101 – TEST FOR B TECH / 5 YR INTEGRATED MSC
(SHIFT III)

PHYSICS

1. A certain screw gauge has a pitch of 0.5 mm. If there are 50 divisions on the head scale, the dimension of the object can then be determined to an accuracy of

   (A) 0.05 cm
   (B) 0.01 cm
   (C) 0.001 cm
   (D) 0.0001 cm

2. The refractive index of glass measured by a given method by four independent measurements is found to have values of 1.54, 1.58, 1.52 and 1.56 respectively. The mean value of refractive index with percentage error is

   (A) 1.55 ± 1.29 %
   (B) 1.55 ± 0 %
   (C) 1.56 ± 6 %
   (D) 1.56 ± 0 %

3. A particle moves for 20 seconds with velocity 3 m/s and then with velocity 4 m/s for another 20 seconds and finally moves with velocity 5 m/s for next 20 seconds. Then the average velocity of the particle is

   (A) 3 m/s
   (B) 4 m/s
   (C) 5 m/s
   (D) Zero

4. An athlete completes one round of a circular track of radius R in 40 s. What will be his displacement at the end of 2 min 40 seconds?

   (A) $8R$
   (B) $8\pi R$
   (C) $2R$
   (D) Zero

5. A wheel having 1 m diameter makes 60 revolutions per minute. The linear speed of a point on its circumference is

   (A) $\pi/2$ m/s
   (B) π m/s
   (C) 2π m/s
   (D) 60π m/s

6. A car starts from rest to cover a distance *s*. The coefficient of friction between the road and the tyres is μ. The maximum time in which the car can cover the distance is proportional to

(A) μ
(B) $\sqrt{\mu}$
(C) $1/\mu$
(D) $1/\sqrt{\mu}$

7. A diesel engine pumps 40 kg of water in 1 second. The water comes out vertically upwards with a velocity of 3 m/s. What is the power of the engine in kilo Watt?

(A) 12 kW
(B) 1.2 kW
(C) 120 kW
(D) 1200 kW

8. Which one of the following is the S.I. unit of electric field strength?

(A) Am^{-1}
(B) Nm^{-1}
(C) Vm^{-1}
(D) Coulomb $s^{-1}cm^{-1}$

9. If the distance between the two charged particles is reduced to half the original distance, then the force between them becomes

(A) doubled
(B) one-forth
(C) one-half
(D) four times

10. A metal sheet is placed between two charges separated by a distance. Then the force between them will

(A) increase
(B) decrease
(C) remains the same
(D) be reduced to half the initial value

11. If the separation between carbon and oxygen in CO molecule is 0.12 nm, then the distance of the center of mass from the carbon atom is

(A) 0.03 nm
(B) 0.068 nm
(C) 0.05 nm
(D) 0.06 nm

12. A hole is drilled along the earth's diameter and a stone is dropped into it. When the stone is at the center of the earth, it has

(A) mass
(B) weight
(C) potential energy
(D) zero mass

13. Two wires of the same radius and material have lengths in the ratio 1:2. If these are stretched by the same force, the strain produced in the two cases will be in the ratio

(A) 1:2
(B) 2:1
(C) 1:1
(D) 4:1

14. The phase difference between the displacement and velocity of a particle executing SHM is

(A) $\pi/2$
(B) π
(C) $\pi/4$
(D) 0

15. Standing waves are produced in a 10 m long stretched string. If the string vibrates in 5 segments and the wave velocity is 20 m/sec, the frequency is

(A) 2 Hz
(B) 4 Hz
(C) 5 Hz
(D) 10 Hz

16. A parallel plate condenser is charged and isolated. When a sheet of glass is interposed between the plates

(A) the charges on the plates will be reduced
(B) the potential difference between the plates will be reduced
(C) the potential difference between the plates will be increased
(D) the charges on the plates will be increased

17. If a capacitor of Capacitance 10 micro Farad (μF) is charged to a potential difference of 100 V, the energy stored in it is

(A) 0.5 J
(B) 0.05 ergs
(C) 10 J
(D) 0.05 J

18. With increase in altitude, the conductivity of the atmosphere

(A) first increases and then decreases
(B) increases
(C) decreases
(D) remains constant

19. An electric iron box has a heater coil of resistance 50 Ω. If it is connected to 230 V AC mains, the current flowing through the heater coil will be

(A) 4.6 mA
(B) 5 A
(C) 4.6 A
(D) 15 A

20. Glass has a resistivity of the order of

(A) 10^{-8} Ω m
(B) 10^{-5} Ω m
(C) 10^{8} Ω m
(D) 10^{12} Ω m

21. A long solenoid of n turns has a self inductance L and area of cross section a. When a current flows through the solenoid, it produces a magnetic field B. The current flowing through the solenoid is

(A) $B\,a\,n\,/\,L$
(B) $BanL$
(C) $Bn\,/\,aL$
(D) $B\,/\,anL$

22. A conductor of length r moves in a uniform magnetic field of induction B with a velocity $\boldsymbol{v}$. The emf induced across the conductor is

(A) $(v \times B)\,.\,r$
(B) $v.\,(r \times B)$
(C) $B\,.\,(r \times v)$
(D) $r \times (v \times B)$

23. The penetrating powers of α, β and γ radiation, in decreasing order are

(A) α, β, γ
(B) γ, α, β
(C) β, γ, α
(D) γ, β, α

24. A half-wave rectifier is being used to rectify an alternating voltage of frequency 50 Hz. The number of pulses of rectified current obtained in one second is

(A) 50
(B) 25
(C) 100
(D) 6

25. The voltage V and the current I flowing through an A.C circuit are given by $V = 2 \cos 100\,\pi t$ and $I = 4 \sin 100\,\pi t$, where t represents time. The power dissipated in the circuit is

(A) zero Watt
(B) 8 Watt
(C) 4 Watt
(D) 2 Watt

26. An alternating e.m.f. is given by $V = 100 \sin 314\, t$. Its frequency is

(A) 100 Hz
(B) 50 Hz
(C) 314 Hz
(D) 60 Hz

27. In a purely inductive circuit, the current

(A) is in phase with voltage
(B) is out of phase with voltage
(C) leads the voltage by 90°
(D) lags behind the voltage by 90°

28. The current and voltage in an A.C. circuit are given by $I = I_o \sin\left(\omega t - \frac{\pi}{2}\right)$ and $E = E_o \sin \omega t$. Then the average power consumption P in the circuit is

(A) $P = \frac{E_o I_o}{\sqrt{2}}$
(B) $P = \frac{EI}{\sqrt{2}}$
(C) $P = \frac{E_o I_o}{2}$
(D) zero

29. Two electric bulbs whose resistances are in the ratio 1:2, are connected in parallel to a constant voltage source. The power dissipated in them is in the ratio

(A) 1:2
(B) 2:1
(C) 1:1
(D) 1:4

30. The neutral temperature for a thermocouple is 270°C. If the temperature of the cold junction is 15°C, then the inversion temperature is

(A) 255°C
(B) 285°C
(C) 570°C
(D) 525°C

31. A source emits a sound of frequency 400 Hz but the listener hears it to be 390 Hz. Then

(A) the listener is moving towards the source
(B) the source is moving toward the listener
(C) the listener is moving away from the source
(D) the listener has a defective ear

32. The binding energy of the electron in a hydrogen atom is 13.6 eV, the energy required to remove the electron from the first excited state of Li^{++} is

(A) 122.4 eV
(B) 30.6 eV
(C) 13.6 eV
(D) 3.4 eV

33. Which of the following nuclei has lowest value of the binding energy per nucleon?

(A) ${}_{2}He^{4}$
(B) ${}_{24}Cr^{52}$
(C) ${}_{62}Sm^{152}$
(D) ${}_{80}Hg^{100}$

34. The average number of neutrons emitted during the fission of U^{235} is

(A) 3
(B) 2
(C) 1.5
(D) 2.5

35. The radioactive decay of uranium into thorium is represented by the equation ${}_{92}U^{238} \rightarrow {}_{90}Th^{234} + X$, then X is

(A) an electron
(B) a neutron
(C) a proton
(D) an alpha particle

36. The same radioactive nucleus may emit

(A) all the three α, β and γ simultaneously
(B) either α or β or γ at a time
(C) all the three α, β and γ at a time
(D) only α and β

