals (X + Y) (X + Z), if X, Y, Z take the values

[A] 0 , 0 , 0
[B] 0 , 1 , 0
[C] 1, 0 , 1
[D] 0 , 1 , 1

112. With .... only one process can execute at a time; meanwhile all other process are waiting for the processor. With .... more than one process can be running simultaneously each on a different processor.

[A] Multiprogramming, Uniprocessing
[B] Uniprogramming, Multiprocessing
[C] Multiprocessing, Multiprogramming
[D] Multiprogramming, Multiprocessing

113. In UNIX, the return value for the fork system call is _____ for the child process and _____ for the parent process

[A] A negative integer, Zero
[B] Zero, A negative integer
[C] Zero, A nonzero integer
[D] A nonzero integer, Zero

114. The output of an AND gate with three inputs, A, B, and C, is HIGH when ________.

[A] A = 1, B = 1, C = 0
[B] A = 0, B = 0, C = 0
[C] A = 1, B = 0, C = 1
[D] A = 1, B = 1, C = 1

115. What is meant by of stream in C++?

[A] Reads from a file

[B] Writes to a file

[C] Both a & b

[D] None of these

116. What is the average waiting time in FCFS scheduling for the following processes?

Process	Arrival Time	Execute Time	Service Time
P0	0	5	0
P1	1	3	5
P2	2	8	8
P3	3	6	16

[A] 5.75

[B] 5.70

[C] 5.00

[D] 3.25

117. Which of the following statements are true?

I. Shortest remaining time first scheduling may cause starvation

II. Preemptive scheduling may cause starvation

III. Round robin is better than FCFS in terms of response time

[A] I only

[B] I and III only

[C] II and III only

[D] I, II and III

118. Consider the situation in which assignment operation is very costly. Which of the following sorting algorithm should be performed so that the number of assignment operations is minimized in general?

[A] Heap sort

[B] Insertion sort

[C] Selection sort

[D] None of these

119. The result of the subtraction $FD_{16} - 88_{16}$ is

[A] 10_{16}
[B] 75_{16}
[C] 65_{16}
[D] $5E_{16}$

120. -9 with signed 2's complement representation is

[A] 11110011
[B] 11110110
[C] 11110111
[D] 10001001

121. In a complete k-ary tree, every internal node has exactly k children or no child. The number of leaves in such a tree with n internal nodes is:

[A] $n(k-1)+1$
[B] $(n-1)k+1$
[C] nk
[D] $n(k-1)$

122. Choose the correct statement.

I. The scope of a macro definition need not be the entire program
II. The scope of a macro definition extends from the point of definition to the end of the file
III. New line is a macro definition delimiter
IV. A macro definition may go beyond a line

[A] I and II
[B] I, II and III
[C] I, II, III and IV
[D] I, II, IV

123. The root node of a depth first spanning tree is called 'x' if it has at least two children, if 'u' is any other vertex then it is not an 'x' if from every child 'w' of 'u'. Then what is 'x'?

[A] Child node
[B] Descendant node of root
[C] Ancestor of root
[D] Articulation node

124. A counting semaphore is initialized to 15. The 16P (wait) operations and 4V (signal) operations were completed in this semaphore. The resulting value of semaphore is

[A] 0
[B] 3
[C] 10
[D] 8

125. How many 64K × 1 RAM chips are needed to provide memory capacity of 256 K-Bytes

[A] 64
[B] 128
[C] 32
[D] 256

126. A 5 stage pipeline with the stages taking 1, 1, 3, 1, 1 units of time has a throughput of

[A] 1/3
[B] 1/7
[C] 7
[D] 3

127. Choose the correct for the following code segment

```
for ( i = 0 ; i < 10 ; i + + )
printf ( " %d " , i & 1 );
```

[A] Compile time error
[B] 0 1 1 1 1 1 1 1 1 1
[C] 1 1 1 1 1 1 1 1 1 1
[D] 0 1 0 1 0 1 0 1 0 1

128. Choose the correct for the following code segment

```
void main()
        {
            int m = 10;
            int n, n1;
            n = ++m;
            n1 = m++;
            n--;
            --n1;
            n -= n1;
            printf("%d",n);
        }
```

[A] 1
[B] 0
[C] 2
[D] 3

129. Choose the correct for the following code segment

```
int i = 10;
void main ( ) ;
{
 int i = 20 ;
   {
    int i = 30 ;
    cout << i << : : i ;
   }
}
```

[A] 3010 [B] 3020
[C] Compile time error [D] Run time error

130. The average memory access time for a machine with a cache hit rate of 90% where the cache access time is 10ns and the memory access time is 100ns is

[A] 50ns [B] 45ns
[C] 70ns [D] 19ns

--------------------CSE (CODE 32) Paper Ends ----------------------------

SECTION – D (Electronics and Communication Engineering)

[Candidate who has opted for ECE (Code-33) in NEE - 2018]

Question numbers 81–110 carry 1 mark each:

81. An AM signal is represented by

$$x(t) = (20 + 4\sin 500\pi t)\cos(2\pi \times 10^5 t)\ V$$

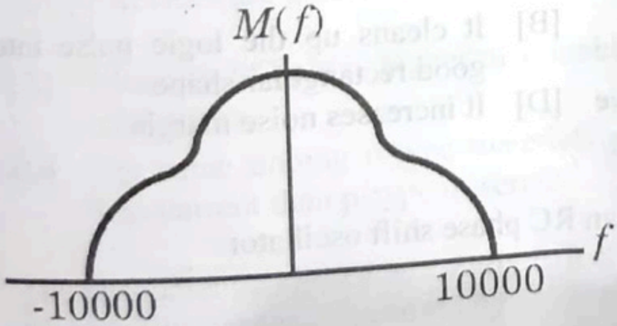
The modulation index is

[A] 20
[B] 4
[C] 0.2
[D] 10

82. For an AM signal, the bandwidth is 10 kHz and the highest frequency component present is 705 kHz. The carrier frequency used for this AM signal is

[A] 695 kHz
[B] 700 kHz
[C] 705 kHz
[D] 710 kHz

83. The Fourier transform M (f) of a signal m(t) is shown in figure. It is to be transmitted from a source to destination. It is known that the signal is amplitude normalized between 1 to 1, and frequency f has unit of Hz. If USSB is employed, the bandwidth of the modulated signal is



[A] 5 kHz
[B] 10 kHz
[C] 20 kHz
[D] None of the above

84. Biasing Mechanism used in integrated circuit is

[A] Fixed Bias
[B] Boot strap Bias
[C] Emitter Bias
[D] Current mirror Bias

85. Thermal run away effect will be more in which of the following Bias

[A] Fixed Bias
[B] Self Bias
[C] Emitter Bias
[D] Collector to Base Bias

86. If the amplification of a single stage is not sufficient or the input or output impedance is not of the correct magnitude for the intended application how many two stages be connected to achieve desired result?

[A] Cascode connection
[B] Complementary symmetry connection
[C] Cascade connection
[D] Totem pole connection

87. An amplifier uses negative feedback to increase the input resistance and output resistance. Then the suitable feedback topology is

[A] Shunt – Shunt
[B] Shunt – Series
[C] Series – Series
[D] Series – Shunt

88. The ripple factor in case of a full wave rectifier is

[A] 1.21
[B] 0.50
[C] 0.48
[D] 1.0

89. Why is a Schmitt trigger introduced between logic circuits?

[A] It reduces propagation delay
[B] It cleans up the logic pulse into good rectangular shape
[C] It converts negative logic to positive and vice versa
[D] It increases noise margin

90. Consider the following statements regarding an RC phase shift oscillator

1. The amplifier gain is positive.
2. The amplifier gain is negative.
3. The phase shift introduced by the feedback network is 180^0.
4. The phase shift introduced by the feedback network is 360^0.

Of these statements

[A] 1 and 3 are correct
[B] 2 and 3 are correct
[C] 2 and 4 are correct
[D] 1 and 4 are correct

91. For various types of oscillators, the correct statement is

[A] LC oscillators are more stable than crystal oscillator
[B] Crystal oscillators have highest Q
[C] Phase shift oscillators have the widest range of frequency
[D] Wien bridge oscillator is used where a single frequency oscillator is required

92. In a Class AB amplifier , the current flows through the active device for

[A] Less than half of the duration of input cycle
[B] Half duration of input cycle
[C] More than half but less than full cycle duration
[D] Full duration of input cycle

93. The sum of two oppositely rotating circularly polarized, waves of equal amplitude will be

[A] A circularly polarized wave
[B] A linearly polarized wave
[C] An elliptically polarized wave
[D] An unpolarized wave

94. If an infinite homogeneous isotropic medium is modeled as an equivalent transmission line, the characteristic impedance of the corresponding transmission line is known as its

[A] characteristics impedance
[B] iterative impedance
[C] wave impedance
[D] intrinsic impedance

95. N-type devices are preferred over P-type devices because of the following reason

[A] Mobility of hole is higher than mobility of electron
[B] Mobility of hole is equal to mobility of electron
[C] For same doping n-type materials give less current than p-type materials
[D] For same doping n-type materials give more current than p-type materials

96. The phenomenon known as " Early Effect" in a bipolar transistor refers to a reduction of the effective base width caused by

[A] Electron hole recombination at the base
[B] the reverse biasing of the base collector junction
[C] the forward biasing of emitter base junction
[D] the early removal of stored base charge during saturation to cutoff switching

97. In order to build a 3 bit simultaneous A/D converter, what is the number of comparator circuits required?
[A] 7
[B] 8
[C] 15
[D] 16

98. Consider the following
Any combinational circuit can be built using
1. NAND gates
2. NOR gates
3. EX-OR gates
4. Multiplexers
Which of these are correct?
[A] 1 , 2 and 3
[B] 1, 3 and 4
[C] 2, 3 and 4
[D] 1, 2 and 4

99. Evaluate (X xor Y) xor Y
[A] All 1's
[B] All 0's
[C] X
[D] Y

100. Dual slope integration type Analog-to-digital converters provide__________________.
[A] higher speeds compared to all other types of A/D converters
[B] very good accuracy without putting extreme requirements on component stability
[C] good rejection of power supply hum
[D] better resolution compared to all other types of A/D converters for the same number of bits

101. The forbidden energy gap for silicon is
[A] 0.12eV
[B] 0.72eV
[C] 1.12eV
[D] 7.2eV

102. The fastest mode of data transfer from CPU to memory in a microprocessor is
[A] memory mapped I/O
[B] I/O mapped I/O
[C] interrupt driven I/O
[D] DMA

103. In a CRO which of the following is not a part of electron gun
[A] cathode
[B] grid
[C] accelerating anode
[D] X - Y plates

104. Assertion (A): Shunt of an ammeter has a low resistance.
Reason (R): Shunt may be connected in series or in parallel with ammeter.
[A] Both A and R are true and R is correct explanation of A
[B] Both A and R are true but R is not correct explanation of A
[C] A is true R is false
[D] A is false R is true

105. If an inductance L is connected in one arm of bridge and resistance R_1, R_2, R_3 in other three arms
[A] the bridge cannot be balanced
[B] the bridge can be balanced
[C] he bridge is balanced for some specified value of frequency
[D] the bridge is balanced for some specific values of R_1, R_2, R_3

106. Which of these has a magnetic brake?
[A] Thermocouple ammeter
[B] Energy meter
[C] Dynamometer wattmeter
[D] Frequency meter

107. The input impedance of CRO is about
[A] zero
[B] 10 Ω
[C] 100 Ω
[D] one mega ohm

108. The correct sequence of steps in the instruction cycle of a basic computer is
[A] Fetch, Execute, Decode and Read effective address
[B] Read effective address, Decode, Fetch and Execute
[C] Fetch, Decode, Read effective address and Execute
[D] Fetch, Read effective address, Decode and Execute

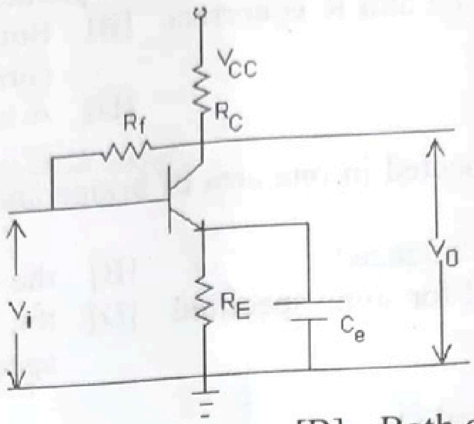
109. The difference between measured value and true value is called
[A] gross error
[B] relative error
[C] probable error
[D] absolute error

110. Noise generated in a resistor is also known as
[A] partition noise
[B] white noise
[C] thermal noise
[D] shot noise

Question numbers 111–130 carry 2 marks each:

111. The 3dB cutoff frequency of a d.c amplifier is 5 MHz. What is its rise time?
[A] 350 ns
[B] 200 ns
[C] 70 ns
[D] 35 ns

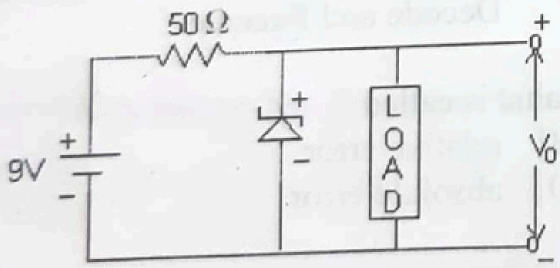
112. In the following circuit if feedback R_f resistor is removed what is its effect on I/P and O/P resistance



[A] Both increases
[B] Both decreases
[C] I/P increases and O/P decreases
[D] I/P decreases and O/P increases

113. For a given filter order, which one of the following type of filter has the least amount of ripple both in passband and stop band ?
[A] Chebyshev type I
[B] Bessel
[C] Chebyshev typeII
[D] Elliptic

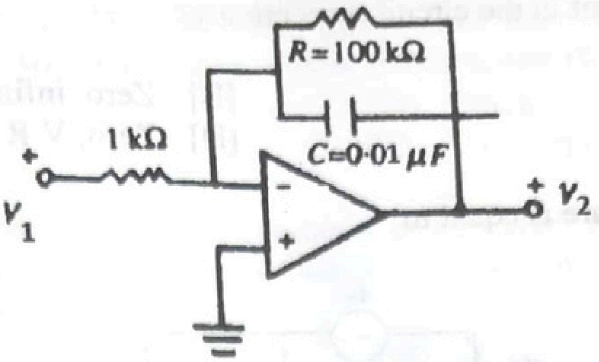
114. A zener diode in the circuit shown in the figure below has a knee current of 5 mA, and a maximum allowed power dissipation of 330 mW. What are the minimum and maximum load currents that can be drawn safely from the circuit, keeping the output voltage at 6V?