37. The radius of a nucleus of mass number A is proportional to

(A) A
(B) $A^{½}$
(C) $A^{⅓}$
(D) A^{3}

38. Which one of the statements about nuclear forces is INCORRECT?

(A) Nuclear forces are short range forces
(B) Nuclear forces are charge independent forces
(C) Nuclear forces are exchange forces
(D) Nuclear forces are central forces

39. Which one of the statements about neutron is INCORRECT?

(A) Neutron is a fundamental particle
(B) Neutron has no charge
(C) Nuclei of all elements in nature contain neutron
(D) Neutron has a spin

40. The ground state energy of the hydrogen atom is

(A) 13.6 eV
(B) 0 eV
(C) –3.4 eV
(D) –13.6 eV

41. Which one of the statements about matter waves is INCORRECT?

(A) Matter waves are not electromagnetic waves
(B) Matter waves are also called probability waves
(C) de Broglie waves are pilot waves i.e., these waves guide the particle
(D) The phase velocity of the matter waves in vacuum is independent of wavelength

42. Kinetic energy of the cathode rays (electrons) depend on

(A) voltage applied to the electrode
(B) depend on work function
(C) depend on both (A) and (B)
(D) does not depend on any physical quantity

43. A man cannot see objects clearly at a distance greater than 2 m. He is then suffering from

(A) short sight
(B) long sight
(C) astigmatism
(D) presbyopia

44. The magnifying power of a simple microscope can be increased by if we use eyepiece of

(A) higher focal length
(B) smaller focal length
(C) higher diameter
(D) smaller diameter

45. If the focal length of the objective and eyepiece lens of an astronomical telescope are f_o and f_e respectively, then its magnifying power is

(A) $\frac{f_o}{f_e}$
(B) $\frac{f_e}{f_o}$
(C) $\frac{2f_o}{f_e}$
(D) $2f_e$

46. If f_r and f_v stand for focal length of the lens for red colour and violet colour respectively, then the longitudinal chromatic aberration of the lens for parallel rays is given by

(A) $f_r - f_v$
(B) $f_v - f_r$
(C) $f_r\ f_v$
(D) $f_v + f_r$

47. The deviation produced by a flint glass prism for violet and red light rays are 3.25° and 3.10° respectively. Then the angular dispersion is

(A) 6.35°
(B) 3.175°
(C) 0.15°
(D) 6.35 radians

48. Total internal reflection is NOT possible in the case when light travels from

(A) glass to air
(B) glass to water
(C) water to glass
(D) water to air

49. When the angle of incidence on a certain material is 60°, the reflected light is completely polarized. The angle of refraction is then

(A) 60°
(B) 90°
(C) 30°
(D) 45°

50. A sugar solution of length 15 cm has specific rotation of 65° and produces a optical rotation of 7°. Then the concentration of the solution is

(A) 0.7 g/cc
(B) 13.9 g/cc
(C) 0.0717 g/cc
(D) 0.01g/cc

51. To observe diffraction, the size of an obstacle

(A) should be of the order of wavelength
(B) should be much larger than the wavelength
(C) has no relation to wavelength
(D) should be exactly $\lambda/2$.

52. If the distance between the screen and the slit is doubled in Young's double slit experiment, the fringe width will become

(A) four times
(B) two times
(C) one-half
(D) one-fourth

53. When light waves suffer reflection at the interface between air and glass, the change of phase of the reflected wave is

(A) zero
(B) π
(C) 2π
(D) $\pi/2$

54. If a string of string constant k is stretched by a length x under tension T, the energy stored is

(A) $\frac{2k}{T^2}$

(B) $\frac{2T^2}{k^2}$

(C) $\frac{T^2}{2k}$

(D) $\frac{2T}{k^2}$

55. The Young's modulus of a perfectly rigid body is

(A) zero
(B) unity
(C) infinite
(D) may be any finite non-zero value

56. A wire elongates by l mm when a load W is hanged at from it. If the wire goes over a pulley and the two weights W each are hung at the two ends, the elongation of the wire (in mm) will be

(A) $l/2$
(B) l
(C) $2l$
(D) zero

57. If two liquids of same masses but densities ρ_1 and ρ_2 respectively are mixed, then the density of the mixture is

(A) $\rho_1 + \rho_2$

(B) $\frac{\rho_1 + \rho_2}{2}$

(C) $\frac{\rho_1 \rho_2}{\rho_1 + \rho_2}$

(D) $\frac{2\rho_1 \rho_2}{\rho_1 + \rho_2}$

58. A boy carries on his head an airtight box containing a bird resting on the floor of the box. When the bird starts flying inside the box, he will feel that the box is now

(A) lighter
(B) heavier
(C) same in weight as before
(D) lighter in the beginning and heavier later

59. A cork ball is floating on the surface of water in a beaker. The beaker is covered with a bell jar and the air is evacuated. What will happen to the ball?

(A) Sink a little
(B) Rise a little
(C) Remain unchanged
(D) Sink completely

60. The thermometer used as a reference standard is

(A) mercury thermometer
(B) platinum resistance thermometer
(C) gas thermometer
(D) thermocouple thermometer

61. If α is coefficient of linear expansion, β is coefficient of superficial expansion and γ is the coefficient of cubical expansion, then for the same rise in temperature, the percentage changes in α, β and γ are in the ratio

(A) 1:2:3
(B) 3:2:1
(C) 1:1:1
(D) 1:2:4

62. If K and σ respectively are the thermal and electrical conductivities of a metal at absolute temperature T, then

(A) $\frac{K}{\sigma T}$ = constant
(B) $\frac{K}{\sigma}$ = constant
(C) $\frac{K}{T}$ = constant
(D) $\frac{\sigma}{KT}$ = constant

63. The velocity V of thermal radiation is (C = velocity of light in vacuum)

(A) $V < C$
(B) $V > C$
(C) $V = C$
(D) dependent on the medium

64. Which one of the following statements about electromagnetic waves is INCORRECT?

(A) They do not require material medium for propagation
(B) They are not deflected in electric an magnetic fields
(C) The waves are transverse in nature
(D) They cannot be diffracted

65. If $\vec{E}$ and $\vec{B}$ represent electric and magnetic field vectors of the electromagnetic waves, then the direction of propagation of the waves will be along

(A) $\vec{B} \times \vec{E}$
(B) $\vec{E}$
(C) $\vec{B}$
(D) $\vec{E} \times \vec{B}$

66. The area of B-H hysteresis loop in a ferromagnetic material is a measure of the

(A) net energy dissipated per unit volume per cycle of magnetization of the material
(B) permeability of the material
(C) susceptibility of the material
(D) retentivity of the material

67. The unit cubic cell of Al has an edge length equal to 4.5×10^{-10} m. The number of unit cells in an aluminium foil of volume 91×10^{-6} m^3 is

(A) 10^{24}
(B) 10^{-24}
(C) 10^{8}
(D) 10^{23}

68. The gate with the Boolean expression $Y = \overline{A \cdot B}$ for its output is

(A) AND
(B) NAND
(C) XOR
(D) XNOR

69. The Boolean expression for NOR gate is

(A) $Y = A + \overline{B}$
(B) $Y = \overline{A + B}$
(C) $Y = \overline{A} + B$
(D) $Y = \overline{A} + \overline{B}$

70. What gate has the truth table given below?

A	B	Y
0	0	0
0	1	0
1	0	0
1	1	1

(A) NOT
(B) AND
(C) NAND
(D) NOR

71. A transistor amplifier is operated in common emitter configuration at constant collector voltage of V_C = 1.5 V, such that the change in the base current from 100 μA to 150 μA produces a change in the collector current from 5 mA to 10 mA. The current gain β of the circuit is then

(A) 50
(B) 67
(C) 75
(D) 100

72. A two stage transistor amplifier has a gain of 10 for the first stage and a gain of 20 for the second stage. The overall gain of the cascade amplifier will be

(A) 30
(B) 10
(C) 200
(D) 2

73. Long range radio transmission is possible when the radio waves are reflected from the ionosphere. For this to happen, the frequency of the radio waves must be in the range