[A] 0 mA , 180 mA
[B] 5 mA , 110 mA
[C] 10 mA , 55 mA
[D] 60 mA , 180 mA

115. A second order bandpass active filter can be obtained by cascading a low pass second order section having cutoff frequency f_{OH} with a high pass second order section having cutoff frequency f_{OL} provided
[A] $f_{OH} > f_{OL}$
[B] $f_{OH} < f_{OL}$
[C] $f_{OH} = f_{OL}$
[D] $f_{OH} \leq \frac{1}{2} f_{OL}$

116. The low frequency gain of the low pass filter shown in the given figure is



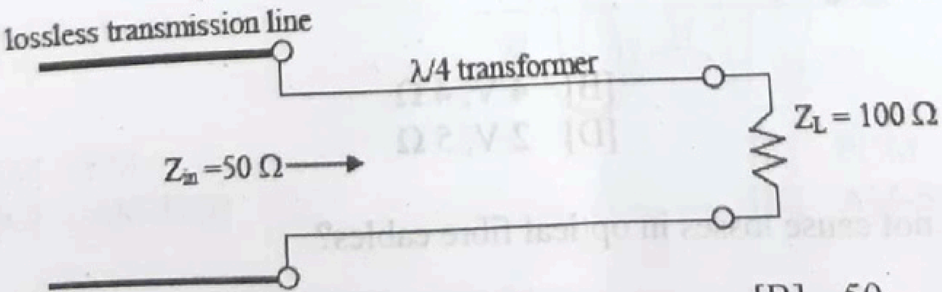
[A] 10 dB
[B] 20 dB
[C] 30 dB
[D] 40 dB

117. A dc power supply has a no load voltage of 30 V, and a full load voltage of 25 V at a full load current of 1A. Its output resistance and load regulation, respectively are
[A] 5 Ω and 20%
[B] 25 Ω and 20%
[C] 5 Ω and 16.7%
[D] 25 Ω and 16.7%

118. An opamp based inverting amplifier has a gain of 10 and a bandwidth of 100kHz. If the gain of the amplifier is reduced to unity , its bandwidth will changes to
[A] 10kHz
[B] 100kHz
[C] 1MHz
[D] 10MHz

119. A coil of inductance 2H and resistance 1 Ω is connected to a 10V battery with negligible internal resistance. The amount of energy stored in the magnetic field is
[A] 100
[B] 50
[C] 200
[D] 400

120. To maximize power transfer, a lossless transmission line is to be matched to a resistive load impedance via a λ/4 transformer as shown

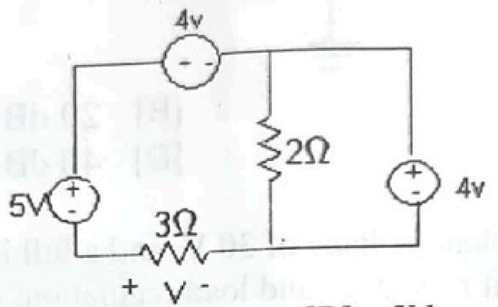


[A] 25
[B] 50
[C] 70.71
[D] 100

121. A series RLC circuit is switched on to a step voltage V at t=0. What are the initial and final values of the current in the circuit respectively?

[A] V/R, V/R
[B] Zero, infinity
[C] Zero, Zero
[D] Zero, V/R

122. The voltage V in the figure is equal to

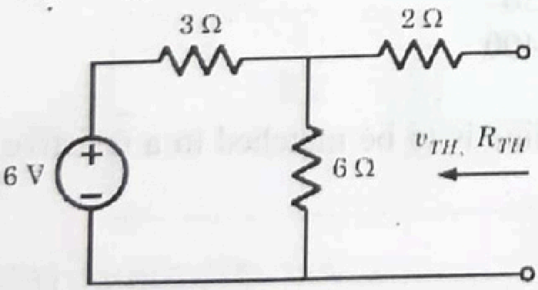


[A] 3V
[B] 5V
[C] - 3V
[D] None of these

123. A 20 m antenna gives a certain uplink gain at frequencies of 4/6 GHz. For getting same gain in the 20/30 GHz band, antenna size required is metre

[A] 100
[B] 4
[C] 1
[D] 10

124. v_{TH} , R_{TH} =?



[A] 2 V, 4 Ω
[B] 4 V, 4 Ω
[C] 4 V, 5Ω
[D] 2 V, 5 Ω

125. Which of the following does not cause losses in optical fibre cables?

[A] Stepped index operation
[B] Impurities
[C] Micro bending
[D] Attenuation in glass

PAPER CODE: 33

126. A diode detector has a load of $k\Omega$ shunted by a 10000 pF capacitor. The diode has a forward resistance of 1 Ω. The maximum permissible depth of modulation, so as to avoid diagonal clipping, with modulating signal frequency of 10 kHz will be

[A] 0.847
[B] 0.628
[C] 0.734
[D] None of these

127. Super heterodyne receiver uses an IF frequency of 455 kHz. The receiver is tuned to a transmitter having a carrier frequency of 2400 kHz. High-side tuning is to be used. The image frequency will be

[A] 2855 kHz
[B] 3310 kHz
[C] 1845 kHz
[D] 1490 kHz

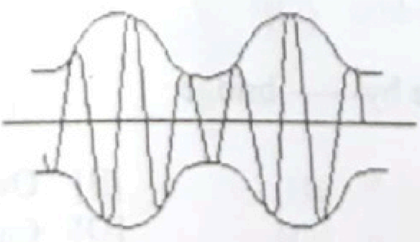
128. Four signals each band limited to 5 kHz are sampled at twice the Nyquist rate. The resulting PAM samples are transmitted over a single channel after time division multiplexing. The theoretical minimum transmissions bandwidth of the channel should be equal to.

[A] 5 kHz
[B] 20 kHz
[C] 40 kHz
[D] 80 kHz

129. Assertion (A): Free space does not interfere with normal radiation and propagation of radio waves.
Reason (R): Free space has no magnetic or gravitational fields

[A] Both A and R are correct and R is correct explanation of A
[B] Both A and R are correct but R is not correct explanation of A
[C] A is correct but R is wrong
[D] A is wrong but R is correct

130. Waveform shown in figure is that for



[A] FM
[B] PCM
[C] AM-DSB
[D] AM-SSB

-------------------ECE (CODE 33) Paper Ends ---------------------------

SECTION – D (Electrical Engineering)

[Candidate who has opted for EE (Code-34) in NEE - 2018]

Question numbers 81–110 carry 1 mark each:

81. The resistivity of the conductor depends on

[A] area of the conductor
[B] length of the conductor
[C] type of material
[D] none of these

82. To obtain a high value of capacitance, the permittivity of dielectric medium should be

[A] low
[B] Zero
[C] high
[D] Unity

83. Magnetic flux of 1 Weber = ... Maxwells

[A] 10^4
[B] 10^{-8}
[C] 10^8
[D] 10^{-4}

84. Which of the following represents ohms law?

[A] V = RI
[B] J = σE
[C] I = GV
[D] All of the above

85. Retentivity will be high in

[A] Soft iron
[B] Steel
[C] Air
[D] Copper

86. Mutual inductance is measure by------ bridge

[A] Hay's
[B] Owen's
[C] Anderson's
[D] Cambell's

87. As a result of reflection from a plane conducting wall, electromagnetic waves acquire an apparent velocity greater than the velocity of light in space. This is called the

[A] velocity of propagation
[B] normal velocity
[C] group velocity
[D] phase velocity

88. Two infinite parallel metal plates are charged with equal surface charge density of the same polarity. The electric field in the gap between the plates is

[A] same as that produced by one plate
[B] double the field produced by one plate
[C] dependent on coordinates of field points
[D] zero

89. Inside a hollow conducting sphere

[A] electric field is zero
[B] electric field is a non zero constant
[C] electric field changes with magnitude of the charge given to the conductor
[D] electric field changes with distance from the center of the sphere

90. Electric field intensity (E) at a point in an electric field is equal to

[A] potential gradient
[B] $(\text{potential gradient})^2$
[C] $(\text{potential gradient})^{1/2}$
[D] $(\text{potential gradient})^{1/3}$

91. If field current is decreased in shunt dc motor, the speed of the motor will

[A] remains same
[B] increase
[C] decrease
[D] none of the above

92. Insulation resistance can be measured by ------- method

[A] loss of charge
[B] voltmeter-ammeter
[C] Ohmmeter
[D] wheat-stone bridge

93. Eddy current loss will depends on

[A] frequency
[B] flux density
[C] thickness
[D] all of the above

94. Which method gives accurate measurement of low resistance?

[A] Potentiometer
[B] Ohmmeter
[C] Wheat-stone Bridge
[D] Voltmeter-Ammeter

95. The emf induced in the dc generator armature winding is

[A] AC
[B] DC
[C] AC and DC
[D] None of the above

96. Unit of retentivity is

[A] Dimension less
[B] Ampere turn
[C] Ampere turn/meter
[D] Ampere turn/Weber

97. For a given power factor of the load, if the load power factor decreases, it will draw ---------current from the supply

[A] less
[B] zero
[C] more
[D] same

98. The nature of current flowing in the armature of the DC machine is

[A] pulsating DC
[B] pure DC
[C] rectified DC
[D] alternating current

99. Dynamic braking is very effective for

[A] shunt motors
[B] separately excited motors
[C] series motors
[D] differential compound motors

100. In Ward Leonard control, the DC motor is

[A] series motor
[B] shunt motor
[C] compound motor
[D] separately excited motor

101. Which type of DC generator is used to charge the batteries?

[A] shunt generator
[B] long shunt compound generator
[C] series generator
[D] none of the above

102. Distribution transformers have core losses…………full load copper loss

[A] more than
[B] equal to
[C] less than
[D] negligible compared

103. When pure inductive load is connected to the alternator, what is the effect of armature reaction?

[A] cross magnetization
[B] demagnetization
[C] magnetization
[D] none of the above

104. In a DC Motor 3 point starter is used to

[A] provide protection against Low-Voltage
[B] provides overload protection
[C] limit the starting current to a safer value
[D] All of above

105. Transformer oil is used as

[A] an inert medium
[B] an insulation
[C] a coolant
[D] both [B] and [C]

106. For maximum starting torque in an induction motor

[A] $r_2 = x_2$
[B] $r_2 = 5x_2$
[C] $r_2 = 0.5x_2$
[D] $2r_2 = x_2$

107. Maximum power transfer capability of transmission line can be increased by

[A] parallel transmission lines
[B] using series capacitance
[C] using bundled conductors
[D] All of the above

108. Unit of deflection sensitivity of a CRO is

[A] V / mm
[B] meter / volt
[C] mm / mV
[D] mm / V

109. A reactance relay is

[A] Voltage restrained directional relay
[B] Directional restrained over current relay
[C] Voltage restrained over current relay
[D] None of these

110. Which statement is true for latching current?

[A] It is related to turn off process of the device
[B] It is related to conduction process of device.
[C] It is related to turn on process of the device
[D] Both [C] and [B]

Question numbers 111–130 carry 2 marks each:

111. Find the reactance voltage when current is changed from -2A to 2A in 4 sec and self inductance is 1H?

[A] 0 V
[B] 4 V
[C] 1 V
[D] 2 V

112. How much current is drawn by the primary of a transformer which steps down 220 V to 22 V to operate a device having an impedance of 220 Ω

[A] 1.01 A
[B] 1.1A
[C] 0.1 A
[D] 0.01 A

113. For flat voltage profile system, voltage regulation is

[A] 0%
[B] 100%
[C] 50%
[D] any of the above

114. Ferranti effect will not occur in which of the following transmission lines?

[A] Long transmission lines
[B] Short transmission lines
[C] Medium transmission lines
[D] All of the above

115. A galvanometer with a full scale current of 10 mA has a resistance of 1000 Ω. The multiplying power (the ratio of measured current to galvanometer current) of 100 Ω shunt with this galvanometer is

[A] 110
[B] 100
[C] 11
[D] 10

116. The measured value of a resistance is 10.25 ohm, whereas its value of 10.22 ohm. What is absolute error of the measurement?

[A] 0.01 ohm
[B] 0.03 ohm
[C] 15.36 ohm
[D] 10.26 ohm

117. If two meters X and Y require 40 mA and 50 mA, respectively to give full scale deflection, then

[A] Y is more sensitive
[B] X is more sensitive
[C] both X and Y are equally sensitive
[D] it would not be possible to asses then sensitivity on the basis of the given data

118. A moving coil ammeter has a uniform scale with 50 division and gives a full scale reading 10 A. The instrument can read up to $(1/5)^{th}$ of a scale division with a fair degree of certainty. What is the resolution of the instrument in mA?

[A] 25 mA
[B] 40 mA
[C] 50 mA
[D] 80 mA

119. A 0 - 100 V voltmeter has a guaranteed accuracy of 2 % of full scale reading. The voltage measured by the voltmeter is 75 V. The limiting error in percentage is

[A] 3.33 %
[B] 2.66 %
[C] 2 %
[D] 1 %

120. An SCR has half cycle surge current rating of 3000 A for 50 Hz supply. One cycle surge current will be

[A] 1500 A
[B] 6000 A
[C] 2121.32 A
[D] 4242.64 A

121. A shunt DC generator has an induced voltage of 200 V, and field and armature resistances are 100 Ω and 0.1 Ω respectively. The terminal voltage is 180 V. The load current will be

[A] 200 A
[B] 198.2 A
[C] 118.2 A
[D] 129.8 A

122. A step up chopper has input voltage 110 V and output voltage 150 V. The value of duty cycle is

[A] 0.32
[B] 0.67
[C] 0.45
[D] 0.27

123. A 3Φ, 50 Hz, 6 pole cage motor is running with a slip of 3%. The frequency of emf induced in the rotor will be

[A] 1.5 Hz
[B] 1.25 Hz
[C] 51.25 Hz
[D] 51.5 Hz

124. What will be the total flux emitted by a source of 60 candle power?

[A] 754.2 lumens
[B] 0.001326 lumens
[C] 60 lumens
[D] None of these

125. The full scale deflection torque of a 20 A MI type ammeter is 6×10^{-5} Nm. The rate of change of self-inductance of the instrument is

[A] 0.3 μH/rad
[B] 0.35 μH/rad
[C] 0.33 μH/rad
[D] 0.4 μH/rad

126. For a 6-pole, three-phase induction motor, fed from a 400V, 50Hz supply, the rated speed is 970rpm. If the supply is changed to 320V, 40Hz, find the rated speed in rpm (slip is assumed to be constant).

[A] 776
[B] 800
[C] 784
[D] 768

127. The speed of the salient pole rotor of a synchronous generator, used in hydro power plants is 200rpm. The number of poles required when its output frequency is 50Hz is

[A] 30
[B] 48
[C] 24
[D] 40

128. A conductor of length 1 m moves at right angles to the magnetic field of flux density of 2 wb/m^2 with a velocity of 5 m/s. The induced emf in the conductor will be

[A] 20 V
[B] 10 V
[C] 2 V
[D] 40 V

129. The efficiency of a three-phase induction motor at full load, fed from a 50Hz supply, is in the range of

[A] 97%
[B] 70%
[C] 90%
[D] 85%

130. A 25 kVA, 3300/400 V transformer has a primary current of

[A] 6.25 A
[B] 7.98 A
[C] 9.72 A
[D] 7.58 A

--------------------EE (CODE 34) Paper Ends --------------------

SECTION – A (Physics)

Questions 1–25 carry 1 mark each :

1. Which of the following is a derived quantity?

[A] Mass
[B] Thermodynamic temperature
[C] Luminous intensity
[D] Surface tension

2. Which of the following is a dimensionless constant?

[A] Gravitational constant
[B] Planck constant
[C] Dielectric constant
[D] Universal gas constant

3. 'n' number of bullets per second eject from a machine gun. Mass of each bullet is m kg and velocity is v m/s. The force acting on the machine gun, in Newtons, is

[A] Mnv [B] mn/v
[C] Mn [D] mv/n

4. When a particle rotates in a circular path, its acceleration

[A] Remains constant
[B] Does not remain constant
[C] Magnitude remains constant but direction changes
[D] Direction remains constant but magnitude changes

5. Escape velocity of earth is v_e. If mass and radius of a planet is twice that of the earth, the escape velocity of the planet will be

[A] v_e [B] $2v_e$
[C] $4v_e$ [D] $16v_e$

6. Which of the followings is more elastic?

[A] Rubber [B] Glass
[C] Steel [D] Copper

7. The dimension of modulus of elasticity is

[A] ML^2T^{-2} [B] $ML^{-1}T^{-2}$
[C] MLT^{-2} [D] $ML^{-1}T^{-1}$

8. A body just floats in a liquid. Their densities are equal. If the body be pressed slightly downward then the body will

[A] Oscillates up and down N/m^2
[B] Sink
[C] Come to the previous position quickly
[D] Come to the previous position slowly

9. According to Newton's law, viscous force depends on

[A] Directly proportional to the area of cross section of two liquid layers.
[B] Inversely proportional to the area of cross section of two liquid layers.
[C] Directly proportional to square of the area of cross section.
[D] None of these.

10. The spherical shape of a rain drop is due to

[A] Density of water [B] Surface tension
[C] Atmospheric pressure [D] Gravity

11. The kinetic energy of a body of mass 1 kg is 12.5 kg m^2/s^2. Its momentum in units of kg-m/s is

[A] 25 [B] 5
[C] 0 [D] 12.5

12. Two holes are made in a copper plate. The plate is heated. The distance between the holes
[A] Remains unchanged [B] Increases
[C] Decreases [D] None of these.

13. The ratio of lengths of two iron rods is 1:2 and that of their cross-sectional areas is 2:3. Due to equal increase in temperature. the ratio of their volume expansions is
[A] 1:2 [B] 1:3
[C] 2:3 [D] 1:6

14. If H amount of heat required to increase the m gm of substance by t° C then
[A] $t \alpha$ Mh [B] $t \alpha$ H/m
[C] $t \alpha$ m/H [D] $t \alpha$ 1/mH

15. Specific heat of copper is 0.1 calgm^{-1} °C^{-1}. The water equivalent of 0.4 kg of copper calorimeter
[A] 40 gm [B] 4000 gm
[C] 200 gm [D] 4 gm

16. In which process the P-V diagram is a straight line parallel to volume axis?
[A] Isothermal [B] Isobaric
[C] Irreversible [D] Adiabatic

17. The period of oscillation of a simple pendulum of constant length at earth's surface is T. Its period inside the mine is
[A] Greater than T [B] Less than T
[C] Equal to T [D] Cannot be compared

18. Doppler effect is applicable to
[A] Sound only [B] Light only
[C] Both sound and light [D] None of these

19. Velocity of longitudinal wave in a string is
[A] $\sqrt{(Y/\rho)}$ [B] $\sqrt{(2Y/\rho)}$
[C] $\sqrt{(3Y/\rho)}$ [D] 0
Where, Y is the Young's modulus and ρ is the density of the material respectively.

20. The speed of sound will be greatest in
[A] Air [B] Vacuum
[C] Water [D] Metal

21. Which of the following characteristics of sound is affected by the change in temperature?
[A] Wave length [B] Amplitude
[C] Intensity [D] Frequency

22. For interference, the interfering beams must be
[A] Spatially coherent only
[B] Temporally coherent only
[C] Both spatially and temporally coherent
[D] None of these.

23. The differential form of Faraday's law of electromagnetic induction is
[A] $\nabla \times \mathbf{B} = -\partial \mathbf{E}/\partial t$ [B] $\nabla \times \mathbf{B} = \mu_0 \mathbf{J}$
[C] $\nabla \times \mathbf{E} = -\partial \mathbf{B}/\partial t$ [D] $\nabla \times \mathbf{B} = -\partial^2 \mathbf{E}/\partial t^2$
Where symbols have their usual meanings.

24. Does a charge at rest establish a magnetic field?
[A] Yes [B] No
[C] Cannot be concluded [D] None of these

25. The direction of induced e. m. f. in a circuit is given by
[A] Faraday's law [B] Lenz's law
[C] Ampere's law [D] Gauss's law

SECTION – B (Chemistry)

Questions 26–50 carry 1 mark each :

26. Stains of Iron rust on clothes can be removed by

[A] Petrol [B] Oxalic acid

[C] H_2O_2 [D] Alcohol

27. The components present in producer gas are

[A] $CO + N_2$ [B] $CO + H_2$

[C] $CO_2 + H_2$ [D] $CO + NO_2$

28. Heating of rubber with sulphur is known as

[A] Sulphonation [B] Galvanization

[C] Vulcanization [D] Bessemerisation

29. $LiAlH_4$ converts acetic acid into

[A] Acetaldehyde [B] Methane

[C] Methyl alcohol [D] Ethyl alcohol

30. The addition of the Grignard reagent to acetaldehyde is a nucleophilic addition to the carbonyl group. The nucleophile in this reaction is

[A] $:CH3^-$ [B] CH_3^+

[C] Br [D] CH_3CHO

31. Choose the correct IUPAC name for

$$\begin{array}{l} CH_3-CH-CHO \\ \quad\quad\;\; | \\ \quad\;\; CH_2CH_3 \end{array}$$

[A] Butan 2-aldehyde [B] 2-methyl butanal

[C] 3-methyl iso butyraldehyde [D] 2-ethyl propanal

32. Gold number is a measure of the

[A] Protective action by a lyophilic colloid on a lyophobic colloid

[B] Protective action of a lyophobic colloid on a lyophilic colloid

[C] Number of mg of gold in a standard red gold solution

[D] Stability of gold solution

33. Hydrolysis of Ester in alkaline medium is

[A] First order reaction with molecularity one

[B] Second order reaction with molecularity two

[C] First order reaction with molecularity two

[D] Second order reaction with molecularity one

34. On the basis of Le-Chatelier's principle, predict which of the following conditions is unfavourable for formation of SO_3? Given that $2SO_2 + O_2 = 2SO_3$; $\Delta H = -42$ kcal

[A] Low temperature [B] High pressure

[C] High temperature [D] High concentration of SO_2

35. Which one is true

[A] $Kp = Kc\,(RT)^{\Delta n}$ [B] $Kc = Kp(RT)^{\Delta n}$

[C] $Kc/RT = (Kp)^{\Delta n}$ [D] $Kp/RT = (Kc)^{\Delta n}$

36. The normality of a solution of NaOH, 100 ml of which contains 4 g of NaOH, is

[A] 0.1 [B] 1.0

[C] 4.0 [D] 0.4

37. In a face centered cubic cell, an atom at the face centre is shared by

[A] 4 unit cells [B] 2 unit cells

[C] 1 unit cell [D] 6 unit cells

38. Which of the followings is an insulator?

[A] Graphite [B] Silicon

[C] Diamond [D] Aluminium

39. The relationship which describes the variation of vapour pressure with temperature is called
[A] Hess law [B] Arrhenius equation
[C] Kirchoff's law [D] Claussius Clapeyron equation

40. Solubility product of A_2B is $4x10^{-9}$ $(moles/lit)^3$ Its solubility is
[A] $10^{[illegible]}$ M [B] $4^{[illegible]} x10^{[illegible]}$ M
[C] $10^{[illegible]}$ M [D] $2 x10^{[illegible]}$ M

41. Volume of 4.4 g of CO_2 at N.T.P is
[A] 22.4 L [B] 2.24 L
[C] 224 L [D] 44.8 L

42. For the adsorption of a gas on a solid, the plot of log x/m versus log p is linear with slope equal to
[A] k [B] Log k
[C] n [D] 1/n

43. The slag obtained during the extraction of copper pyrites is mainly composed of
[A] Cu_2S [B] $FeSiO_3$
[C] $CuSiO_3$ [D] SiO_2

44. Gun metal is an alloy of
[A] Mg, Sn, Zn [B] Cu, Ni, Zn
[C] Cu, Sn, Zn [D] Cu, Sb, Zn, Pb

45. The first order reaction has specific rate constant of 2 min^{-1}. The half life of the reaction will be
[A] 1.653 min [B] 0.347 min
[C] 2.0 min [D] 0.0347 min

46. The calorific value of Coal gas is
[A] 2700 $KCal/m^3$ [B] 4500 to 5900 $KCal/m^3$
[C] 1800 $KCal/m^3$ [D] 900 $KCal/m^3$

47. Sulphonation of benzoic acid gives
[A] o-benzene sulphonic acid
[B] m-benzene sulphonic acid
[C] p-benzene sulphonic acid
[D] o & p-benzene sulphonic acid

48. Lead pipes are readily corroded by
[A] Water [B] Concentrated H_2SO_4
[C] Acetic acid [D] Dilute H_2SO_4

49. Tear gas is
[A] chloropicrin [B] Methylene chloride
[C] chloretone [D] Methyl chloride

50. The bond orders in O_2^+ and O_2^- respectively are
[A] 2.5 & 1.5 [B] 1.5 & 2.5
[C] 2 & 1.5 [D] 3 & 2

SECTION – C (Mathematics)

Questions 51–80 carry 1 mark each :

51. A multiple choice test consists of 8 questions with 3 answer options for each question of which only one is correct. A student answers each question by rolling an unbiased dice checking the first answer if he gets 1 or 2, the second answer if he gets 3 or 4 and the third answer if he gets 5 or 6. To get a distinction, the student must secure at least 75% correct answers. If there is no negative marking, the probability that the student secures a distinction is
[A] $\frac{1}{3^6}\left(\frac{43}{3}\right)$ [B] $\frac{1}{3^6}\left(\frac{169}{9}\right)$
[C] $\frac{1}{4^6}\left(\frac{43}{3}\right)$ [D] $\frac{1}{4^6}\left(\frac{169}{9}\right)$

52. Let A = {1, 3, 5, 7, 9} and B = {2, 4, 6, 8}. If the Cartesian product A X B, chosen randomly, the probability of a + b = 9 is (where A X B = {(a, b) : a ∈ A and b ∈ B})

[A] ¼ [B] 1/5

[C] 1 [D] 0

53. $Sec^2\theta = \frac{4xy}{(x+y)^2}$ is true if and only if

[A] $x+y \neq 0$ [B] $x = y,\ x \neq 0$

[C] $x = y$ [D] $x \neq 0, y \neq 0$

54. If $\tan^{-1}\frac{x-1}{x-2} + \tan^{-1}\frac{x+1}{x+2} = \frac{\pi}{4}$, then

[A] $x = \pm\frac{1}{\sqrt{2}}$ [B] $x = \pm\frac{1}{\sqrt{3}}$

[C] $x = \pm 1$ [D] $x = \sqrt{3}$

55. If $Sin^{-1}\frac{x}{5} + Cosec^{-1}\frac{5}{4} = \frac{\pi}{2}$, then a value of x is

[A] 1 [B] 3

[C] 4 [D] 5

56. Solution of the simultaneous equations $x - y + z = 0,\ 2x + 3y - 5z = 7$ and $3x - 4y - 2z = -1$ is

[A] $x = 11/7,\ y = 21/14,\ z = 1/7$

[B] $x = 11/9,\ y = 0,\ z = -11/9$

[C] $x = 11/8,\ y = 21/16,\ z = -1/16$

[D] None of these

57. Consider the system of equations $2x - y - 2z = 2,\ x - 2y + z = -4$ and $x + y + kz = 4$. What is the value of k for no solution of the system of equations ?

[A] 1 [B] 2

[C] 3 [D] −3

58. The real number x, when added to its inverse, gives the minimum value of sum at x equal to

[A] 2 [B] 1

[C] −1 [D] −2

59. The sum of the divisors of 360 is

[A] 1170 [B] 1440

[C] 650 [D] 870

60. Highest power of 3 contained in 1001 is

[A] 64 [B] 48

[C] 50 [D] 46

61. The probability of Krishna will be alive for 10 years hence is 7/15 and that for Hari is 7/10. The probability that both Krishna and Hari will die 10 years hence is

[A] 4/25 [B] 7/50

[C] 49/150 [D] 28/75

62. If $x^2 + y^2 = 1$, then

[A] $yy' - 2(y')^2 + 1 = 0$ [B] $yy' + (y')^2 + 1 = 0$

[C] $yy' - (y')^2 - 1 = 0$ [D] $yy' + 2(y')^2 + 1 = 0$

63. A gardener having 120 m long fencing wishes to enclose a rectangular plot of land of greatest area and also to erect a fence using the available fencing materials across the land parallel to two of its sides. The maximum area he can enclose is

[A] 850 m^2 [B] 500 m^2

[C] 600 m^2 [D] 900 m^2

64. The radius of curvature of $y = 4\sin x - \sin 2x$ at $x = \pi/2$ is

[A] $\frac{5\sqrt{5}}{4}$ [B] $\frac{5\sqrt[3]{5}}{4}$

[C] $\frac{37\sqrt{37}}{4}$ [D] $\frac{37\sqrt[3]{37}}{4}$

65. If $u = \frac{y}{z} + \frac{z}{x} + \frac{x}{y}$, then

$x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y} + z\frac{\partial u}{\partial z} = ?$

[A] 0   [B] $(x+y+z)^2$

[C] $\frac{3}{x+y+z}$ [D] None of these

66. The coordinates of the points on the curve $y = x^2 + 3x + 4$, the tangent at which passes through the origin, are

[A] (2, 14) ; (−2, 2)   [B] (2, 14) ; (−2, −2)

[C] (2, 14) ; (2, 2)   [D] None of these

67. The two curves $x^3 - 3xy^2 + 2 = 0$ and $3x^2y - y^3 - 2 = 0$, intersect at an angle of

[A] 45^0 [B] 60^0

[C] 90^0 [D] 30^0

68. If n be a positive integer greater than 1, and if $A = n^n, B = 1.3.5..........(2n-1)$, then the relation between A and B is

[A] A = B   [B] A > B

[C] A < B   [D] None of these

69. How many three digit odd numbers can be formed using the digits 1, 2, 3, 4, 5, and 6, when repetition of digits are allowed ?

[A] 648   [B] 120

[C] 108   [D] 216

70. $1 + \frac{4}{5} + \frac{7}{5^2} + \frac{10}{5^3} + ...$ to infinity is

[A] 16/35   [B] 11/8

[C] 35/16   [D] 7/16

71. If $a^x = b^y = c^z$ and a, b, c are in G.P., then x, y, z are in

[A] A. P.   [B] G. P.

[C] H. P.   [D] None of these

72. If $(1+x)^n = C_0 + C_1x + C_2x^2 + ... + C_nx^n$, then $C_0^2 + C_1^2 + C_2^2 + ... C_n^2$ is equal to

[A] $\frac{(2n)!}{n!n!}$ [B] $\frac{(2n)!}{2(n!)^2}$

[C] 2^n [D] 2^{2n-2}

73. A straight line is parallel to $2x + 3y + 11 = 0$ and that the sum of the intercepts on the axes is 15. The equation of the line is

[A] $2x + 3y - 18 = 0$ [B] $2x - 3y - 18 = 0$

[C] $2x + 3y + 18 = 0$ [D] $2x - 3y + 18 = 0$

74. The equation of the bisector of the obtuse angle between the straight lines $4x + 3y - 11 = 0$ and $4x + 12y + 9 = 0$ is

[A] $9x - 7y - 41 = 0$ [B] $7x + 9y - 3 = 0$

[C] $9x + 7y + 3 = 0$ [D] None of these

75. $\int \frac{x^2+1}{x^4+1}dx$ is equal to

[A] $\frac{1}{\sqrt{2}}\tan^{-1}\left(\frac{x^2}{\sqrt{2}\,x}\right)+C$

[B] $\frac{1}{\sqrt{2}}\tan^{-1}\left(\frac{x^2-1}{\sqrt{2}\,x}\right)+C$

[C] $\frac{1}{\sqrt{2}}\tan^{-1}\left(\frac{x^2+1}{x}\right)+C$

[D] $\tan^{-1}\left(\frac{x^2-1}{\sqrt{2}\,x}\right)+C$

76. $\int_0^{\pi/4} \frac{\sin^2 x \cos^2 x}{(\sin^3 x+\cos^3 x)^2}\,dx$ is equal to

[A] 1/6 [B] 1/12

[C] ¼ [D] None of these

77. $\int_0^{\pi/2} \log(\sin x)dx$ is equal to

[A] $\frac{\pi}{2}\log 2$ [B] $\frac{\pi}{2}\log\frac{1}{2}$

[C] $\log 2$ [D] $\frac{\pi}{4}\log\frac{1}{2}$

78. The equation of the curve whose slope is $\frac{dy}{dx}=\frac{2y}{x}, x>0, y>0$ and passes through the point (1, 1) is

[A] $x^2=y$ [B] $y^2=x$

[C] $x^2=2y$ [D] $y^2=2x$

79. The equation of the plane through the points (1, 1, 0), (−2, 2, −1) and (1, 2, 1) is

[A] $2x+3y+3z=5$ [B] $2x-3y+3z=5$

[C] $2x+3y-3z=3$ [D] $2x+3y-3z=5$

80. If 'r' is an integer, then $r(r^2-1)(3r+2)$ is divisible by

[A] 21 [B] 24

[C] 48 [D] 14

SECTION – D (Civil Engineering)

Questions 81 – 110 carry 1 mark each :

81. Shear stress on principal planes is

[A] zero [B] maximum

[C] minimum [D] None of these

82. The variation of bending moment in the portion of a beam carrying linearly varying load is

[A] linear [B] Parabolic

[C] cubic [D] Constant

83. The ratio of intensity of stress in case of a suddenly applied load to that in case of a gradually applied load is

[A] 1/2 [B] 1

[C] 2 [D] More than 2

84. Castigliano's first theorm is applicable

[A] for statistically determinate structures only

[B] when the system behaves elastically

[C] only when principle of superposition is valid

[D] none of the above

85. The factor of safety for

[A] steel and concrete are same

[B] steel is lower than concrete

[C] steel is higher than concrete

[D] none of the above

86. Lap length in compression shall not be less than
[A] 15 F [B] 20 F
[C] 24 F [D] 30 F

87. Minimum pitch of transverse reinforcement in a column is
[A] the least lateral dimension of the member
[B] 16 times the smallest diameter of longitudinal reinforcement bar to be tied
[C] 48 times the diameter of transverse reinforcement
[D] lesser of the above