(A) 80-150 MHz
(B) 8-25 MHz
(C) 1-3 MHz
(D) 150-1500 kHz

74. The colour of a star is dependent on its

(A) radius
(B) distance from the earth
(C) temperature
(D) structure

75. Hubble constant *H* has the dimensions of

(A) mass
(B) length
(C) $(\text{time})^{-1}$
(D) temperature

CHEMISTRY

76. Given the latent heat of vapouration of water as 40.7 kJ mol^{-1} at 373 K, ΔS for one mole of water converted to steam at 373 K is

(A) 109.1 JK^{-1} mol^{-1}
(B) 40.7 kJ mol^{-1}
(C) 81.4 kJ mol^{-1}
(D) 218.2 JK^{-1} mol^{-1}

77. For a non-linear triatomic gas the value of the ratio of C_p and C_v at laboratory temperature is (assuming no vibrational contribution)

(A) 7/5
(B) 9/7
(C) 8/3
(D) 4/3

78. 6 moles of SO_2 and 6 moles of O_2 are allowed to form SO_3 in a closed vessel. At the equilibrium stage, 60% of SO_2 is used up. The total number moles of the mixture at equilibrium is

(A) 10.2
(B) 9.8
(C) 7.2
(D) 11.2

79. pH of a solution obtained by mixing equal volumes of the solutions with pH 3 and pH 5 is

(A) 4.0
(B) 3.5
(C) 3.3
(D) 2.0

80. The K_{sp} of AgCl is 1×10^{-10}, its solubility in pure water in 0.01 M NaCl is

(A) 2×10^{-10}
(B) 1×10^{-8}
(C) 2×10^{-8}
(D) 1×10^{-10}

81. The edge length of fcc unit cell is 508 pm. The radius of the atom is …… pm.

(A) 180
(B) 200
(C) 618
(D) 288

82. Crystalline solids having the least enthalpy of fusion is

(A) Molecular solid
(B) Metallic solid
(C) Ionic solid
(D) Covalent solid

83. Vapour pressure of water at 298 K is 19.8 mm of Hg. 0.1 mole of glucose is dissolved in 172.8 g of water. The vapour pressure of the solution is

(A) 19.6 mm
(B) 16.9 mm
(C) 19.0 mm
(D) 18.9 mm

84. Osmotic pressure of blood is 8.21 atm at 37°C. Amount of glucose that should be used per litre of intravenous injection that is at the same osmotic pressure of blood is

(A) 58.4 g
(B) 29.2 g
(C) 5.84 g
(D) 2.92 g

85. The equitant conductance of 1 M benzoic acid is 12.8 $Scm^2\ eq^{-1}$ and if the limiting equivalent conductance of benzoate ion and H^+ ion are 42 and 288.42 $Scm^2\ eq^{-1}$, respectively, its degree of dissociation is

(A) 39%
(B) 3.9%
(C) 0.35%
(D) 0.039%

86. Two half-cells of electrode potentials of E_1 and E_2 are combined to form a cell of potential E_3, (n_1, n_2 and n_3 are number of electrons involved in first electrode, second electrode and the cell) E_3 is

(A) $E_3 = E_2 - E_1$
(B) $E_3 = (E_1n_1 + E_2n_2)/n_3$
(C) $E_3 = (E_1n_1 - E_2n_2)/n_3^2$
(D) $E_3 = E_1 + E_2$

87. The potential of half-cell consisting of zinc electrode in 0.01 M $ZnSO_4$ solution at 25°C is (E° = –0.763 V)

(A) –0.8221 V
(B) –0.704 V
(C) –0.881 V
(D) –0.645 V

88. A dilute aqueous solution of $CuSO_4$ is electrolyzed using Pt electrodes. The products at the anode and cathode are

(A) O_2, H_2
(B) H_2, O_2
(C) O_2, Cu
(D) $S_2O_8^{2-}$, H_2

89. The half-life for radioactive decay of C^{14} is 5730 years. An archaeological artefact containing wood had only 80% of the C^{14} found in living tree. The age of the sample is

(A) 1845 years
(B) 2865 years
(C) 4584 years
(D) 1146 years

90. If the volume of the reaction vessel is halved, for the reaction, $2SO_2(g) + O_2(g) \rightarrow 2SO_3(g)$, then the rate is

(A) $1/6^{th}$ of its initial value
(B) $1/4^{th}$ of its initial value
(C) 8 times of its initial value
(D) 4 times of its initial value

91. The rate equation for a reaction: $A \rightarrow B$ is $r = k[A]^0$. If the initial concentration of the reactant is 'a' mol dm^{-3}, then half-life period of reaction is

(A) a/k
(B) 2a/k
(C) a/2k
(D) k/a

92. The number of unit cells present in 39 g of potassium that crystallizes as body centered cubic structure is (N_A = Avogadro number)

(A) N_A
(B) 0.25 N_A
(C) 0.5 N_A
(D) 0.75 N_A

93. Which one of the following is not correctly matched?

(A) $[Ni(CN)_4]^{2-}$ – dsp^2 hybridization, dia-magnetic
(B) $[Cu(NH_3)_4]^{2+}$ – sp^3 hybridization, para-magnetic
(C) $[NiCl_4]^{2-}$ – sp^3 hybridization, tetrahedral
(D) $[CuCl_4]^{2-}$ – sp^3 hybridization, para-magnetic

94. Which one of the following statements is not true according to Werner's theory of coordination compounds?

(A) Both primary and secondary valencies can be satisfied by anions
(B) Secondary valency is non-directional
(C) Primary valency is ionic valency
(D) Metal ions exhibit two types of valencies

95. Which one of the following is true regarding the energies of d-orbitals of tetragonally distorted octahedral geometry?

(A) $d_{yz} > d_{xz} > d_{xy}$
(B) $d_{x^2-y^2} = d_{z^2}$
(C) $d_{xz} > d_{yz}$
(D) $d_{z^2} > d_{x^2-y^2}$

96. In the estimation of Ca(II) ions, in the presence of ammonia-ammonium chloride buffer solution, EDTA acts as a …… ligand.

(A) flexidentate
(B) pi-donor
(C) hexadentate
(D) tetradentate

97. How much amount of oxalic acid dihydrate crystals are required to prepare 1 L of a decinormal solution of it?

(A) 6.3 g
(B) 12.6 g
(C) 3.15 g
(D) 9 g

98. What is correct order of increasing acidic strength of oxides of nitrogen?

(A) $NO < N_2O_3 < N_2O_4 < N_2O_5$
(B) $NO = N_2O_3 < N_2O_4 = N_2O_5$
(C) $NO > N_2O_3 < N_2O_4 > N_2O_5$
(D) $NO > N_2O_3 > N_2O_4 > N_2O_5$

99. Regarding compounds of sulfur, which one of the following statements in not true?

(A) SF_6 does not undergo hydrolysis
(B) SF_4 undergoes hydrolysis
(C) SF_6 is thermally stable and chemically inert
(D) SF_4 acts as Lewis acid

100. Fluorine does not act as the central atom in interhalogen compounds, because

(A) it is highly electronegative
(B) of absence of d-orbitals
(C) of its small size
(D) of its gaseous nature

101. A hydrometallurgical process involves the following steps.

$Ag_2S + 4\ NaCN \rightarrow 2\ Na[Ag(CN)_2] + Na_2S$

$2\ Na[Ag(CN)_2] + Zn \rightarrow Na_2[Zn(CN)_4] + 2\ Ag\downarrow$

Which one of the following statements is true?