88. A metallic tape is made of
[A] steel [B] invar
[C] linen [D] cloth and wires

89. The correction for sag is
[A] always additive
[B] always subtractive
[C] always zero
[D] sometimes additive and sometimes subtractive

90. Local attraction in compass surveying may exist due to
[A] incorrect leveling of the magnetic needle
[B] loss of magnetism of the needle
[C] friction of the needle at the pivot
[D] presence of magnetic substances near the instrument

91. The following sights are taken on a turning point
[A] foresight only [B] backsight only
[C] foresight and backsight [D] foresight and intermediate sight

92. The type of valve, which is provided on the suction pipe in a tube well is
[A] air relief valve [B] reflux valve
[C] pressure relief valve [D] sluice valve

93. The most common cause of acidity in water is
[A] carbon dioxide [B] Oxygen
[C] hydrogen [D] Nitrogen

94. The dissolved oxygen level in natural unpolluted water at normal temperature is found to be the order of
[A] 1 mg/l [B] 10 mg/l
[C] 100 mg/l [D] 1000 mg/l

95. For country like India, where rainfall is mainly confined to one season, the suitable sewerage system will be
[A] separate system [B] combined system
[C] partially combined system [D] partially separate system

96. A soil has a bulk density of 22 kN/m^3 and water content 10 %. The dry density of the soil is
[A] 18.6 kN/m^3 [B] 20 kN/m^3
[C] 22 kN/m^3 [D] 23.2 kN/m^3

97. According to IS classification, the range of silt size particle is
[A] 4.75 mm to 2.00 mm
[B] 2.00 mm to 0.425 mm
[C] 0.425 mm to 0.075 mm
[D] 0.075 mm to 0.002 mm

98. The process by which the mass of saturated soil is caused by external forces to suddenly

lose its shear strength and to behave as a fluid is called

[A] piping [B] slide
[C] quick condition [D] liquifaction

99. A soil having particles of nearly same size is known as

[A] well graded [B] uniformly graded
[C] poorly graded [D] gap graded

100. Fish plate is in contact with rail at

[A] web of rail [B] fishing plane
[C] head of rail [D] foot of rail

101. The compensation for curvature on gradient for meter gauge is given by

[A] 70/R [B] 52.5/R
[C] 35/R [D] 105/R

Where R is the radius of the curve

102. An ideal fluid has

[A] zero surface tension and is incompressible
[B] zero shear stress and behaves as a perfect gas
[C] constant density and viscosity
[D] zero viscosity and is incompressible

103. Local atmospheric pressure is measured by

[A] hydrometer [B] barometer
[C] hygrometer [D] altimeter

104. The total head in a flow is the sum of

[A] piezometric head and datum head
[B] piezometric head and pressure head
[C] piezometric head and velocity head
[D] piezometric head, velocity head and datum head

105. The minimum pitch of the rivets shall not be less than

[A] 1.5d [B] 2.0 d
[C] 2.5d [D] 3.0 d

106. If the permeability of the soil is 0.08 cm/sec, the type of soil is

[A] gravel [B] sand
[C] silt [D] clay

107. The maximum permissible limit for fluoride in drinking water is

[A] 0.1 mg/L [B] 1.5 mg/L
[C] 5 mg/L [D] 10 mg/L

108. Theodolite is an instrument used for

[A] tightening the capstan headed nuts of level tube
[B] measurement of horizontal angle
[C] measurement of vertical angles
[D] measurement of horizontal and vertical angles

109. Different grades are joined together by a

[A] compound curve [B] vertical curve
[C] reverse curve [D] transition curve

110. When the path travelled along the road surface is more than the circumferential movement of wheels due to rotation, then it results in

[A] Skipping [B] skidding
[C] turning [D] revolving

Questions 111 – 130 carry 2 marks each :

111. If the length of a simply supported beam carrying a concentrated load at the center is

doubled, the deflection at the center will become

[A] two times [B] four times
[C] eight times [D] sixteen times

112 Method of joints is applicable only when the number of unknown forces at the joint under consideration is not more than

[A] one [B] two
[C] three [D] four

113. Strain energy stored in a member is given by

[A] 0.5 x stress x volume
[B] 0.5 x strain x volume
[C] 0.5 x stress x strain x volume
[D] 0.5 x stress x strain

114. If a beam fails in bond, then its bond strength can be increased most economically by

[A] increasing the depth of beam
[B] using thinner bars but more in number
[C] using thicker bars but less in number
[D] providing vertical stirrups

115. Maximum percentage of reinforcement in case of slabs is limited to

[A] 2 [B] 4
[C] 6 [D] 8

116. According to Indian Standards, the minimum 7 days compressive strengths of ordinary portland cement and portland pozzolana cement in N/mm^2

[A] 15.5 and 15.5 [B] 21.5 and 15.5
[C] 15.5 and 21.5 [D] 21.5 and 21.5

117. If the forebearing of the line AB is 35^0 and that of the line BC is 15^0, then the included angle between the lines is

[A] 20^0 [B] 50^0
[C] 160^0 [D] 230^0

118. The sensitivity of a bubble tube can be increased by

[A] increasing the diameter of the tube
[B] decreasing the length of the tube
[C] increasing the viscosity of the liquid
[D] decreasing the radius of curvature of the tube

119. The following consecutive readings were taken with dumpy level and a 3 m staff on a continuously sloping ground.
0.425, 1.035, 1.950, 2.360, 2.950, 0.750, 1.565, 2.450, 0.320, 1.025, 2.165, 2.955.
Which of the following readings are backsights ?

[A] 0.425, 2.950, 0.750, 0.320
[B] 0.425, 0.750, 0.320, 2.955
[C] 0.425, 0,750, 0.320
[D] 0.425, 2.360, 0.750, 0.320

120. The self-cleaning velocity for all sewers in India is usually

[A] less than 1.0 m/s [B] 1.0 m/s to 1.2 m/s
[C] 1.5 m/s to 2 m/s [D] 3.0 m/s to 3.5 m/s

121. A city supply 0f 1500 cubic meters of water per day is treated with a chlorine dose of 0.5 ppm. For this purpose, the requirement of 25 % bleaching powder per day would be

[A] 300 kg [B] 75 kg
[C] 30 kg [D] 7.5 kg

PAPER SET :

PAPER CODE : 31

122. Under natural conditions of flow, an unpolluted river would contain

[A] more dissolved oxygen in summer than in winter

[B] less dissolved oxygen in summer than in winter

[C] more or less the same amount of dissolved oxygen in summer than in winter

[D] the least amount of dissolved oxygen during floods

123. For a given soil sample C_c is the coefficient of gradation, C_u coefficient of uniformity, D_{10} is the effective size and D_{30} is the diameter through which 30 % of the total soil mass is passing. If C_c=1.0 C_u=4.0 then the value of D_{30}/D_{10} would be

[A] 2.0 [B] 1.75

[C] 1.50 [D] 1.25

124. For a broad gauge route with M+7 sleeper density, number of sleeper per rail length is

[A] 18 [B] 19

[C] 20 [D] 21

125. The maximum width of the vehicle as recommended by IRC is

[A] 1.85 m [B] 2.44 m

[C] 3.81 m [D] 4.72 m

126. The standard sea level atmospheric pressure in kilopascals is

[A] 133.105 [B] 103.305

[C] 101.425 [D] 760

127. Slenderless ratio of a 5 m long column hinged at both ends and having a circular cross section with diameter 16 cm is

[A] 31.25 [B] 62.5

[C] 100 [D] 125

128. A 6 h unit hydrograph of a catchment is triangular in shape with base width of 75 h and a peak discharge of 12 m^3/s. The unit hydrograph refers to a catchment of area, in km^2

[A] 65 [B] 162

[C] 320 [D] 1800

129. Size of a right angled fillet weld is given by

[A] 0.707 times throat thickness

[B] 1.414 times throat thickness (0.414)

[C] 2.0 times throat thickness

[D] throat thickness

130. The coefficient of active earth pressure for a loose sand having an angle of internal friction of 30^0 is

[A] 1/3 [B] 3

[C] 1 [D] 1/2

------ *End of Questions* -----

PAPER SET: 15/III/30–35/A

SECTION – A (PHYSICS)

[Section A is compulsory for all the candidates]

Question numbers 1–25 carry 1 mark each :

1. Dimensions of Boltzmann constant are same as that of
   [A] Pressure density [B] Stefan's constant
   [C] Planck's constant [D] Entropy

2. A ball thrown up is caught by the thrower 6 s after start. The height to which the ball has risen is ($g = 10\ ms^{-2}$)
   [A] 10 m [B] 30 m
   [C] 45 m [D] 90 m

3. The dimensions of gravitational constant G are
   [A] $[MLT^{-2}]$ [B] $[ML^{3}T^{-2}]$
   [C] $[M^{-1}L^{3}T^{-2}]$ [D] $[M^{-1}LT^{-2}]$

4. What is the angle between vectors A = i+j+k and B = i
   [A] 0° [B] $\pi/6$
   [C] $\pi/6$ [D] none of the above

5. A bullet of mass 10 g is fired from a gun of mass 1 kg with recoil velocity of gun = 5 m/s. The muzzle velocity will be
   [A] 30 km/m [B] 60 km/m
   [C] 30 m/s [D] 500 m/s

6. If earth suddenly shrinks to half of its present radius, the acceleration due to gravity will be
   [A] 4g [B] 2g
   [C] g/2 [D] g/4

7. Two soap bubbles have radii in the ratio of 2:1. What is the ratio of excess pressure inside them?
   [A] 1:2 [B] 1:4
   [C] 2:1 [D] 4:1

8. Avalanche breakdown is primarily dependent on the phenomenon of
   [A] Doping of charge carriers [B] Collision
   [C] Ionization [D] Recombination of charge carriers

The best instrument for the measurement of emf of a cell is
   [A] Meter bridge [B] Voltmeter
   [C] Potentiometer [D] Ammeter

10.

10. The kilo-calorie is a unit of

[A] Temperature. [B] Heat.
[C] Power. [D] Pressure.

11. At a given temperature, velocity of sound in oxygen and hydrogen has the ratio

[A] 4:1 [B] 1:4
[C] 1:1 [D] 2:1

12. A uniform magnetic field acts at right angle to the direction of motion of electron. As a result of this, the electron describes a circular path of radius 2 cm. If the speed of electron is doubled, the radius of circular path will become

[A] 4 cm [B] 2 cm
[C] 1 cm [D] 8 cm

13. 1 J is equal to

[A] A^{-1} V s [B] AV s^{-1}
[C] AV^{-1} s [D] AV s

14. In an eye piece, field lens and eye lens have focal length 7.5 cm and 7.3 cm. To eliminate spherical aberration, distance between them should be

[A] 0.2 cm [B] 0.4 cm
[C] 0.1 cm [D] 0.5 cm

15. 1 Tesla is equal to

[A] $NA^{-1}m$ [B] $NA^{-1}m^{-1}$
[C] Nam [D] Nam^{-1}

16. The ratio of the speed of a body to the speed of sound is called

[A] Refractive index [B] Sonic index
[C] Mach number [D] Doppler ratio

17. Which of the following rays can pass through 20 cm thick steel sheet?

[A] γ-rays [B] x-rays
[C] α-particles [D] ultra-violet rays

18. An ideal voltmeter has

[A] Zero resistance [B] Finite resistance
[C] Variable resistance [D] Infinite resistance

19. A wheel is rotating at 900 rpm about the axis. When the power is cut off it comes to rest in 1 min. The angular retardation in rad s^{-1} is

[A] $\pi/2$ [B] $\pi/6$
[C] $\pi/4$ [D] $\pi/8$

20. An electronic equipment operating at 240 V has a resistance R = 120 Ω. Then the power P =

[A] 400 W
[B] 2 W
[C] 480 W
[D] 240 W

21. An object attached to one end of a spring makes 20 complete oscillations in 10 s. Its time period (T) is:

[A] 10 s
[B] 5 s
[C] 2 s
[D] 0.5 s

22. Two thin lenses of focal lengths f_1 and f_2 are in contact with each other. Then their equivalent focal length is:

[A] $1/f_1 - 1/f_2$
[B] $f_1f_2/(f_1 - f_2)$
[C] $f_1 - f_2$
[D] $f_1 + f_2$

23. The reverse saturation current in a p-n junction is due to flow of:

[A] Majority carriers
[B] Both majority and minority carriers
[C] Minority carriers
[D] Impurity ions

24. An ice skater with rotational inertia I_0 is spinning with angular speed ω_0. When ice skater pulls her arms in, thereby increasing her angular speed to $4\omega_0$ then the rotational inertia is:

[A] $I_0/2$
[B] $2I_0$
[C] I_0
[D] $I_0/4$

25. In simple harmonic motion, the magnitude of the acceleration is:

[A] Inversely proportional to the displacement
[B] Proportional to the displacement
[C] Greatest when the velocity is greatest
[D] Constant

SECTION – B (CHEMISTRY)

[Section B is compulsory for all the candidates]

Question numbers 26–50 carry 1 mark each :

26. How should the conditions be changed to prevent the volume of a given gas from expanding when its mass is increased?

[A] Temperature is lowered and pressure is increased.
[B] Temperature is increased and pressure is lowered.
[C] Temperature and pressure both are lowered.
[D] Temperature and pressure both are increased.

27. Which of the following pairs of expressions of concentration term is independent of temperature?

[A] Normality and Molarity
[B] Molarity and Molality
[C] Molality and Mole fraction
[D] Normality and Formality

(Space for rough works)

20. An electronic equipment operating at 240 V has a resistance R = 120 Ω. Then the power P =
[A] 400 W [B] 2 W
[C] 480 W [D] 240 W

21. An object attached to one end of a spring makes 20 complete oscillations in 10 s. Its time period (T) is:
[A] 10 s [B] 5 s
[C] 2 s [D] 0.5 s

22. Two thin lenses of focal lengths f_1 and f_2 are in contact with each other. Then their equivalent focal length is:
[A] $1/f_1 + 1/f_2$ [B] $f_1f_2/(f_1 + f_2)$
[C] $f_1 - f_2$ [D] $f_1 + f_2$

23. The reverse saturation current in a p-n junction is due to flow of.
[A] Majority carriers [B] Both majority and minority carriers
[C] Minority carriers [D] Impurity ions

24. An ice skater with rotational inertia I_0 is spinning with angular speed ω_0. When ice skater pulls her arms in, thereby increasing her angular speed to $4\omega_0$ then the rotational inertia is:
[A] $I_0/2$ [B] $2I_0$
[C] I_0 [D] $I_0/4$

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[C] Molality and Mole fraction [D] Normality and Formality

(Space for rough works)

28. The equilibrium will be shifted in opposite direction in $PCl_{3(g)} + Cl_{2(g)} \leftrightarrow PCl_{5(g)}$ if

[A] PCl_3 is added.
[B] Helium gas is added.
[C] Catalyst is added.
[D] Pressure is reduced.

29. If α is the degree of dissociation, C the concentration of a weak electrolyte and K_a the acid ionization constant, then the correct relationship between α, C and K_a is

[A] $\alpha^2 = \sqrt{(K_a/C)}$
[B] $\alpha^2 = (\sqrt{C/K_a})$
[C] $\alpha = \sqrt{(K_a/C)}$
[D] $\alpha = \sqrt{(C/K_a)}$

30. Which type of hybridization leads to octahedron shape?

[A] SP^3
[B] SP^3d
[C] SP^3d^2
[D] SP^3d^3

31. For the reation $2A + B \leftrightarrow D + E$, the following mechanism is proposed:

(i) $A + B \leftrightarrow C + D$ (slow)
(ii) $A + C \leftrightarrow E$ (fast)

The rate law expression for the reaction is

[A] Rate = k $[A]^2$ [B]
[B] Rate = k [A] [B]
[C] Rate = k [A] [C]
[D] Rate = k $[A]^2$ [B] [C]

32. Magnetic quantum number specifies

[A] Size of atomic orbitals
[B] Shape of atomic orbitals
[C] Nuclear stability
[D] Orientation of atomic orbitals in space

33. The relative lowering of vapour pressure is equal to the mole fraction of the solute. The law is known as

[A] Henry's law
[B] Raoult's law
[C] Van't Hoff's law
[D] Ostwald dilution law

34. An alum is a

[A] Double salt.
[B] Mixed salt.
[C] Amphoteric salt.
[D] Common salt.