(A) In the second step Zn(II) is reduced to Zn(0)
(B) Dicyanoargentum(I) complex is insoluble in water
(C) In the first step Ag(I) is reduced to Ag(0)
(D) Tetracyanozinc(II) complex is soluble in water

102. Transition metals exhibit variable oxidation states. This is because

(A) the outermost shell is empty
(B) they are all metals
(C) the energies of $(n-1)$d and ns orbitals are almost equal
(D) the ionization energy to remove electron from ns orbital is very low

103. The general electronic configuration of inner-transition elements is

(A) $(n-2)f^{1-14}\ (n-1)d^{0,\ 1}$
(B) $(n-2)f^{1-14}\ (n-1)d^{0-1}\ ns^2$
(C) $(n-1)f^{1-14}\ (n-1)d^{0-1}\ ns^2$
(D) $(n-2)f^{1-14}\ ns^2$

104. Which of the following species would be diamagnetic?

(A) Cr^{3+}
(B) Co^{3+}
(C) Br
(D) Zn^{2+}

105. Which orbital is designated by the quantum numbers: n = 5, l =1, m_l = 0?

(A) 5s
(B) 5p
(C) 5d
(D) 5f

106. If travelling at equal speeds, which of the following matter waves have the longest wavelength?

(A) Electron
(B) Proton
(C) Neutron
(D) α particle

107. Number of angular nodes for 4d orbital is

(A) 4
(B) 3
(C) 2
(D) 1

108. Which of the following will not show deflection from the path on passing through electric field?

(A) Electron
(B) Neutron
(C) Cathode rays
(D) Proton

109. Complete the following nuclear equation:

$^{59}_{27}Co + ^{1}_{0}n \rightarrow ^{56}_{25}Mn + ?$

(A) $4\,^{1}_{1}H$

(B) $4\,^{1}_{1}n$

(C) $^{4}_{2}He$

(D) $2\,^{1}_{1}H$

110. Which among the following sequence is best suited for selective transformation on 2-methylbutane to 2-methylbutan-2-ol?

(A) Treatment with Cl_2 in the presence of UV light followed by hydrolysis with potassium hydroxide in water

(B) Treatment with Cl_2 in the presence of UV light followed by hydrolysis with potassium hydroxide in ethanol

(C) Treatment with Br_2 in the presence of UV light followed by hydrolysis with potassium hydroxide in water

(D) Treatment with I_2 in the presence of UV light followed by hydrolysis with potassium hydroxide in a 1:1 mixture of water and ethanol

111. Ozone depletion in Antartica is due to

(A) sulphur containing gases
(B) peroxy acetyl nitrate
(C) chlorine nitrate
(D) fluorine

112. When an organic compound 'A' was treated sequentially with ammonia and Br_2/KOH, methanamine was obtained. Then 'A' is an

(A) ethanol
(B) ethyl acetate
(C) acetonitrile
(D) acetic acid

113. How many structural isomers are possible for C_3H_9N?

(A) 3
(B) 4
(C) 5
(D) 6

114. Which is a non-reducing sugar?

(A) Glucose
(B) Sucrose
(C) Maltose
(D) Fructose

115. 0.200 g of an organic compound contains 71% carbon. What is the mass of CO_2 produced when it is subjected to complete combustion?

(A) 0.142
(B) 0.039
(C) 0.521
(D) 0.733

116. Consider the following compounds:

(i) hydrazine
(ii) paracetamol
(iii) chlorophyll
(iv) saccharin

How many among them will test negative for nitrogen in Lassaigne's test ?

(A) 1
(B) 2
(C) 3
(D) 4

117. Which among the following is more reactive towards nitration using nitrating mixture?

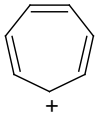
(A) *tertiary*-Butylbenzene
(B) Toluene
(C) Benzene
(D) Chlorobenzene

118. Which among the following is antiaromatic?

(A) 

(B) 

(C) 

(D) 

119. Hydrogenation of acetyl chloride in the presence of Pd-$BaSO_4$ as catalyst to obtain ethanal is

(A) Clemmensen reduction
(B) Rosenmund reduction
(C) Schmidt reaction
(D) Dakin reaction

120. Which among the following compounds will selectively give the same addition product with HBr under both Markonikkoff's and anti-Markonikkoff's addition conditions?

(A) CH_3-CH=CH-CH_2-CH_3
(B) CH_3-CH=CH-C$(CH_3)_2$
(C) CH_3-CH=CH-CH$(CH_3)_2$
(D) C_6H_5-CH=CH_2

121. Among the following, the organic compound that gives propyne on treatment with sodamide with minimal side products is

(A) $CH_3CH_2CHCl_2$
(B) $CH_3CCl=CH_2$
(C) $CH_3CCl=CH_2Cl$
(D) CH_3CCl_2-CH_3

122. Which among the following tests is useful to differentiate between styrene and phenol?

(A) Lucas test
(B) Test with bromine water
(C) Test with bromine in dry chloroform
(D) Test with $KMnO_4$

123. Identify the **incorrect** statement about natural rubber.

(A) Double bonds are located between C_2 and C_3 of each isoprene unit
(B) Has mostly trans double bonds
(C) Intermolecular forces are quite weak
(D) Has a randomly coiled structure

124. The monomer unit/units in cellulose is/are

(A) α-D-glucose
(B) β-D-glucose
(C) Alternating α-D-glucose and D-fructose units
(D) Alternating β-D-fructose and D-fructose units

125. Which among the following vitamins is the most efficient antioxidant?

(A) Vitamin D
(B) Vitamin C
(C) Vitamin B
(D) Vitamin A

MATHEMATICS

126. Suppose $\sqrt{\frac{1+\cos A}{1-\cos A}} = 2$. Then $\tan A =$

(A) $\tan A < 1$
(B) $\tan A > 2$
(C) $\tan A > 1$
(D) $\tan A = \infty$

127. Let a and b be non zero real numbers such that $a^2 + b^2 = 1$. Then

(A) $a + b = 1$
(B) $a + b \leq \sqrt{2}$
(C) $a + b \geq \sqrt{2}$
(D) $a + b = 2$

128. Let $\tan^2 x = 2\tan^2 y + 1$. Then $\sin^2 y =$

(A) $\sin 2x$
(B) $-\cos 2x$
(C) $\cos 2x$
(D) $-\sin 2x$

129. Let $\tan\alpha = \frac{x}{x+1}$ and $\tan\beta = \frac{x+1}{x}$. Then $\alpha + \beta =$

(A) $\frac{\pi}{3}$
(B) $\frac{\pi}{6}$
(C) $\frac{\pi}{2}$
(D) $\frac{\pi}{4}$

130. Let $a = \sin x,\ b = \text{cosec}\, x$ and $a + b = 3$. Then $a^2 + b^2 =$

(A) 3
(B) 5
(C) 7
(D) 9

131. Suppose $\frac{1+\sin 2\theta}{1-\sin 2\theta} = \cot^2(x+\theta)$, then x is equal to

(A) $\frac{\pi}{4}$
(B) $\frac{\pi}{3}$
(C) $\frac{2\pi}{3}$
(D) $\frac{3\pi}{4}$

132. The maximum value of $5\sin^2 x + 4\cos^2 x + \sin\frac{x}{2} + \cos\frac{x}{2}$ is

(A) $5 + 2\sqrt{2}$
(B) $5 - 2\sqrt{2}$
(C) $5 + \sqrt{2}$
(D) $5 - \sqrt{2}$

133. The chances to fail in Mathematics is 20% and the chances to fail in Chemistry is 25%. The chance to fail in at least one subject is

(A) $\frac{11}{13}$
(B) $\frac{14}{15}$
(C) $\frac{2}{5}$
(D) $\frac{11}{12}$

134. An urn contains 4 red and 6 blue balls. The probability that two balls are drawn in which second ball drawn is blue without replacements, is

(A) $\frac{3}{5}$
(B) $\frac{4}{5}$
(C) $\frac{2}{5}$
(D) $\frac{7}{15}$

135. The third moment about the mean for normal distribution is

(A) 5σ
(B) $3\sigma^2$
(C) $7\sigma^2$
(D) 0

136. A box contains 24 identical balls of which 12 are white and remaining black. The balls are drawn at random from the box one at a time with replacement. The probability that a white ball is drawn for the 4^{th} time on the 7^{th} draw is

(A) $\frac{6}{32}$
(B) $\frac{5}{32}$
(C) $\frac{7}{32}$
(D) $\frac{1}{2}$

137. 5 gentlemen and 5 ladies take seats at random round a table. The probability that they are sitting alternatively is

(A) $\frac{3}{126}$
(B) $\frac{1}{252}$
(C) $\frac{1}{126}$
(D) $\frac{3}{252}$

138. Let A and B be two non-empty subsets of a set X such that A is not a subset of B. Then

(A) A and B are disjoint
(B) $B \subseteq A$
(C) A is the complement of B
(D) A and B may be disjoint

139. Let $f : R \to R$ be defined by $f(x) = \cos 2x$. Then f is

(A) a one-to-one function
(B) an onto function
(C) both one-to-one and onto function
(D) neither one-to-one nor onto function