35. Ammonia reacts with Nessler's reagent to give

[A] White precipitate.
[B] Brown precipitate.
[C] Deep blue precipitate.
[D] Orange precipitate.

36. Which of the following is a good conductor of electricity?

[A] Red phosphorus
[B] Wood
[C] Black phosphorus
[D] Yellow phosphorus

37. Which of the following is a sulphide ore?

[A] Cuprite
[B] Bauxite
[C] Haematite
[D] Chalcocite

38. For which of the following, enthalpy change (ΔH) is always negative?
[A] Enthalpy of fusion
[B] Enthalpy of solution
[C] Enthalpy of neutralization
[D] Enthalpy of formation

39. Which of the following compounds gives a ketone with Grignard reagent?
[A] Formaldehyde
[B] Ethyl cyanide
[C] Ethyl alcohol
[D] Methyl iodide

40. A dilute alkaline $KMnO_4$ Solution is known as
[A] Schiff's reagent
[B] Tollen's reagent
[C] Grignard reagent
[D] Baeyer's reagent

41. Number of atoms in a fcc unit cell will be
[A] 1
[B] 2
[C] 3
[D] 4

42. Of the following which is a step growth polymer?
[A] Bakelite
[B] Polyethylene
[C] Teflon
[D] PVC

43. The process of heating iron pyrite in air to remove sulphur is known as
[A] Roasting
[B] Calcination
[C] Smelting
[D] Fluxing

44. Which of the following pollutants causes depletion of stratospheric ozone layer?
[A] Sulphur dioxide
[B] Carbondioxide
[C] Carbon monoxide
[D] Freons

45. Calgon is a trade name given to
[A] Sodium Phosphate
[B] Sodium hexametaphosphate
[C] Calcium phosphate
[D] Sodium zeolite

46. Which of the following is not an organo-metallic compound?
[A] C_3H_7MgI
[B] C_2H_5ONa
[C] $(C_2H_5)_3Al$
[D] Tetra ethyl lead (TEL)

47. Which of the following compounds is obtained on heating a mixture of sodium benzoate and soda lime?
[A] Toluene
[B] Phenol
[C] Benzene
[D] Benzoic acid

48. The gas, which is produced by the reaction between aluminium carbide and water, is
[A] Ethyne
[B] Ethene
[C] Methane
[D] Ethane

(Space for rough works)

$\frac{d}{dx} \sin^{-1} x = \frac{d}{dx}(\ldots) + \frac{d}{d\theta} \tan^{-1} \ldots$

49. $F_2C = CF_2$ is a monomer of

[A] Teflon
[B] Orlon
[C] Dacron
[D] Rayon

50. Which of the following compounds, on reaction with hot concentrated sulphuric acid, loses a molecule of water?

[A] $CH_3CO\ CH_3$
[B] CH_3COOH
[C] CH_3CHO
[D] CH_3CH_2OH

SECTION – C (MATHEMATICS)

[Section C is compulsory for all the candidates]

Question numbers 51– 80 carry 1 mark each :

51. The interior angles of a polygon are in A.P. If the smallest angle is 120^0 and the common difference is 5^0, then the number of sides is

[A] 5
[B] 7
[C] 9
[D] 15

52. If z be any complex number $(z \neq 0)$, and amp $\left(\frac{z-1}{z+1}\right) = \frac{\pi}{3}$, then the z is

[A] Straight line
[B] Circle
[C] Parabola
[D] The single point

53. The number of ways of selecting 4 cards of an ordinary pack of playing cards so that exactly 3 of are of the same denomination is

एक ही संप्रदाय

[A] 2496
[B] ${}^{13}C_3 \times {}^{4}C_3 \times 48$
[C] ${}^{52}C_3 \times 48$
[D] 2346

54. If $u = \sin^{-1}\left(\frac{x}{y}\right) + \tan^{-1}\left(\frac{y}{x}\right)$, then the value of $x\frac{\partial u}{\partial x} + y\frac{\partial u}{\partial y}$ is

[A] 0
[B] 0
[C] $\frac{1}{20}\tan u$
[D] 2u

55. Sum of the last 20 coefficients in the expansion of $(1+x)^{39}$, when expanded in ascending powers of x, is

[A] 2^{19}
[B] 2^{18}
[C] ${}^{40}C_{20} - 2^{19}$
[D] 2^{38}

(Space for rough works)

$(n-2)\,360$

PAPER SET: 15/III/30–35/A

56. The value of $div\left(\frac{\vec{r}}{r^3}\right)$, where $\vec{r} = x\hat{i} + y\hat{j} + z\hat{k}$ and $|\vec{r}| = r$, is

[A] 0
[B] 1
[C] 2
[D] 3

57. The value of $\int_C \vec{F}.d\vec{r}$, where $\vec{F} = (x^2 + y^2)\hat{i} - 2xy\,\hat{j}$. Curve C is the rectangle in the xy-plane bounded by $y = 0, x = a; y = b, x = 0$ is

[A] ab
[B] $-ab^2$
[C] a^2b
[D] $-2ab^2$

58. The unit normal to the surface $x^4 - 3xyz + z^2 + 1 = 0$ at the point (1, 1, 4) is

[A] $\hat{i} + \hat{j} - 3\hat{k}$
[B] $\frac{1}{\sqrt{11}}(\hat{i} - 3\hat{j} - \hat{k})$
[C] $\frac{1}{3}(-\hat{i} + 2\hat{j} + 2\hat{k})$
[D] $\frac{1}{3}(2\hat{i} + \hat{j} - 2\hat{k})$

59. The radius of curvature of the curve $\sqrt{x} + \sqrt{y} = 1$ at $\left(\frac{1}{4}, \frac{1}{4}\right)$ is

[A] $\frac{3}{4}$
[B] $\frac{3}{2}$
[C] $\frac{\sqrt{3}}{2}$
[D] $\frac{1}{\sqrt{2}}$

60. The focus of the parabola $4y^2 + 12x - 20y + 67 = 0$ is

[A] $\left(-\frac{7}{2}, \frac{5}{2}\right)$
[B] $\left(-\frac{3}{4}, \frac{5}{2}\right)$
[C] $\left(-\frac{17}{4}, \frac{5}{2}\right)$
[D] $\left(\frac{5}{2}, -\frac{3}{4}\right)$

61. If three positive real numbers a, b, c are in A.P. such that $abc = 4$, then the minimum possible of b is

[A] $2^{\frac{3}{2}}$
[B] $2^{\frac{2}{3}}$
[C] $2^{\frac{1}{3}}$
[D] $2^{\frac{5}{2}}$

62. If $A = \tan^{-1}\left(\frac{1}{7}\right)$, $B = \tan^{-1}\left(\frac{1}{3}\right)$, then

[A] $\cos 2A = \sin 2A$

[B] $\cos 2A = \sin 2B$

[C] $\cos 2B = \sin 2A$

[D] $\cos 2A = \sin 4B$

63. If the pairs of lines $x^2 + 2xy + ay^2 = 0$ and $ax^2 + 2xy + y^2 = 0$ have exactly one line in common then the joint equation of the other two lines is given by

[A] $3x^2 + 8xy - 3y^2 = 0$

[B] $3x^2 + 10xy + 3y^2 = 0$

[C] $y^2 + 2xy - 3x^2 = 0$

[D] $x^2 + 2xy - 3y^2 = 0$

64. If e_1 and e_2 are eccentricities of the two hyperbolas $\frac{x^2}{a^2} - \frac{y^2}{b^2} = 1$ and $\frac{x^2}{b^2} - \frac{y^2}{a^2} = 1$ then

[A] $e_1 = e_2$

[B] $e_1 e_2 = 1$

[C] $e_1 = -e_2$

[D] $\frac{1}{e_1^2} + \frac{1}{e_2^2} = 1$

65. A committee of five is to be chosen from a group of 9 people. The probability that a certain married couple will either served together or not at all is

[A] $\frac{1}{2}$

[B] $\frac{5}{9}$

[C] $\frac{4}{9}$

[D] $\frac{2}{3}$

66. If $\int \sqrt{1 + \sec x}\, dx = k \sin^{-1}(f(x)) + C$ then

[A] $f(x) = \sqrt{2} \sin\left(\frac{x}{2}\right), k = 2$

[B] $f(x) = \sqrt{2} \cos\left(\frac{x}{2}\right), k = 2$

[C] $f(x) = \sqrt{2} \tan\left(\frac{x}{2}\right), k = 2$

[D] $f(x) = \sqrt{2} \sin\left(\frac{x}{2}\right), k = \sqrt{2}$

67. The value of $\int_{-1}^{1}\left(\cos^{-1} x + \frac{x^7 - 3x^5 + 7x^3 - x}{\cos^2 x}\right)dx$ is

[A] $\frac{\pi}{2}$

[B] 0

[C] 2π

[D] π

68. The area of the figure bounded by the lines $x = 0$, $x = \frac{\pi}{2}$, $f(x) = \sin x$ and $g(x) = \cos x$ is

[A] $2(\sqrt{2} - 1)$ [B] $\sqrt{3} - 1$

[C] $2(\sqrt{3} - 1)$ [D] $2(\sqrt{2} + 1)$

69. Algebraic sum of the intercepts made by the plane $x + 3y - 4z + 6 = 0$ on the axes is

[A] $-\frac{13}{2}$ [B] $\frac{19}{2}$

[C] $-\frac{22}{3}$ [D] $\frac{26}{3}$

70. The planes $bx - ay = n$, $cy - bz = l$, $az - cx = m$ intersect in a line if .

[A] $al - bm + cn = 1$ [B] $al + bm + cn = 0$

[C] $al - bm - cn + 1 = 0$ [D] $al + bm + cn = 1$

71. The distance between the origin and the normal to the curve $y = e^{2x} + x^2$ at the point whose abscissa is zero is

[A] $\frac{1}{\sqrt{5}}$ [B] $\frac{2}{\sqrt{5}}$

[C] $\frac{3}{\sqrt{5}}$ [D] $\frac{2}{\sqrt{3}}$

72. The difference between the greatest and least values of the function $f(x) = \cos x + \frac{1}{2}\cos 2x - \frac{1}{3}\cos 3x$ is

[A] $\frac{3}{8}$ [B] $\frac{2}{3}$

[C] $\frac{8}{7}$ [D] $\frac{9}{4}$

73. If A and B are matrices of the same order, then $(A + B)^2 = A^2 + 2AB + B^2$ is possible if

[A] AB = I [B] BA = I

[C] AB = BA [D] A = AB

74. If the 4th term in the expansion of $\left(ax + \frac{1}{n}\right)^n$ is $\frac{5}{2}$, then the values of a and n are

[A] $\frac{1}{2}, 6$ [B] 1, 3.

[C] $\frac{1}{2}, 3$ [D] $\frac{5}{2}, \frac{7}{3}$

75. Fifteen coupons are numbered 1, 2, 3, ...15, respectively. Three coupons are selected at random without replacement. The probability that maximum number on the selected coupon is 9 is

[A] $\frac{1}{65}$
[B] $\frac{3}{65}$
[C] $\frac{1}{13}$
[D] $\frac{4}{65}$

76. The exponent of 7 in ${}^{100}C_{50}$ is

[A] 0
[B] 2
[C] 4
[D] 8

77. The particular integral of the differential equation $\frac{d^2y}{dx^2} - 6\frac{dy}{dx} + 9y = e^{3x}$ is

[A] $\frac{e^{3x}}{2}$
[B] $\frac{xe^{3x}}{2}$
[C] $\frac{x^2e^{3x}}{2}$
[D] $\frac{x^3e^{3x}}{2}$

78. The lines $\frac{x-2}{1} = \frac{y-3}{1} = \frac{z-4}{-k}$, and $\frac{x-1}{k} = \frac{y-4}{2} = \frac{z-5}{1}$ are coplanar if

[A] $k = 0$
[B] $k = -1$
[C] $k = 2$
[D] $k = 3$

79. If square matrix A is such that $3A^3 + 2A^2 + 5A + I = O$, then A^{-1} is equal to

[A] $3A^2 + 2A + 5I$
[B] $-(3A^2 + 2A + 5I)$
[C] $3A^2 - 2A + 5I$
[D] $3A^2 - 2A - 5I$

80. The value of $\int_0^{\frac{\pi}{2}} \frac{dx}{1+\tan^3 x}$ is

[A] 0
[B] 1
[C] $\frac{\pi}{4}$
[D] $\frac{\pi}{2}$

[CANDIDATES HAVE TO ATTEMPT QUESTION NUMBERS 81 – 130 FROM SECTION (D) OF THEIR APPROPRIATE BRACH AS OPTED IN THE NEE2015 ONLINE FORM]

SECTION – D (CIVIL ENGINEERING)

[Candidate who has opted for CE (Code – 31) in the NEE 2015]

Question numbers 81–110 carry 1 mark each:

81. Limit of proportionality depends upon
    [A] Area of the cross-section
    [B] Type of loading
    [C] Type of material
    [D] Shape of the cross section

82. Effective length of the column fixed at one end and hinged at other end is
    [A] $\frac{1}{2}$
    [B] $\frac{1}{\sqrt{2}}$
    [C] $2 \times l$
    [D] $\sqrt{l}$

83. If a material has identical properties in all directions, it is said to be
    [A] Homogeneous
    [B] Isotropic
    [C] Elastic
    [D Orthotropic

84. The number of independent equations to be satisfied for static equilibrium of a plane structure is
    [A] 1
    [B] 2
    [C] 3
    [D] 6

85. Creep is the
    [A] Longitudinal movement of rail
    [B] Lateral movement of rail
    [C] Vertical movement of rail
    [D Difference in level of two rails

86. Workability is inversely proportional to
    [A] Time of transit
    [B] Water cement ratio
    [C] Air in the mix
    [D Size of aggregate

87. The maximum percentage of reinforcement in case of the slab is limited to
    [A] 2
    [B] 4
    [C] 5
    [D] 8

88. The main reason for providing number of reinforcing bars at a support in a simply supported beam is to resist in that zone
    [A] Compressive stress
    [B] Shear stress
    [C] Bond stress
    [D] Tensile stress

89. Modulus of rigidity is defined as the ratio of
    [A] Longitudinal stress to longitudinal strain
    [B] Shear stress to shear strain
    [C] Stress to strain
    [D] Stress to volumetric strain

90 A simply supported beam carries uniformly distributed load of W over the entire span of length L. The maximum bending moment at the mid-span is

[A] $\frac{WL}{2}$ [B] $\frac{WL}{4}$

[C] $\frac{WL}{12}$ [D] $\frac{WL}{8}$

91 Activated carbon is used for

[A] Disinfection [B] Removing hardness

[C] Removing odours [D] Removing corrosiveness

92 Standard BOD is measured at

[A] 20°C - 1 day [B] 25°C – 3 day

[C] 20°C – 5 day [D] 30°C – 5 day

93 Average rate of water consumption per head day as per Indian Standard is

[A] 100 litres [B] 135 litres

[C] 165 litres [D] 200 litres

94 Sewerage system is usually designed for

[A] 10 years [B] 25 years

[C] 50 years [D] 75 years

95 A fully saturated soil is said to be

[A] One face system [B] Two phase system with soil and air

[C] Two phase system with soil and water [D] Three phase system

96 When the plastic limit of a soil is greater than the liquid limit, then plasticity index is reported as

[A] Negative [B] Zero

[C] Non-plastic [D] 1

97 Coefficient of consolidation of a soil is affected by

[A] Compressibility [B] Permeability

[C] Both compressibility and permeability [D] None

98 A soil having particles of nearly the same size is known as

[A] Well graded [B] Uniformly graded

[C] Poorly graded [D] Gap graded

99 The background colour of the informatory sign board is

[A] Red [B] Yellow

[C] Green [D] White

100. The rail is designated by its
- [A] Length
- [B] Weight
- [C] Cross-section
- [D] Weight per unit length

101. Hydrograph is a graphical representation of
- [A] Runoff and time
- [B] Precipitation and time
- [C] Ground water flow and time
- [D] Soil moisture and time

102. If intensity of rainfall is more than the infiltration capacity of soil, then infiltration rate will be
- [A] Equal to rate of the rainfall
- [B] Equal to infiltration capacity
- [C] More than rate of rainfall
- [D] More than infiltration capacity

103. A raingauge should preferably be fixed
- [A] Near the building
- [B] Under the tree
- [C] In an open space
- [D] In a closed space

104. Cross staff is an instrument used for
- [A] Measuring approximate horizontal angles
- [B] Setting out right angles
- [C] Measuring bearings of the lines
- [D] None of these

105. The rise and fall method of levelling provides a complete check on
- [A] Backsight
- [B] Intermediate sight
- [C] Foresight
- [D] All of the above

106. Number of links in a 30 m metric chain is
- [A] 100
- [B] 150
- [C] 180
- [D] 200

107. The correction for sag is
- [A] Always additive
- [B] Subtractive
- [C] Always zero
- [D] Sometimes additive and sometimes subtractive

108. The prismatic and the surveyor's compass
- [A] Give whole circle bearing (WCB) and quadrantal bearing (QB) of a line, respectively
- [B] Both give WCB and QB of a line
- [C] Both give QB of a line
- [D] Both give WCB of a line

[illegible] If it rains between 2 P.M. and 3 P.M. and the entire basin area just starts contributing water at 3 P.M. to the outlet, then time of concentration will be
- [A] 15 minutes
- [B] 20 minutes
- [C] 30 minutes
- [D] 60 minutes

110. Permanent wilting point is

[A] A characteristic of plant

[B] A characteristic of soil

[C] A characteristic of soil modified by plant

[D] Depends on soil water plant fertilizer interaction

Question numbers 111–130 carry 2 marks each:

111. A metal bar of length 100 mm is inserted between two rigid supports and its temperature is increased by 10°C. If the coefficient of the thermal expansion is $12 \times 10^{-6}/^{o}C$ and Young's modulus is 2×10^{5} MPa. The stress in the bar is

[A] Zero

[B] 12 Mpa

[C] 24 Mpa

[D] 2400 Mpa

112. If the principle stress at a point in a strained body are p_1 and p_2 $(p_1 > p_2)$ then the resultant stress on a plane carrying the maximum shear stress is equal to

[A] $\sqrt{p_1^2 + p_2^2}$

[B] $\sqrt{(p_1^2 + p_2^2)/2}$

[C] $\sqrt{(p_1^2 - p_2^2)/2}$

[D] $(\sqrt{p_1^2 + p_2^2})/2$

113. Which of the following sections should preferably be used at a places where torsion occurs

[A] Angle section

[B] Channel section

[C] Box

[D] Any type of the section

114. The compressive strength of 100 mm cube as compared to 150 mm cube is always

[A] Less

[B] More

[C] Equal

[D] None of the above

115. The factor of the safety for

[A] Steel and concrete are same

[B] Steel is lower than that for the concrete

[C] Steel is higher than that for concrete

[D] None of the above

116. Portland cement is manufactured by burning in a kiln the following materials

[A] Limestone and alumina

[B] Limestone and clay

[C] Limestone and sand

[D] Lime and clay

117. Which one of the following set of values given the minimum clear cover (in mm) for the main reinforcement in the slab, bean, column and footing respectively, according to IS: 456-2000?

[A] 20, 25, 40, 50

[B] 5, 15, 25, 50

[C] 15, 25, 40, 75

[D] None

PAPER SET: 15/III/30–35/A

118. A combined footing is generally used when
[A] When number of columns is more than two and they are spaced far apart
[B] When number of columns is two and they are spaced close to each other
[C] When number of columns is two and they are spaced far apart
[D] There is only one column

119. Average daily consumption of water of city is 100,000 m^3. The maximum daily consumption on peak hourly demand will be
[A] 1,00,000 m^3
[B] 1,50,000 m^3
[C] 1,80,000 m^3
[D] 2,70,000 m^3

120. The population of a town in three consecutive years was 5000, 7000 and 8400, respectively. The population of town in fourth consecutive year according to geometrical increase method will be
[A] 9500
[B] 9800
[C] 10100
[D] 10920

121. A city supply of 15000 cubic meters of water per day is treated with a chlorine dosage of 0.5 ppm. For this purpose, the requirement of bleaching powder per day (assuming the bleaching powder contains 25% chlorine), would be
[A] 300 kg
[B] 75 kg
[C] 30 kg
[D] 7.5 kg

122. When the degree of consolidation is 50%, time factor is about
[A] 0.2
[B] 0.5
[C] 1.0
[D] 2.0

123. If two springs of stiffness K_1 and K_2 are connected in series, the stiffness of the combined springs is
[A] $\frac{K_1 \times K_2}{K_1 + K_2}$
[B] $\frac{K_1 + K_2}{K_1 \times K_2}$
[C] $K_1 + K_2$
[D] $K_1 \times K_2$

124. For a given soil sample, C_c =coefficient of gradation, C_u =coefficient of uniformity, D_{10}=effective size, D_{30} = diameter through which 30% of the total soil mass is passing if C_c = 1.0 and C_u = 4.0 then value of D_{30}/D_{10} would be
[A] 2
[B] 1.75
[C] 1.50
[D] 1.25

25. It was noted that on a section of road the free speed was 80 kmph and the jam density was 70 vehicles per km. The maximum vehicle flow can be expected on this road is
[A] 800 vehicles per hour
[B] 1400 vehicles per hour
[C] 2800 vehicles per hour
[D] 5600 vehicles per hour

PAPER SET: 15/III/30–35/A

126. The R.L. of point A which is on the floor is 100 m and the backsight reading on A is 2.455 m. If the foresight reading on point B which is on the ceiling is 2.745 m, the R.L. of point B will be

[A] 94.8 m
[B] 99.71 m
[C] 100.29 m
[D] 105.2 m

127. Which one of the following instrument is used in plane table surveying for the measurement of horizontal and vertical distances directly

[A] Plain alidade
[B] Telescopic alidade
[C] Tacheometer
[D] Clinometer

128. In leveling between two points A and B on opposite banks of a river, the following readings were taken

Level Position	Staff reading A	Staff reading B
A	1.5	1
B	1.35	0.85

If the R. L. of A is 100 m, then the R. L. of B

[A] Is less than 100 m
[B] Is more than 100 m
[C] Is 100.00m
[D] Cannot be determined by given data

129. A fluid jet is discharging from a 4 cm diameter orifice with 3 cm diameter at its vena contracta. If the coefficient of velocity is 0.98, the coefficient of discharge for the orifice will be

[A] $0.98 \times (0.75)^2$
[B] $\frac{(0.75)^2}{0.98}$
[C] $0.98 \times (1.33)^2$
[D] $\frac{0.98}{(1.33)^2}$

130. The length of the pipe is 1 km and its diameter is 20 cm. If the diameter of an equivalent pipe is 40 cm then its length is

[A] 32 km
[B] 20 km
[C] 8 km
[D] 4 km

------ CE (CODE 31) ENDS -----

SECTION – A (PHYSICS)

[Section A is **compulsory** for all the candidates]

Question numbers 1–25 carry 1 mark each :

1: Potential energy of two equal and opposite point charges 2μC each held 1 m apart in air is
[A] 2 J
[B] 2 eV
[C] 4 J
[D] 0.036 J

2. The average number of neutron released by the fission of the Uranium atom is
[A] 1
[B] 2
[C] 3
[D] 4

. Work done in isothermal expansion of a gas depends upon
[A] Temperature
[B] Expansion ratio
[C] Both [A] & [B]
[D] Neither [A] nor [B]

To convert a galvanometer into a volt meter
[A] a high resistance is connected in parallel
[B] a low resistance is connected in series
[C] a low resistance is connected in parallel
[D] a high resistance is connected in series

As the temperature of a metallic resistor is increased. the product of resistivity and conductivity
[A] increases
[B] decreases
[C] may increase or decrease
[D] remains constant

The two vectors are given as $\vec{A} = \hat{\imath} + \hat{\jmath}$ and $\vec{B} = \hat{\imath} - \hat{k}$. What is the value of the scalar products of vectors A and B?
[A] 1
[B] 2
[C] $\sqrt{2}$
[D] $\sqrt{3}$

A conductor is moving in the magnetic field B, the induced current is I. If the magnetic field is doubled the induced current will
[A] remain same
[B] become half
[C] be doubled
[D] be four times

Two soap bubbles have radii in the ratio of 2:1. What is the ratio of excess pressure inside them?
[A] 2:1
[B] 1:4
[C] 2:1
[D] 4:1

9. The phenomenon that requires transverse nature of light is
[A] diffraction
[B] polarisation
[C] interference
[D] dispersion

10. The temperature scale, which is independent of the properties of any substance is the
[A] Celsius scale
[B] Reaumer scale
[C] Fahrenheit scale
[D] Kelvin scale

11. When a source is going away from stationary observer with the velocity equal to that of sound in air, then the frequency heard by observer will be
[A] halved
[B] one third
[C] doubled
[D] Same

12. An electric dipole is kept in a uniform electric field. It experiences
[A] a force and a torque
[B] a torque but no force
[C] a force but no torque
[D] neither force nor a torque

13. If temperature of a hot blackbody is raised by 5%, heat energy radiated would increase by
[A] 25.7%
[B] 21.6%
[C] 15.6%
[D] 12.5%

14. The kinetic energy of a body rotating with angular speed ω, depends on
[A] distribution of mass
[B] angular speed
[C] both distribution of mass and angular speed
[D] none of these

15. What will be the wattage of a 50 W, 200 V lamp when used on 160 V power supply?
[A] 120 W
[B] 96 W
[C] 64 W
[D] 32 W

16. When a force is applied at one end of an elastic wire, it produces strain l in the wire. If Y is the Youngs' modulus of the material of the wire, then the amount of energy stored per unit volume of the wire is given by
[A] $Y\,l$
[B] $0.5\,Y\,l$
[C] $Y\,l^2$
[D] $0.5\,Y\,l^2$

17. If relative permeability of iron is 2000, its absolute permeability in S.I. units is
[A] $8\pi \times 10^{-4}$
[B] $8\pi \times 10^{-3}$
[C] $\frac{800}{\pi}$
[D] $\frac{5 \times 10^{9}}{\pi}$

18. It is possible to observe total internal reflection when a ray travels from
[A] Glass into water
[B] Water into glass
[C] Air into water
[D] Air into glass

19. Three resistors of 4 Ω, 6 Ω and 12 Ω are connected in parallel **across a 4 volt battery**. The battery current is

[A] 0.5 A [B] 1 A
[C] 2 A [D] 10A

20. The focal length of convex lens is 30 cm and the size of image is **quarter of the** object, then the object distance is

[A] 90 cm [B] 60 cm
[C] 30 cm [D] 40 cm

21. A projectile has a minimum range of 200 m. The maximum height attained by it is

[A] 2.5 m [B] 50 m
[C] 75 m [D] 100m

22. A pair of physical quantity having same dimensional formula is

[A] energy and power [B] power and angular momentum
[C] angular momentum and torque [D] torque and energy

23. When two semiconductors of p-type and n-type are brought in contact, they form a p-n junction which acts like

[A] amplifier [B] oscillator
[C] rectifier [D] transistor

24. The energy of the visible light is of the order of

[A] few eV [B] few MeV
[C] few keV [D] 0.0001eV

25. A simple harmonic motion is given by the equation $x = 3\sin\pi t + 4\cos 3\pi t$, where x is in meters. The amplitude of the motion is

[A] 3 m [B] 4 m
[C] 5 m [D] 7 m

SECTION – B (CHEMISTRY)

[Section B is **<u>compulsory</u>** for all the candidates]

Question numbers 26–50 carry 1 mark each :

26. Body centered cubic lattice has coordination number of

[A] 8 [B] 4
[C] 12 [D] 6

the

ion

in

27. The solution which show positive or negative deviation from Raoult's law are called
[A] Ideal solutions
[B] True solutions
[C] Real solutions
[D] Non ideal solutions

28. Tyndall phenomena is exhibited by
[A] NaCl solution
[B] Starch solution
[C] Urea solution
[D] $FeCl_3$ solution

29. The heat change for the reaction
$2CO(g) + O_2(g) \rightarrow 2CO_2(g)$ is called
[A] Heat of reaction
[B] Heat of fusion
[C] Heat of formation
[D] Heat of combustion

30. A system that can transfer neither nor energy to and from its surrounding is called
[A] An isolated system
[B] A closed system
[C] An open system
[D] A homogeneous system

31. The molecularity of a reaction $X + 2Y \rightarrow$ Products is
[A] 1
[B] 2
[C] 3
[D] 0

32. The relationship between solubility of binary electrolyte and solubility product is given by
[A] $S^2 = \sqrt{K_{SP}}$
[B] $S = \sqrt{K_{SP}}$
[C] $4S^2 = K_{SP}$
[D] $2S^2 = K_{SP}$

33. When the azimuthal quantum number (l) is 3, m can have
[A] 1 value
[B] 3 values
[C] 5 values
[D] 7 values

34. The molecular shape of NH_3 is
[A] Triangular
[B] Tetrahedral
[C] Pyramidal
[D] Octahedral

35. Which of the following can act both as Lowry Bronsted acids and bases?
[A] CO_3^{-2}
[B] H_3O^+
[C] BF_3
[D] HSO_4^-

36. The alloy commonly used for making heating element is
[A] Brass
[B] Bronze
[C] Duralumin
[D] Nichrome

37. Which of the following ore is called malachite?
[A] Cu_2S
[B] $CuCO_3.Cu(OH)_2$
[C] Cu_2O
[D] $CuFeS_2$

38. Red-Lead is
[A] Pb_2O_3
[B] Pb_3O_4
[C] PbO
[D] Pb_2O

39. In qualitative analysis of Pb^{+2}, Ag^{+}, Cu^{+2} and Cd^{+2}, the common ions are furnished by
[A] HCl and H_2S
[B] NH_4OH and NH_4Cl
[C] Na_2SO_4 and H_2S
[D] NH_4OH and $(NH_4)_2CO_3$

40. Polymerization of chloroethylene gives rise to the polymer
[A] Polyethene
[B] PVC
[C] Teflon
[D] Nylon

41. Hard water when passed through ion exchange resin containing RCOOH group becomes free from
[A] Mg^{2+}
[B] Ca^{2+}
[C] Cl^{-}
[D] H_3O^{+}

42. Stains of iron rust on clothes can be removed by
[A] Petrol
[B] Oxalic acid
[C] H_2O_2
[D] Alcohol

43. The components present in the producer gas are mainly
[A] $CO_2 + N_2$
[B] $CO + H_2 + N_2$
[C] $CO_2 + H_2$
[D] $CO + NO_2$

44. The alkene which on ozonolysis yield acetone is
[A] $CH_2{=}CH_2$
[B] $CH_3 - CH = CH - CH_3$
[C] $(CH_3)_2C = C(CH_3)_2$
[D] $CH_3 - CH = CH_2$

45. General formula $(RCO)_2O$ represents
[A] A ketone
[B] An ester
[C] An acid anhydride
[D] A carboxylic acid

46. Picric acid is
[A] Tri nitroaniline
[B] Tri nitrotoluene
[C] A volatile liquid
[D] 2,4,6-trinitrophenol

47. Which one is the method for converting a ketone into hydrocarbon
[A] Aldol condensation
[B] RiemerTiemann reaction
[C] Wolf- Kishner reduction
[D] Cannizzaro reaction

48. When aniline is treated with chloroform in alcoholic KOH, the product is
[A] Benzene diazonium chloride
[B] Benzanilide
[C] A Schiff's base
[D] Phenyl isocyanide

49. Tollen's reagent is
[A] Ammonical cuprous chloride
[B] Ammonical cuprous oxide
[C] Ammonical silver bromide
[D] Ammonical silver nitrate