140. Let $f\left(z+\frac{1}{z}\right)=z^2+\frac{1}{z^2}$ for all real $z \in R \setminus \{0\}$. Then $f(z)=$

(A) z^2
(B) z^2-1
(C) z^2-2 for all $|z| \geq 2$
(D) z^2+2 for all $|z| \geq 2$

141. Define $f(x)=|x-1|$ for all real numbers x. Then

(A) $f\left(x^2\right)=\left(f(x)\right)^2$ for all x
(B) $f(x+y)=f(x)+f(y)$ for all x, y
(C) $f\left(|x|\right)=|f(x)|$ for all x
(D) All (A) to (C) above are not true

142. The sum $\sum_{i=1}^{\infty} \frac{1}{i!}\left(\sum_{k=1}^{i} 2^{k-1}\right)$ is equal to

(A) e^2-e
(B) e^2+e
(C) e^2+1/e
(D) $e+1/e$

143. If $S=\sum_{n=0}^{\infty} \frac{(\log x)^{2n}}{(2n)!}$, then $S=$

(A) $x+x^{-1}$
(B) $x-x^{-1}$
(C) $\frac{x+x^{-1}}{2}$
(D) 0

144. The sum of the series $\frac{2^2}{2!}+\frac{3^2}{3!}+\ldots+\infty$ is

(A) $2e$
(B) $2e^2$
(C) $e/2$
(D) $-e/2$

145. If $y=-\left(x^3+\frac{x^6}{2}+\frac{x^9}{3}+\ldots+\infty\right)$

(A) $x=1-e^y$
(B) $x=1+e^y$
(C) $x^3=1-e^y$
(D) $x^3=1+e^{-y}$

146. Sum of the series $\frac{2}{1!}+\frac{4}{3!}+\frac{6}{5!}+\ldots+\infty$

(A) e
(B) e^2
(C) $-e$
(D) $-e^2$

147. The value of $f(\theta)=\begin{vmatrix}\cos^2\theta & \cos\theta\sin\theta & \sin\theta\\ \cos\theta\sin\theta & \sin^2\theta & -\cos\theta\\ \sin\theta & -\cos\theta & 0\end{vmatrix}$

(A) 0
(B) 1
(C) -1
(D) 2

148. If A is a skew-symmetric matrix of order n, then the trace of A is

(A) n^2
(B) n
(C) 0
(D) 1

149. Suppose $A=\begin{vmatrix} y-1 & 0 & 7 \\ y^2-1 & y-1 & 8 \\ 2y & 3y & 0 \end{vmatrix}=ay^3+by^2+cy+d$. Then

(A) $c=-17, d=0$
(B) $b=38, d=0$
(C) $a=-21, b=38$
(D) $a=21, d=0$

150. Let $A=\begin{bmatrix} 4x-7 & 2 & 2 \\ 2 & 4x-7 & 2 \\ 2 & 2 & 4x-7 \end{bmatrix}$. One of the root of the equation $|A|=0$ is

(A) $3/4$
(B) $-3/4$
(C) $4/3$
(D) $-4/3$

151. Let A be the matrix $\begin{bmatrix} -2 & 0 & 0 \\ 0 & -2 & 0 \\ 0 & 0 & -2 \end{bmatrix}$. Then the value of $|adj\ A|$ is equal to

(A) 8
(B) 64
(C) 16
(D) 32

152. Given that the matrix $\begin{bmatrix} 1/36 & 0 \\ x & 1/36 \end{bmatrix}=\begin{bmatrix} 6 & 0 \\ -a & 6 \end{bmatrix}^{-2}$. Then the value of x is

(A) $\frac{a}{108}$
(B) $\frac{5a}{108}$
(C) $\frac{3a}{118}$
(D) $\frac{a}{118}$

153. For a positive integer n, the third term in the expansion of $\left(\sqrt[4]{a}+\frac{a}{\sqrt{a^{-1}}}\right)^n$ is $15a^4$. Then the value of n is

(A) 6
(B) -5
(C) 3
(D) 15

154. $\sum_{i=0}^{k}\frac{i.{}^kC_i}{{}^kC_{i-1}}$ is equal to

(A) $\frac{k(2k+1)}{2}$
(B) $\frac{k(k+1)}{2}$
(C) $\frac{k(2k-1)}{2}$
(D) $\frac{k(k^2+1)}{2}$

155. The coefficient of x^8 in the expansion of $\left[(1+x)^7+(1+x)^8+...+(1+x)^{14}\right]$

(A) ${}^{15}C_8$
(B) ${}^{15}C_6$
(C) ${}^{15}C_4$
(D) ${}^{15}C_5$

156. Given that the coefficient of x^7 and x^8 in the expansion of $\left(2+\frac{x}{4}\right)^n$ are equal. Then n =

(A) 91
(B) 8.7!
(C) 71
(D) 7.8!

157. Number of terms in the expansion of $\left(y^2+\sqrt{y^2-1}\right)^4+\left(y^2-\sqrt{y^2-1}\right)^4$ is

(A) 10
(B) 8
(C) 6
(D) 5

158. There are 5 letters and 5 different envelopes. The number of ways in which all the letters can be put in wrong envelope is

(A) 119
(B) 44
(C) 59
(D) 40

159. The number of diagonals in an octagon will be

(A) 12
(B) 16
(C) 18
(D) 20

160. The number of divisors of the form $4n+2\ (n\geq 0)$ of the integer 240 is equal to

(A) 3
(B) 4
(C) 12
(D) 15

161. There are three coplanar parallel lines. If any p points are taken on each of the lines, the maximum number of triangles with vertices at these points is

(A) $p^2(p+3)$
(B) $p^2(p-3)$
(C) $p^2(4p+3)$
(D) $p^2(4p-3)$

162. In class of 18 students, every student has to hand shake with every other student. The total number of handshakes was

(A) 17
(B) 18
(C) 153
(D) 306

163. Total number of numbers that are less than 4.10^6 and can be formed using the digits 1, 2, 3 is equal to

(A) $\frac{9.3^8+3}{2}$
(B) $\frac{9.3^8-2}{3}$
(C) $\frac{9.3^8+3}{3}$
(D) $\frac{9.3^8-3}{2}$

164. A variable name in certain computer language must be either an alphabet or an alphabet followed by a decimal digit. Total number of different variable names that can exist in that language is equal to

(A) 280
(B) 286
(C) 290
(D) 296

165. Let $X = \{a \mid a \text{ is a prime number and } a < 30\}$. The number of different rational numbers whose numerator and denominator belong to X is

(A) 90
(B) 91
(C) 180
(D) 181

166. Let $z^2 - z + 1 = 0$ and z be a complex number. Then the value of $z^n - z^{-n}$, where n is a multiple of 3 is

(A) $2(-1)^n$
(B) 2^n
(C) $(-1)^{n+1}$
(D) 0

167. Assume that $(1+i)(1+2i)(1+3i)...(1+xi)=\alpha+i\beta$. Then $2.5.10...\left(1+x^2\right)$ is equal to

(A) $\alpha^2-\beta^2$
(B) $\alpha^2+\beta^2$
(C) $\alpha-i\beta$
(D) $\alpha.\beta$

168. If ω is a cube root of unity, then $\left(3+5\omega+3\omega^2\right)^2+\left(3+3\omega+5\omega^2\right)^2$ is equal to

(A) –2
(B) 2
(C) 4
(D) –4

169. $\cos\left(i\log\left(\frac{x-iy}{x+iy}\right)\right)$ is equal to

(A) $\frac{x^2-y^2}{x^2+y^2}$
(B) $\frac{xy}{x^2+y^2}$
(C) $\frac{x^2-y^2}{2xy}$
(D) $\frac{2xy}{x^2+y^2}$

170. Let z be a complex number satisfying the relation $|z-36|^2=36|z-1|^2$.
Then $|z|$ is equal to

(A) 5
(B) 6
(C) 7
(D) 8

171. If z is a complex number such that $\left|\frac{z-1}{z+1}\right| = 0$ is purely real. Then

(A) z is purely imaginary
(B) z is purely real
(C) $|z| = 1$
(D) $\text{Re}(z) \neq 0$ and $\text{Im}(z) \neq 0$