50. Rosenmund reduction would convert
[A] Benzoyl chloride to benzaldehyde
[B] Acetone to propane
[C] Acetaldehyde to ethyl alcohol
[D] Acetylene to acetaldehyde

SECTION – C (MATHEMATICS)

[Section C is **compulsory** for all the candidates]

Question numbers 51– 80 carry 1 mark each :

51. A student is allowed to select atmost n books from a collection of $(2n + 1)$ books. If the total number of ways in which he can select atleast one book is 255, then the value of n is
[A] 3
[B] 4
[C] 5
[D] 6

52. If A and B are two matrices such that AB = B and BA = A, then
[A] $A - B$ is idempotent
[B] $A + B$ is idempotent
[C] $(A^5 - B^5)^3 = A^3 - B^3$
[D] $A - B$ is nilpotent

53. An integrating factor of the differential equation $(1 + y + x^2y)dx + (x + x^3)dy = 0$ is
[A] x
[B] e^x
[C] $\frac{1}{x}$
[D] $\log x$

54. The equation of the plane through the intersection of the planes $x + y + z = 1$, $2x + 3y + 4z = 5$ and perpendicular to the plane $x - y + z = 0$ is
[A] $2x + 3z + 4 = 0$
[B] $x + 31z - 68 = 0$
[C] $x - z + 2 = 0$
[D] $x - 7y + 21z - 41 = 0$

55. If $\sin v = \frac{x + 2y + 3z}{\sqrt{x^8 + y^8 + z^8}}$, then $x\frac{\partial v}{\partial x} + y\frac{\partial v}{\partial y} + z\frac{\partial v}{\partial z}$ is equal to
[A] $-3\sin v$
[B] $-3\cos v$
[C] $-3\cot v$
[D] $-3\tan v$

56. If $\sin^{-1} x + \sin^{-1} y + \sin^{-1} z = \frac{3\pi}{2}$, then the value of $x^{100} + y^{100} + z^{100} - \frac{9}{x^{101}+y^{101}+z^{101}}$ is

[A] 0
[B] 1
[C] 2
[D] 3

57. If $3\tan^{-1}\left(\frac{1}{2+\sqrt{3}}\right) - \tan^{-1}\left(\frac{1}{x}\right) = \tan^{-1}\left(\frac{1}{2}\right)$, then x is equal to

[A] 1
[B] 3
[C] $\sqrt{3}$
[D] $\frac{1}{\sqrt{3}}$

58. Two bags contain 3 white, 2 black and 2 white, 4 black balls respectively. A ball is chosen at random then the probability of its being black is

[A] $\frac{8}{15}$
[B] $\frac{2}{3}$
[C] $\frac{1}{5}$
[D] None of these

59. A circle touches the x-axis and also touches the circle with centre at (0, 3) and radius 2. The locus of the centre of the circle is

[A] A hyperbola
[B] A parabola
[C] An ellipse
[D] A circle

60. The value of a so that the vector $\vec{F} = (axy - z^3)\hat{i} + (a-2)x^2\hat{j} + (1-a)xz^2\hat{k}$ is irrotational is

[A] 2
[B] 3
[C] 4
[D] 1

61. The straight lines $3x + 4y - 5 = 0$ and $4x = 3y + 15$ intersects at the point P. On these lines the points Q and R are chosen so that PQ = PR. The possible slopes of the line QR passing through (1, 2) are

[A] $-7, \frac{1}{7}$
[B] $7, \frac{1}{7}$
[C] $7, -\frac{1}{7}$
[D] $3, -\frac{1}{3}$

62. The lines $\frac{x-1}{1} = \frac{y-1}{2} = \frac{z-3}{0}$ and $\frac{x-2}{0} = \frac{y-3}{0} = \frac{z-4}{1}$ are

[A] parallel
[B] coincident
[C] skew
[D] perpendicular

63. If the function $f(x) = 2x^3 - 9ax^2 + 12a^2x + 1$, where $a > 0$, attains its maximum and minimum values at p and q respectively such that $p^2 = q$, then a is equal to

[A] $\frac{1}{2}$ [B] 3

[C] 2 [D] 1

64. If Rolle's theorem holds for $f(x) = x^3 - 6x^2 + Kx + 5$ on $[1, 3]$, with $c = 2 + \frac{1}{\sqrt{3}}$, then the value of K is

[A] −3 [B] 3

[C] 7 [D] 11

65. If S is any closed surface enclosing a volume V and $\vec{F} = x\hat{\imath} + 2y\hat{\jmath} + 3z\hat{k}$. The value of $\iint_s \vec{F} \cdot \hat{n} ds$ is

[A] 2V [B] 3V

[C] 4V [D] 6V

66. If $\vec{r} = x\hat{\imath} + y\hat{\jmath} + z\hat{k}$ and $r = |\vec{r}|$, then the value of $curl(r^n \vec{r})$ is

[A] $2\hat{\imath}$ [B] $3\hat{\imath} + 2\hat{\jmath}$

[C] $\vec{0}$ [D] $x^2 + y^2 + z^2$

67. The shortest distance between the lines $\frac{x-1}{1} = \frac{y-2}{3} = \frac{z-3}{4}$ and $\frac{x-2}{3} = \frac{y-4}{4} = \frac{z-5}{5}$ is

[A] $\frac{1}{6}$ $\frac{(b_1 \times b_2) \cdot (a_2 - a_1)}{|b_1 \times b_2|}$ [B] $\frac{1}{\sqrt{6}}$

[C] $\frac{1}{\sqrt{3}}$ [D] $\frac{1}{3}$

68. The radius of curvature at the origin for the curve $x^3 + y^3 - 2x^2 + 6y = 0$ is

[A] $\frac{3}{2}$ [B] $\frac{5}{2}$

[C] $\frac{1}{2}$ [D] 1

69. The value of the determinant

$-5 + K + 5 - 2 + \frac{1}{\sqrt{3}}$

$$\begin{vmatrix} 0 & a-b & a-c \\ b-a & 0 & b-c \\ c-a & c-b & 0 \end{vmatrix} \text{ is}$$

[A] abc [B] 1

[C] 0 [D] (a–b) (b–c) (c–a)

70. If X is a Poisson variate such that $P(2) = 9P(4) + 90P(6)$, then the mean of X is

[A] ±1
[B] ±2
[C] ±3
[D] None of these

71. The value of line integral $\int_c [(x^2 - y^2)dx + 2xy\,dy]$ where c is the boundary of the rectangle formed by lines $x = 0, x = 2, y = 0, y = 1$ is

[A] 1
[B] 2
[C] 3
[D] 4

72. If $\log_3 2, \log_3(2^x - 5)$ and $\log_3(2^x - \frac{7}{2})$ are in A.P., then x is equal to

[A] 1
[B] 5
[C] 2
[D] None of these

73. If third term of an H. P. is $\frac{1}{13}$ and the fifth term is $\frac{1}{19}$, then its 15th term is

[A] $\frac{1}{49}$
[B] $\frac{1}{29}$
[C] $\frac{1}{53}$
[D] $\frac{1}{59}$

74. The radius of curvature at the point (x, y) on the curve $x^2 = 4ay$ is

[A] $2\sqrt{a}(y + a)^{3/2}$
[B] $\frac{2}{\sqrt{a}}(y + a)^{3/2}$
[C] $\frac{1}{\sqrt{3}}(1 + x^2)^{3/2}$
[D] $\frac{1}{\sqrt{3}}(x - a)^{3/2}$

75. The coefficients of the $(2r + 4)^{th}$ and $(r - 2)^{th}$ terms in $(1 + x)^{18}$ are equal, then r is equal to

[A] 10
[B] 8
[C] 5
[D] 6

76. If $f(x) = \begin{vmatrix} \sin x & \sec x & x^2 - 1 \\ \operatorname{cosec} x & x \sin x & \cos x \\ \tan x & x \tan x & x^2 + 1 \end{vmatrix}$, then $\int_{-\pi/3}^{\pi/3} f(x)\,dx$ is equal to

[A] 0
[B] $\frac{\pi}{3} + 1$
[C] $\frac{\pi}{3} - 1$
[D] 1

77. The equation of the bisectors of the angle between the lines represented by the equation $x^2 + 2xy \operatorname{cosec}\theta - y^2 = 0$ is

[A] $x^2 - 2xy\ \sec\theta - y^2 = 0$

[B] $x^2 - 2xy\ \cos\theta - y^2 = 0$

[C] $x^2 - 2xy\ \sin\theta - y^2 = 0$

[D] None of these

78. The focus of the parabola $x^2 - 8x + 2y - 10 = 0$ is

[A] $(4, 13)$

[B] $\left(4, \frac{27}{2}\right)$

[C] $\left(1, \frac{13}{2}\right)$

[D] $\left(4, \frac{25}{2}\right)$

79. The area bounded by $y = x^2$ and $y = 1 - x^2$ is

[A] $\frac{16}{3}$

[B] $\frac{32}{3}$

[C] $\frac{\sqrt{8}}{3}$

[D] $\frac{64}{3}$

80. The greatest rate of increase of $u = x^2 + yz^2$ at the point $(1, -1, 3)$ is

[A] 11

[B] $4\sqrt{2}$

[C] $\sqrt{3}$

[D] None of these

[CANDIDATE HAS TO ATTEMPT QUESTION NUMBERS 81 – 130 OF SECTION D FROM APPROPRIATE ENGINEERING BRANCH AS SHOWN IN THE ADMIT CARD OF NEE – 2016]

SECTION – C (MATHEMATICS)

[Section C is **Compulsory** for all al the candidates]

Question numbers 51–80 carry 1 mark each:

51. The number of solution of the equation $tan^{-1}(x-1) + tan^{-1}x + tan^{-1}(x+1) = tan^{-1}3x$ is .

[A] 3
[B] 2
[C] 1
[D] 4

52. The foci of the ellipse $\frac{x^2}{16} + \frac{y^2}{b^2} = 1$ and the hyperbola $\frac{x^2}{144} - \frac{y^2}{81} = \frac{1}{25}$ coincide, then the value of b^2 is

a>b

$\frac{1}{e_1^2} + \frac{1}{e_2^2} = 1$

[A] 1
[B] 5
[C] 9
[D] 7

53. If $F = xy^2i + 2x^2yzj - 3yz^2k$, then curl F at $(1,-1,1)$ is

[A] $i + 2k$
[B] $-i + 2k$
[C] $-i - 2k$
[D] $-i - 2j$

54. Equations of the straight line through the point *(a, b, c)* which is parallel to z-axis is

[A] $\frac{x-a}{1} = \frac{y-b}{0} = \frac{z-c}{0}$
[B] $\frac{x-a}{0} = \frac{y-b}{0} = \frac{z-c}{1}$
[C] $\frac{x-a}{0} = \frac{y-b}{1} = \frac{z-c}{0}$
[D] None of these

55. A purse contains 4 copper, 3 silver coins and the second purse contains 6 copper, 2 silver coins. A coin is taken from any purse, the probability that it is a copper coin be

[A] 4/7
[B] 1/4
[C] 3/7
[D] 37/56

56. The events A and B are such that $P(A) = 1/4$, $P(A \cup B) = 1/2$ and $P(B|A) = 2/3$. Then $P(B)$ is

[A] 1/2
[B] 1/3
[C] 1/6
[D] 2/3

$\frac{\partial u}{\partial x} = 6x + 3x^2$ $\frac{\partial u}{\partial y} = -2y$

$\frac{\partial^2 u}{\partial x^2} = 6 + 6x$ $\frac{\partial^2 u}{\partial y^2} = -2$

$\frac{\partial}{\partial} \frac{\partial u}{\partial} = 0$

57. $\int_0^{\frac{\barwedge}{2}} \frac{dx}{a^2 cos^2 x + b^2 sin^2 x} =$

$3x$ $x^2 + 2x$ $x(x+2)$

[A] $2\barwedge ab$ [B] $\barwedge a^2 b^2$

[C] $\frac{\barwedge}{a^2 b^2}$ [D] $\frac{\barwedge}{2ab}$

58. If $z = \tan(y + ax) + (y - ax)^{\frac{3}{2}}$, than $\frac{\partial^2}{\partial x} - a^2\left(\frac{\partial^2 z}{\partial y^2}\right)$ is equal to

[A] 0 [B] 1
[C] $y - ax$ [D] $sec(y + ax)$

59. The function $u = 3x^2 - y^2 + x^3$ is maximum at

[A] (-5, -3) [B] (0, 2)
[C] (-2, 0) [D] (3, 5)

60. The distance between the point(-1, -5, -10) and the point of intersection of the line $\frac{x-2}{3} = \frac{y+1}{4} = \frac{z-2}{12}$ with the plane x-y+z = 5 is

$$\left|\begin{array}{ccc|c} 1 & 1 & 1 & 6 \\ 1 & 2 & 3 & 10 \\ 1 & 2 & \alpha & \beta \end{array}\right|$$

[A] 13 [B] 15
[C] 16 [D] 12

61. If a, b, c and x are real numbers and

$$\Delta = \begin{vmatrix} 1+a & 1+ax & 1+ax^2 \\ 1+b & 1+bx & 1+bx^2 \\ 1+c & 1+cx & 1+cx^2 \end{vmatrix}$$. Then the value of Δ is

$$\left|\begin{array}{ccc|c} 1 & 1 & 1 & 6 \\ 0 & 1 & 2 & 4 \\ 0 & 1 & \alpha-1 & \beta-6 \end{array}\right|$$

$$\left|\begin{array}{ccc|c} 1 & 1 & 1 & 6 \\ 0 & 1 & 2 & 4 \\ 0 & 0 & \alpha-3 & \beta-10 \end{array}\right|$$

[A] 0 [B] Abcx
[C] abc [D] None of these

62. If sum of the slopes of the lines given by $x^2 - 2axy - 7y^2 = 0$ is four times their product, the value of a is

[A] 1 [B] -1
[C] 2 [D] -2

$2\frac{1}{1+\log y} = \frac{1}{1+\log x}\ \frac{1}{1+\log z}$

63. If $x>1, y>1, z>1$ are in G.P. then $\frac{1}{1+\log x}, \frac{1}{1+\log y}, \frac{1}{+\log z}$ are in

[A] A.P. [B]] .P.
[C] G.P. [D]] one of these

$yz^2 + xz^2 + xyz^2$

$= 1 * 9$

64. The greatest rate of increase of u = xyz^2 at the point (1,), 3)

[A]✓ 9 [B] :
[C] -9 [D] (

65. The linear system of equations $x+y+z=6,\ x+2y+3z=10,\ x+2y+\alpha z=\beta$ has unique solution if

[A] $\beta \neq 10$, α may have any value [B] $\alpha = 3,\ \beta \neq 10$
[C] $\alpha = 3,\ \beta = 10$ [D]✓ $\alpha \neq 3$, β may have any value

66. The value of an integral is $\int \frac{x^2+1}{x^4+1}\, dx$ is

[A]✓ $(1/\sqrt{2})\ tan^{-1}[(x^2-1)/x\sqrt{2})]$ [B] $(1/\sqrt{2})\ log[(x^2-1)/x\sqrt{2})]$
[C] $(1/\sqrt{2})\ sin^{-1}[(x^2-1)/x\sqrt{2})]$ [D] $(1/\sqrt{2})\ log[(x^2+1)/x\sqrt{2})]$

67. If S is any closed surface, then $\iint_S curl\, \overline{F}.\hat{n}\, dS$

[A] -2 [B] :
[C] 1 [D]✓ (

$y_2 - y_1$ m_1 m_2 $x_2 - x_1$ λ_4 λ_2

68. The lines $\frac{x-2}{1} = \frac{y-3}{1} = \frac{z-4}{-\alpha}$ and $\frac{x-1}{\alpha} = \frac{y-4}{2} = \frac{z-5}{1}$ are coplanar if

[A] $\alpha = 1$ or -1 [B] $\alpha = 0$ or -3
[C] $\alpha = 3$ or -3 [D]✓ $\alpha = 0$ or -1