172. The product of all values of $(\cos x + i \sin x)^{\frac{3}{4}}$ is

(A) $(\cos 4x + i \sin 4x)$
(B) $(\cos 4x - i \sin 4x)$
(C) $(\cos 3x - i \sin 3x)$
(D) $(\cos 3x + i \sin 3x)$

173. Let z be a complex number such that $|z+4| \leq 3$. Then

(A) $|z+1| = 6$
(B) $0 \leq |z+1| \leq 6$
(C) $|z+1| = 0$
(D) $3 \leq |z+1| \leq 6$

174. Let $a, b, c > 0$. Then $a(1-b) > \frac{1}{4}$, $b(1-c) > \frac{1}{4}$, $c(1-a) > \frac{1}{4}$

(A) are never possible
(B) are always possible
(C) are sometimes possible
(D) cannot be discussed

175. The inequality $\frac{2}{x} < 3$ is true, when x belongs to

(A) $[2/3, \infty)$
(B) $(-\infty, 2/3]$
(C) $(2/3, \infty) \cup (-\infty, 0)$
(D) $(-\infty, 0)$

176. Let $\alpha \in \left(0, \frac{\pi}{2}\right)$. The value of the expression $\sqrt{x^2+x} + \frac{\sin^2 \alpha}{\sqrt{x^2+x}}$ is always greater than or equal to

(A) 1
(B) 2
(C) $2\sin\alpha$
(D) $2\text{cosec}\ \alpha$

177. Solutions of $2y - 3 = |y + 6|$ are

(A) $-1, -1$
(B) $1, -1$
(C) $-1, 9$
(D) 9

178. If $a \in R$ and $m = \frac{a^2}{1+a^4}$ is real, then

(A) $0 \le m \le \frac{1}{2}$
(B) $0 \le m \le 1$
(C) $0 \le m \le 2$
(D) $0 \le m \le \infty$

179. Let *a, b, c* be three distinct numbers which are in a Geometric Progression. Also the numbers *a*, 2*b*, 3*c* are in an Arithmetic Progression. Then the common ratio of the Geometric Progression is

(A) 3
(B) 1
(C) $\frac{2}{3}$
(D) $\frac{1}{3}$

180. Three positive real numbers *x*, *y*, *z* are in Arithmetic Progression and *xyz* = 4. The the minimum value of *y* is

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

181. The maximum possible integer value of sum $15+14\frac{1}{7}+13\frac{2}{7}+...$ is

(A) 134
(B) 136
(C) 138
(D) 140

182. Let S_n denotes the sum of n terms of an Arithmetic Progression.
Then the value of $S_{n+3}-5S_{n+2}+7S_{n+1}-3S_n$ is

(A) 0
(B) 3
(C) 6
(D) 9

183. The sum of 10 terms of the series $\sqrt{3}+\sqrt{12}+\sqrt{48}+...$

(A) $S=1023\sqrt{3}$
(B) $S=1023\sqrt{2}$
(C) $S=1025\sqrt{2}$
(D) $S=1025\sqrt{3}$

184. The harmonic mean of two numbers is 8. Also their arithmetic mean is A and geometric mean is G. If G satisfies $2A + G^2 = 90$, then the numbers are

(A) $2,-2$
(B) $6,-12$
(C) $2,12$
(D) $6,12$

185. The sum $\sum_{r=1}^{n}\frac{r^2-r-1}{(r+1)!}$ is equal to

(A) $\frac{n}{(n+1)!}$
(B) $-\frac{1}{(n+1)(n-1)!}$
(C) $\frac{n}{(n+1)!}-1$
(D) $-\frac{n}{(n+1)!}-1$

186. The equation $\sqrt{y+2-4\sqrt{y-2}}+\sqrt{y+7-6\sqrt{y-2}}=1$ has

(A) no solution
(B) one solution
(C) two solutions
(D) more than two solutions

187. Let α and β be the roots of the equation $my^2 - ny - p = 0$.
Then the root of the equation $(m + px)^2 = n^2x$ are

(A) $\alpha+\beta, \alpha-\beta$
(B) $\frac{1}{\alpha^2}, \frac{1}{\beta^2}$
(C) $\frac{1}{\alpha^2}, -\frac{1}{\beta^2}$
(D) α^2, β^2

188. If the roots of the equation $y^2 - 2my + m^2 + m - 3 = 0$ are real and less than 3, then

(A) $m = 1$
(B) $m < -1$
(C) $m = 2$
(D) $m < 2$

189. Let β, β^2 be the roots of the equation $y^2+4y+1=0$.
Then β^{46}, β^{62} are roots of the equation

(A) $y^2+4y+1=0$
(B) $y^2-4y+1=0$
(C) $y^2-4y-1=0$
(D) $y^2+4y-1=0$

190. The number of real solutions of the equation $\left(\frac{7}{13}\right)^x = -13+x-x^2$ is

(A) 3
(B) 2
(C) 1
(D) 0

191. Given that the sum of the squares of the roots of the equation $y^2-(k-3)y-k-2=0$ is 13. Then number of values of k lying in the interval [1, 4] is

(A) 0
(B) 1
(C) 2
(D) 3

192. Let $8^{\sin^2 x}+8^{\cos^2 x}=6$. Then

(A) $\sin^2 x=\frac{2}{3}$
(B) $\sin x=-\frac{1}{3}$
(C) $\cos^2 x=\frac{1}{2}$
(D) $\cos x=-\frac{1}{2}$

193. The equation $|\sin x|=2\cos x$ has

(A) infinitely many solutions
(B) finitely many solutions
(C) has no solutions in integers
(D) has no solutions

194. The value of x satisfying $1+\cos x+\cos^2 x+\ldots=4+2\sqrt{3}$ in the interval $\left[\frac{\pi}{2},\pi\right]$ is

(A) $\frac{2\pi}{3}$
(B) $\frac{\pi}{2}$
(C) $\frac{4\pi}{5}$
(D) $\frac{3\pi}{4}$

195. In a triangle ABC, let $\frac{2\cos A}{a}+\frac{\cos B}{b}+\frac{2\cos C}{c}=\frac{a}{bc}+\frac{b}{ac}$. Then b^2+c^2 is equal to

(A) a^2
(B) ac
(C) bc
(D) $a+b$

196. Let a,b,c be the sides of a ΔABC. Further two equation $ax^2+bx+c=0$ and $x^2+\sqrt{5}x+2=0$ have a common root. Then the $\angle C=$

(A) $\frac{\pi}{2}$
(B) $\frac{\pi}{4}$
(C) $\frac{\pi}{3}$
(D) $\frac{2\pi}{6}$

197. If the sides of a triangle are proportional to the cosines of the opposite angles, then

(A) the triangle is right angled
(B) the triangle is isosceles
(C) the triangle is equilateral
(D) one of the angle is obtuse

198. Let $a=7,b=4,c=9$ a in a ΔABC. Then the values of $\sin\frac{A}{2}$ and $\cos A$ are equal to respectively

(A) $\sqrt{\frac{4}{13}}$ and $\frac{9}{13}$
(B) $\sqrt{\frac{5}{13}}$ and $\frac{8}{13}$
(C) $\sqrt{\frac{7}{13}}$ and $\frac{6}{13}$
(D) $\sqrt{\frac{6}{13}}$ and $\frac{7}{13}$

199. Given that the lengths of the sides p, q, r of a ΔPQR are in an Arithmetic Progression. Then the ration $\frac{q}{r}$ lies in the interval

(A) $\left(\frac{1}{3}, \frac{2}{3}\right)$

(B) $\left(\frac{2}{3}, 2\right)$

(C) $\left(\frac{2}{3}, 1\right)$

(D) $\left(\frac{1}{3}, \frac{4}{3}\right)$

200. The two adjacent sides *AB* and *BC* of a cyclic quadrilateral *ABCD* are 2 and 5 units respectively and the angle between them is 60°. Then the area of circle circumscribing the quadrilateral *ABCD* is

(A) $\frac{9\pi}{2}$

(B) $\frac{19\pi}{2}$

(C) $\frac{9\pi}{3}$

(D) $\frac{19\pi}{3}$

201. In a ΔABC, $2a^2 + 9b^2 + c^2 = 6ab + 2ac$, then $\cos C$ is equal to

(A) $1/2$

(B) $1/3$

(C) $1/4$

(D) $1/6$

202. In the ΔABC, $(a+b+c)\left(\tan\frac{A}{2}+\tan\frac{B}{2}\right)$ is equal to

(A) $2c\cot\frac{C}{2}$

(B) $2a\cot\frac{A}{2}$

(C) $2b\cot\frac{B}{2}$

(D) $\tan\frac{C}{2}$

203. $\sin\left[\frac{\pi}{6}-\sin^{-1}\left(-\frac{1}{2}\right)\right]$ is equal to

(A) 0
(B) ∞
(C) 1
(D) -1

204. If $\sin A+\cos B=a$ and $\sin B+\cos A=b$, $\sin(A+B)$ is equal to

(A) $\frac{a^2+b^2-2}{2}$

(B) $\frac{a^2+b^2+2}{2}$

(C) $\frac{a^2-b^2+2}{2}$

(D) $\frac{a^2-b^2-2}{2}$

205. The first and last terms of an Arithmetic Progression are 1 and 56. If the sum of its terms is 290, then the number of terms will be

(A) 4
(B) 6
(C) 8
(D) 10

206. Suppose A is a point which is at equidistant from $X(1,3), Y(-3,5)$ and $Z(5,-1)$. Then the point A is

(A) $(-8,-10)$
(B) $(8,-10)$
(C) $(-8,10)$
(D) $(8,10)$

207. The midpoint of the line joining $(-6, 4)$ and $(8,-6)$ divides the line joining $(3, 6)$ and $(-6,-3)$ in the ratio

(A) 2:7 externally
(B) 2:7 internally
(C) 3:7 internally
(D) 3:7 externally

208. The sum of the distances from a point to the two perpendicular lines is 2. The locus of the point is

(A) a square
(B) a pair of straight lines
(C) an ellipse
(D) a parabola

209. If a point $P(2,1)$ is shifted by a distance $\sqrt{2}$ units parallel to the line $x+y=0$, then the new position of P is

(A) $(-1,2)$
(B) $(-1,-2)$
(C) $(1,-2)$
(D) $(1,2)$

210. The length of the common chord of intersection of the circles $x^2+y^2-2x+4y-4=0$ and $x^2+y^2-2x-6y+6=0$ is

(A) 0
(B) 1
(C) 2
(D) 3

211. The equation of the tangents to the circle $x^2 + y^2 = 25$ with 3 as x coordinate are

(A) $3x \pm 5y = 25$
(B) $3x \pm 4y = 5$
(C) $3x \pm 4y = 25$
(D) $3x \pm 5y = 5$

212. The equation of the circumcircle of the triangle formed by the lines $x = 2, y = 0$ and $x + y - 6 = 0$ is

(A) $x^2 + y^2 + 8x - 4y - 12 = 0$
(B) $x^2 + y^2 - 8x - 4y - 12 = 0$
(C) $x^2 + y^2 - 8x - 4y + 12 = 0$
(D) $x^2 + y^2 + 8x - 4y + 12 = 0$

213. The equation of a parabola is $y^2 = 4x$. $P(1, 3)$ and $Q(1, 1)$ are two points in the xy-plane. Then, for the parabola

(A) P and Q are exterior points
(B) P is an interior point while Q is an exterior point
(C) P and Q are interior points
(D) P is an exterior point while Q is an interior point

214. A circle having its center at (2, 3) is cut orthogonally by the parabola $y^2 = 4x$. The possible intersection point of these curves can be

(A) (1, 2) or $\left(3, 3\sqrt{3}\right)$
(B) (9, 6) or $\left(2, 2\sqrt{2}\right)$
(C) (1, 2) or (4, 4)
(D) (1, 3) or $\left(2, 2\sqrt{2}\right)$

215. If the polar of $y^2 = 4ax$ is always touching the ellipse $\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$, then the locus of the pole is

(A) $4a^2x^2 + b^2y^2 = 4a^4$
(B) $4a^2x^2 - b^2y^2 = 4a^4$
(C) $4a^2x^2 - b^2y^2 = 4b^4$
(D) $4a^2x^2 - b^2y^2 = 4b^4$

216. The radius of the circle passing through the foci of the ellipse $\frac{x^2}{16}+\frac{y^2}{9}=1$ and having its center (0, 3) is

(A) 4
(B) 3
(C) $\sqrt{12}$
(D) $\frac{7}{2}$

217. The equation to the hyperbola having its eccentricity 2 and the distance between foci as 8, is

(A) $\frac{x^2}{4}-\frac{y^2}{12}=1$

(B) $\frac{x^2}{12}-\frac{y^2}{4}=1$

(C) $\frac{x^2}{2}-\frac{y^2}{4}=1$

(D) $\frac{x^2}{4}-\frac{y^2}{2}=1$

218. The equation of the hyperbola whose vertices are at (5, 0) and (−5, 0) and $x=\frac{25}{7}$ as one of its directrices, is

(A) $\frac{x^2}{25}-\frac{y^2}{24}=1$

(B) $\frac{x^2}{24}-\frac{y^2}{25}=1$

(C) $\frac{x^2}{16}-\frac{y^2}{25}=1$

(D) $\frac{x^2}{25}-\frac{y^2}{16}=1$

219. $\frac{d}{dx}\left\{\tan^{-1}\left(\frac{3x-x^3}{1-3x^2}\right)\right\}$ is equal to

(A) $\frac{3}{1+9x^2}\forall|x|<\frac{1}{\sqrt{3}}$

(B) $\frac{9}{1+x^2}\forall|x|<\frac{1}{\sqrt{3}}$

(C) $\frac{3}{1+x^2}\forall|x|<\frac{1}{\sqrt{3}}$

(D) $\frac{1}{9+x^2}\forall|x|<\frac{1}{\sqrt{3}}$

220. Let $x=\sec\theta-\cos\theta$ and $y=\sec^2\theta-\cos^2\theta$. Then $\left(\frac{dy}{dx}\right)^2=$

(A) $\frac{4\left(y^2-4\right)}{x^2+4}$

(B) $\frac{4\left(y^2+4\right)}{x^2+4}$

(C) $\frac{4\left(y^2-4\right)}{x^2-4}$

(D) $\frac{4\left(y^2+4\right)}{x^2-4}$

221. Given that the line $y = 3x + c$ touches the curve $\frac{x^2}{4}+\frac{y^2}{9}=1$. The value of c is

(A) an integer
(B) always a rational number
(C) always an irrational number
(D) sometimes a rational number

222. Let $f(x)=|\cos x|+|\sin x|$. Then $f'(2\pi/3)=$

(A) $\frac{1-\sqrt{3}}{2}$

(B) $\frac{\sqrt{3}-1}{2}$

(C) 0

(D) $\frac{\sqrt{3}+1}{2}$

223. If $x=a\left\{\cos\theta+\log\tan\left(\frac{\theta}{2}\right)\right\}$ and $y=a\sin\theta$, then $\frac{dy}{dx}$ is

(A) $\cot\theta$

(B) $\tan\theta$

(C) $\sin\theta$

(D) $\cos\theta$

224. If $f(x)=|x-1|$ $g(x)=f(f(x))$, then, for all $x\geq 2$, $g'(x)=$

(A) 1

(B) 2

(C) -1

(D) 0

225. If $y=\sin\left[\cos^{-1}\left\{\sin\left(\cos^{-1}x\right)\right\}\right]$, then $\frac{dy}{dx}$ at $x=\frac{1}{2}$ is equal to

(A) 0

(B) 1

(C) $2/\sqrt{3}$

(D) -1

226. The function $f(x)=\sqrt{\log_{10}\left(\frac{5x-x^2}{4}\right)}$ exists for

(A) [1, 4]

(B) [1, 0]

(C) [0, 5]

(D) [5, 0]

227. The range of the function $f(x)=\dfrac{x+3}{|x+3|},\ x\neq -3$ is

(A) $\{0\}$
(B) $\{0, 1\}$
(C) $\{-3,3\}$
(D) $\{-1,1\}$

228. The period of the function $f(x)=\cos\dfrac{2x}{7}+\sin\dfrac{x}{2}$ is

(A) 7π
(B) 4π
(C) 14π
(D) 28π

229. Let $f:R\to R$ be defined as $f(x)=\begin{cases}0, & x \text{ is irrational}\\ \sin|x|, & x \text{ is rational}\end{cases}$.