$1-2$

69. For a binomial variable X if n = 5 and P(X = 1) = 8P(X = 3). Then p is given by

[A] 4/5 [B] 1/3
[C] 1/5 [D] 2/3

${}^5C_1\, pq^4 = 8 \times {}^5C_3\, p^3 q^2$

$P(x=r) = {}^nC_r\, p^r q^{n-r}$

$A^{-1} = \frac{1}{|A|} \text{Adj } A$

$|A| A^{-1} = \text{Adj}$

4×1

70. The area bounded by the curves $y^2 = 4x\, and :{}^2 = 4y$ is

[A] 32/3
[B] 16/3
[C] 8/3
[D] 0

71. Two linearly independent solutions of the differential equation $4\left(\frac{d^2y}{dx^2}\right) + 4\left(\frac{dy}{dx}\right) + 5y = 0$ are

[A] $e^{x/2}\cos x, \quad e^{-x/2}\ sinx$
[B] $e^{x/2}\cos x, \quad e^{x/2}\ sinx$
[C] $e^{-x/2}\cos x, \quad e^{-x/2}\ sinx$
[D] $e^{-x/2}\cos x, \quad e^{x/2}\ sinx$

72. If a is a real number and if the middle term of $\left(\frac{a}{3}+3\right)^8$ is 1120, then value of a is

[A] ± 2
[B] ± 1
[C] $\pm\sqrt{3}$
[D] $\pm\sqrt{2}$

73. The point on the curve $\sqrt{x}+\sqrt{y}=\sqrt{a}$, the normal at which is parallel to the X-axis is

(0,y)

[A] (0, 0)
[B] (0, a)
[C] (a, 0)
[D] (a, a)

74. The number of diagonals in a octagon is

[A] 20
[B] 28
[C] 10
[D] 16

75. If the lines $3x + y + 2 = 0$, $2x - y + 3 = 0$ and $x + my - 3 = 0$ are concurrent, then the value of m is

$$\begin{vmatrix} 3 & 1 & 2 \\ 2 & -1 & 3 \\ 1 & m & -3 \end{vmatrix}$$

[A] 1
[B] 2
[C] 3
[D] 4

76. If A be an 4×4 matrix such that determinant of A is 2. Then the determinant of $adj\ A$ is

$3(3-3m) - 1(-6-3) + 2(2m$

$9 - 9m + 6 + 3 + 4m + 2$

$-5m + 20 = 0$

[A] 8
[B] 16
[C] 2
[D] 4

77. The value of line integral $\int_C (3x-5y)dx+(x-6y)dy$, where C is the ellipse $\frac{x^2}{4}+y^2=1$

[A] 0
[B] 10π
[C] -12π
[D] 12π

78. Which is the solution of the differential equation: $(x + 2y^3)\left(\frac{dy}{dx}\right) = y$

[A] $y/x = x^2 + c$
[B] $y = (1/2)y^4 + c$
[C] $x/y = y^2 + c$
[D] None of these

$\sin^{-1}\left(\frac{x}{5}\right) + \sin^{-1}\left(\frac{5}{4}\right) = \frac{\pi}{2}$

$\sin^{-1}\frac{x}{5} = \cos^{-1}\frac{4}{5}$

$\sin^{-1}\frac{x}{5} = \sin^{-1}\frac{3}{5}$

79. If $\sin^{-1}\left(\frac{x}{5}\right) + cosec^{-1}\left(\frac{5}{4}\right) = \frac{\pi}{2}$, then the value of x is

[A] 1
[B] [illegible]
[C] 4
[D] [illegible]

80. In an ellipse, the distance between its foci is 6 and minor axis is 8, then its eccentricity is

[A] 1/2
[B] [illegible]$/\sqrt{5}$
[C] 4/5
[D] 3/5

$(\pm ae, 0)$

$\pm ae = 6$

$a = \frac{6}{e}$

$2b = 8$

$b = 4$

------xxx---Mathematics Paper End----xxx-----

$b^2(e^2-1)$

$= \frac{36}{e^2}(e^2-1)$

$= 36 - \frac{36}{e^2}$

$= 36e^2 - 36$

$b^2 = a^2(1-e^2)$

$16 = \frac{36}{e^2}(1-e^2)$

$16 = 36 - \frac{36}{e^2}$

$16e^2 = 36e^2 - 36$

$20e^2 = 36$

$e^2 = \frac{36}{20} = \frac{9}{5}$

$16 = 36 - e$

$16e^2 = 36e^2 -$

$20e^2$

CANDIDATE HAS TO ATTEMPT QUESTION NUMBERS 81-130 OF SECTION-D FROM APPROPRIATE ENGINEERING BRANCH AS SHOWN IN THE ADMIT CARD OF NEE-2017

$= 36$

$\frac{9}{8}$

SECTION – D (Civil Engineering)

[Candidate who has opted for CE (Code-31) in NEE - 2017]

Question numbers 81–110 carry 1 mark each:

81. An element is subjected to two equal and like stresses σ, on two mutually perpendicula planes. The shape of the Mohr's circle will be

[A] A circle of radius 2σ
[B] A circle of radius σ
[C] A circle of radius σ/2
[D] A point

82. The difference between bending moment values at any two sections will be equal to

[A] The area of shear force diagram between those two sections
[B] The difference in slopes of shea force diagram at the same sections
[C] The area of loading diagram between the two sections
[D] The moment of area of diagrar between the two sections taken abou mid-point between the two sections

83. The neutral axis of the cross-section a beam is that axis at which the bending stress is

[A] Maximum
[B] Average
[C] Minimum
[D] zero

84. The maximum deflection of a fixed beam carrying a central point load lies at

[A] Fixed ends
[B] l/3 from fixed ends
[C] Centre of beam
[D] None of these

85. The ratio of compressive strength to tensile strength of concrete

[A] Increases with age
[B] Decreases with age
[C] Remains constant
[D] None of these

86. The relation between modulus of rupture f_{cr} and characteristics strength of concrete f_{ck} i given by (where f_{cr} and f_{ck} are in N/mm^2)

[A] $f_{cr} = 0.35\sqrt{f_{ck}}$
[B] $f_{cr} = 0.5\sqrt{f_{ck}}$
[C] $f_{cr} = 0.7\sqrt{f_{ck}}$
[D] $f_{cr} = 1.2\sqrt{f_{ck}}$

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87. Irrigation canal is generally aligned along

[A] Ridge line
[B] Contour line
[C] Valley line
[D] Straight line

88. Reynolds number is the ratio of inertial force and … …………

[A] Elasticity
[B] Gravitational force
[C] Surface tension
[D] Viscous force

89. Hydrostatic pressure on dam depends upon, its

[A] Length
[B] Depth
[C] Material
[D] All of these

90. If the dynamic viscosity of a fluid is 0.5 poise and specific gravity is 0.5, then the kinematic viscosity of that fluid in stokes is

[A] 0.25
[B] 0.50
[C] 1.0
[D] None of these

91. The ratio of the volume of voids to the volume of soil solids in a given soil mass, is known as

[A] Porosity
[B] Void ratio
[C] Specific gravity
[D] None of these

92. A vertical triangular area with vertex downward and altitude 'h' has its base lying on the free surface of a liquid. The centre of pressure below the free surface is at a distance of

[A] h/4
[B] h/3
[C] h/2
[D] 2h/3

93. Under-reamed piles are generally

[A] Driven pile
[B] Bored pile
[C] Precast pile
[D] All of these

94. The unit weight of a soil at zero air voids depends on

[A] Specific gravity
[B] Water content
[C] Unit weight of water
[D] All of these

95. For a given soil sample, C_c = coefficient of gradation, C_u = coefficient of uniformity, D_{10} = effective size, D_{30} = diameter through which 30 per cent of the total soil mass is passing. If $C_c = 1.0$ and $C_u = 4.0$, then the value of D_{30}/D_{10} would be

[A] 2.00
[B] 1.75
[C] 1.50
[D] 1.25

96. Shearing strength of a cohesionless soil depends upon

[A] Dry density
[B] Loading rate
[C] Confining pressure
[D] Nature of loading

97. In water bound macadam (WBM) roads, binding materials to hold the stones is

[A] Stone dust
[B] Sand
[C] Brick dust
[D] Cement

98. The convexity provided to the carriageway between the crown and edge of the pavement is known as

[A] Super-elevation
[B] Camber
[C] Height of the pavement
[D] None of these

99. If the stopping distance and average length of a vehicle are 18 m and 6 m, respectively, then the theoretical maximum capacity of a traffic lane at a speed of 10 m/sec is

[A] 3000 vehicles per hour
[B] 2000 vehicles per hour
[C] 2500 vehicles per hour
[D] 1500 vehicles per hour

100. The boundary of water of a still lake, represents

[A] Contour line
[B] Level line
[C] Contour gradient
[D] Contour surface

101. The compensation for curvature on gradient for Meter Gauge is given by

[A] 70/R
[B] 52.5/R
[C] 35/R
[D] 105/R

102. In a metric leveling staff, value of subdivision is

[A] 3 mm
[B] 4 mm
[C] 5 mm
[D] 10 mm

103. If the lower clamp screw is tightened and upper clamp screw is loosened, the theodolite may be rotated

[A] On its outer spindle without a relative motion between the vernier and graduated scale of lower plate
[B] On its outer spindle with a relative motion between the vernier and graduated scale of lower plate
[C] On its inner spindle with a relative motion between the vernier and graduated scale of lower plate
[D] On its inner spindle without a relative motion between the vernier and graduated scale of lower plate

104. For steel structure, the most economical section for column is

[A] Rectangular
[B] Solid circular
[C] Tubular section
[D] Hexagonal

105. The detention period in coagulation tanks is usually kept as

[A] 1.0 to 1.5 hours
[B] 2.0 to 6.0 hours
[C] 7 to 9 hours
[D] 8 to 12 hours

106. If the focal length of the object glass is 25 cm and the distance from object glass to the trunnion axis is 15 cm, the additive constant is

[A] 0.1
[B] 0.6
[C] 0.4
[D] 1.33

107. The population of a town in three consecutive years is 5000, 7000 and 8400, respectively. The population of the town in the fourth consecutive year according to geometrical increase method is

[A] 9500
[B] 9800
[C] 10100
[D] 10920

108. The type of valve which is provided on the suction pipe in a tube-well is

[A] Reflux valve
[B] Air-relief valve
[C] Pressure relief valve
[D] Sluice valve

109. For controlling the growth of algae, the chemical generally used is

[A] Alum
[B] Lime
[C] Bleaching powder
[D] Copper sulphate

(Space for rough works)

6 3 1,0 C4 [illegible]

110. Self-cleansing velocity is

[A] The minimum velocity of flow required to maintain a certain amount of solids in the flow

[B] The maximum velocity of flow required to maintain a certain amount of solids in the flow

[C] Such flow velocity as would be sufficient to flush out any deposited solids in the sewer

[D] Such flow velocity as would be sufficient to ensure that sewage does not remain in the sewer

Question numbers 111–130 carry 2 marks each:

111. One simply supported beam 'A' carries a point load at its mid span. Another identical beam 'B' carries same load uniformly distributed over the entire span. The ratio of maximum deflection of the beams A and B will be

[A] 5/8
[B] 8/5
[C] 3/5
[D] None of the these

112. The slope of the elastic curve at the free end of a cantilever beam of span L and flexural rigidity EI, subjected to uniformly distributed load of intensity W is

[A] $WL^3/6EI$
[B] $WL^3/3EI$
[C] $WL^4/8EI$
[D] $WL^3/2EI$

113. A drainage basin has axial length and area 100 km and 225 km^2, respectively. The form factor of the same basin is

[A] 0.15
[B] 0.20
[C] 0.25
[D] 0.30

114. The reduction coefficient of a reinforced concrete column with an effective length of 4.8 m and size 250x300 mm is

[A] 0.80
[B] 0.95
[C] 0.90
[D] 0.85

115. If the velocities of flow of a stream of 10 m depth recorded by a current meter at depths of 2 m and 8 m are 0.7 m and 0.3 m, respectively, the discharge per unit width of the stream in cubic metres, is

[A] 2.5
[B] 5.0
[C] 10.0
[D] None of these

1+G $\qquad \frac{1-0.75}{1+2.75} \qquad$ 3.75

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116. A coarse grained soil sample has void ratio 0.75 and specific gravity 2.75. The critical gradient at which quick sand condition occurs, is

[A] 1.00 [B] 0.50
[C] 0.75 [D] 0.25

117. If one wants to be 90% sure that the design flood in a dam project will not occur during the design life period of 100 years, the recurrence interval for such a flood would be

[A] About 90 years [B] Equal to 100 years
[C] About 110 years [D] Roughly 1000 years

118. The intensity of active earth pressure at a depth of 10 m in a dry cohesionless sand with an angle internal friction 30° and weight 18 kN/m^3, is

[A] 40 kN/m^2 [B] 50 kN/m^2
[C] 60 kN/m^2 [D] 80 kN/m^2

119. A fluid jet discharging from a 4 cm diameter orifice has a diameter 3 cm at its vena contracta. If the coefficient of velocity is 0.98, the coefficient of discharge for the orifice will be

[A] $0.98 \times (0.75)^2$ [B] $(0.75)^2 / 0.98$
[C] $0.98 \times (1.33)^2$ [D] $0.98 / (1.33)^2$

120. A clay strata of 2 m thickness consolidates 80% in 10 years. For 80% consolidation of 8 m thick of same clay layer, required time is

[A] 100 years [B] 160 years
[C] 140 years [D] 120 years

121. A vehicle is travelling at a speed of 80 km/hour on concrete pavement. For the coefficient of friction between tyre and pavement surface being 0.35, stopping distance for the vehicle is

[A] 44.44 m [B] 75.99 m
[C] 116.43 m [D] 232.86 m

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122. Given that Plasticity Index (PI) of local soil = 15 and PI of sand = zero, then for a desired PI of 6, the percentage of sand in the mix should be

[A] 70 [B] 60
[C] 40 [D] 30

123. A soil has a discharge velocity of $6x10^{-7}$ m/s and a void ratio of 0.5. Find its seepage velocity

[A] $18x10^{-7}$ m/s [B] $12x10^{-7}$ m/s
[C] $6x10^{-7}$ m/s [D] $3x10^{-7}$ m/s

124. A summit curve is formed at the intersection of a 3% up gradient and 5% down gradient. To provide a stopping distance of 128 m, the length of summit curve needed will be

[A] 271 m [B] 340 m
[C] 322 m [D] 298 m

125. An old short column 20 cm x 20 cm in section is reinforced with 4 bars whose area of cross sectional area is 20 sq. cm. If permissible compressive stresses in concrete and steel are 4.0 MPa and 130 MPa, the safe load on the column, should not exceed

[A] 41.2 kN [B] 412 kN
[C] 412 0 kN [D] None of these

126. For a sleeper density of (n+5), the number of sleepers required for constructing a broad gauge railway track of length 650 m is

[A] 900 [B] 918
[C] 975 [D] 880

127. The following consecutive readings were taken with a dumpy level and a 3 m staff on a continuously sloping ground.

0.425, 1.035, 1.950, 2.360, 2.950, 0.750, .565, 2.450, 0.320, 1.025, 2.165, 2.955.
Which of the following reading are backsight ?

[A] 0.425, 2.950, 0.750, 0.320 [B] 0.425, 0.750, 0.320, 2.955
[C] 0.425, 0.750, 0.320 [D] 0.425, 2.360, 0.750, 0.320

128. The back staff reading on a bench mark (B. M.) of R. L 300 m is 2.685 m and fore sight reading on a point is 1.345 m. The reduced level of that point is

[A] 302.685 m
[B] 30 .345 m
[C] 304.030 m
[D] 30 .340 m

129. A city supply of 15000 cubic metres of water per day is treated with a chlorine dosage of 0.5 ppm. For this purpose, the requirement of 25% bleaching powder per day would be

[A] 300 kg
[B] 75 kg
[C] 30 kg
[D] 7. kg

130. In a BOD test, 1.0 ml of raw sewage was diluted to 00 ml and the dissolved oxygen concentration of diluted sample was 6.0 ppm. On incubating the diluted sample for 5 day at 20°C, its BOD was 4.0 ppm. The BOD of raw sewage was

[A] 100 ppm
[B] 200 ppm
[C] 300 ppm
[D] None of these

------xxxx….. Civil Engineering (Code – 31) Paper Ends---------xxxx----------