Then which of the following is true?

(A) f is discontinuous for all x
(B) f is continuous for all x
(C) f is discontinuous at $x=k\pi$, where k is an integer
(D) f is continuous at $x=k\pi$, where k is an integer

230. The period of the function $f(x)=\ \text{cosec}^3 3x+\cot 4x$ is

(A) $\dfrac{\pi}{3}$
(B) $\dfrac{\pi}{4}$
(C) $\dfrac{\pi}{6}$
(D) π

231. $\lim\limits_{x\to\infty}\left(\dfrac{x+7}{x+3}\right)^{x+2}$ is equal to

(A) e^2
(B) e^4
(C) e^{-4}
(D) e^{-2}

232. Let m, n be natural numbers with $n > m$. $\lim_{x \to 0} \frac{\sin x^n}{(\sin x)^m}$ is equal to

(A) 2
(B) -2
(C) -1
(D) 0

233. $\lim_{x \to \frac{\pi}{2}} \frac{\sin x - (\sin x)^{\sin x}}{1 - \sin x + \log \sin x}$

(A) 1
(B) 2
(C) 3
(D) 4

234. If the curve $y = x^2 + bx + c$ touches the line $y = x$ at the point (1, 1), then the values of x for which the curve has a negative gradient are

(A) $x > \frac{3}{2}$
(B) $x < \frac{3}{2}$
(C) $x > \frac{1}{2}$
(D) $x < \frac{1}{2}$

235. The sub tangent, ordinate and sub normal to the parabola $y^2 = 4ax$ at a point (different from the origin) are

(A) in Harmonic Progression
(B) in Geometric Progression
(C) in Arithmetic Progression
(D) equal

236. If $0 < x < \frac{\pi}{2}$, then

(A) $\cos(\sin x) < \sin(\cos x)$
(B) $\sin(\cos x) > \cos x$
(C) $\cos(\sin x) > \sin(\cos x)$
(D) $\cos(\sin x) \leq \cos x$

237. The minimum value of $e^{\left(2x^2+2x+1\right)\sin^2 x}$ is

(A) 0
(B) 1
(C) 2
(D) 3

238. $\int \frac{dx}{x^2+4x+5}$ is equal to

(A) $\frac{1}{2}\left\{\tan^{-1}(x+2)+\frac{x+2}{x^2+4x+5}\right\}+c$

(B) $\frac{1}{2}\left\{\tan^{-1}(x+2)+\frac{x}{x^2+4x+5}\right\}+c$

(C) $\frac{1}{2}\left\{\tan^{-1}(x+2)+\frac{x-2}{x^2+4x+5}\right\}+c$

(D) $\frac{1}{2}\left\{\tan^{-1}(x-2)+\frac{x}{x^2+4x+5}\right\}+c$

239. $\int\left(\frac{x+2}{x+4}\right)^2 e^x dx$ is equal to

(A) $e^x\left(\frac{x}{x+4}\right)+c$

(B) $e^x\left(\frac{x+2}{x+4}\right)+c$

(C) $e^x\left(\frac{x-2}{x+4}\right)+c$

(D) $e^x\left(\frac{2xe^x}{x+4}\right)+c$

240. The value of $I = \int_0^1 x\left|x - \frac{1}{2}\right| dx$ is equal to

(A) $\frac{1}{2}$

(B) $\frac{1}{3}$

(C) $\frac{1}{4}$

(D) $\frac{1}{8}$

241. Consider the group $\left(R \setminus \left\{\frac{1}{2}\right\}, *\right)$ where $a * b = a + b - 2ab$ for all $a, b \in R \setminus \left\{\frac{1}{2}\right\}$. Then the inverse of arbitrary element a is

(A) $\frac{a}{a-1}$

(B) $\frac{a}{2a+1}$

(C) $\frac{a}{2a-1}$

(D) $\frac{a}{a+1}$

242. The area bounded by $y = 2x - x^2$ and y -axis is

(A) 3 sq. units
(B) 2 sq. units
(C) 1 sq. units
(D) 0 sq. units

243. If the position vector of three points are $\vec{a} - 2\vec{b} + 3\vec{c}, 3\vec{a} + 4\vec{b} - 5\vec{c}, -\vec{a} - 8\vec{b} + 11\vec{c}$, then the three points are

(A) non-coplanar
(B) non-collinear
(C) collinear
(D) unit vectors

244. The sides of a parallelogram are $\vec{a} = \vec{i} + 2\vec{j} - 3\vec{k}, \vec{b} = \vec{i} + \vec{j} + 2\vec{k}$. Then the unit vector parallel to one of the diagonals is

(A) $\frac{1}{\sqrt{14}}(2\vec{i} + 3\vec{j} + \vec{k})$

(B) $\frac{1}{\sqrt{14}}(2\vec{i} + 3\vec{j} - \vec{k})$

(C) $\frac{1}{\sqrt{26}}(\vec{j} + 5\vec{k})$

(D) $\frac{1}{26}(-\vec{j} - 5\vec{k})$

245. In a three dimensional space, the equation $8x + 7y = 0$ represents

(A) the z-axis
(B) the z-plane
(C) the x-axis
(D) the plane $y = 0$

246. The plane $x - 2y + z = 6$ and the line $\frac{x}{1} = \frac{y}{2} = \frac{z}{3}$ are related as

(A) parallel to the plane
(B) at right angles to a plane
(C) lies in the plane
(D) meets the plane obliquely

247. If the position vectors of A, B and C are respectively $\hat{i} + \hat{j} + \hat{k}, \hat{i} - 2\hat{j} - 4\hat{k}$ and $2\hat{i} - 3\hat{j} - 3\hat{k}$, then $\cos^2 B$ is equal to

(A) $\frac{1}{63}$

(B) $\frac{4}{63}$

(C) $\frac{6}{63}$

(D) $\frac{11}{63}$

248. The number of solutions at $x = 5$ for the equation $\left|\frac{dy}{dx}\right| + |x| + 7 = 0$ is

(A) 0
(B) 1
(C) 5
(D) ∞

249. A solution of the differential equation $(x+y)^2 \frac{dy}{dx} = 4$ is

(A) $y = 2\tan^{-1}\left(\frac{x-y}{2}\right) + c$
(B) $y = 2\tan^{-1}\left(\frac{x+y}{2}\right) + c$
(C) $y = \tan^{-1}\left(\frac{x-y}{2}\right) + c$
(D) $y = \tan^{-1}\left(\frac{x+y}{2}\right) + c$

250. $I = \int_{-3}^{2} \left(|x+1| + |x+2|\right) dx =$

(A) 10
(B) 12
(C) 15
(D) 18

FINAL ANSWER KEY

Subject Name: 101 B TECH 16-S2

SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key	SI No.	Key
1	C	31	C	61	A	91	C	121	A	151	B	181	C	211	C	241	C
2	A	32	B	62	A	92	C	122	C	152	A	182	A	212	C	242	D
3	B	33	A	63	C	93	B	123	B	153	A	183	A	213	D	243	C
4	D	34	D	64	D	94	B	124	B	154	B	184	D	214	C	244	B
5	B	35	D	65	D	95	D	125	B	155	B	185	B	215	B	245	A
6	D	36	B	66	A	96	C	126	C	156	C	186	D	216	A	246	A
7	B	37	C	67	A	97	A	127	B	157	D	187	B	217	A	247	B
8	C	38	D	68	B	98	A	128	B	158	B	188	D	218	A	248	A
9	D	39	C	69	B	99	D	129	C	159	D	189	A	219	C	249	B
10	A	40	D	70	B	100	B	130	C	160	B	190	D	220	B	250	C
11	B	41	D	71	D	101	D	131	D	161	D	191	B	221	C		
12	A	42	C	72	C	102	C	132	C	162	C	192	A	222	B		
13	C	43	A	73	B	103	B	133	C	163	D	193	D	223	B		
14	A	44	B	74	C	104	D	134	A	164	B	194	A	224	A		
15	C	45	A	75	C	105	B	135	D	165	B	195	A	225	B		
16	C	46	A	76	A	106	A	136	B	166	D	196	B	226	A		
17	D	47	C	77	D	107	C	137	C	167	B	197	C	227	D		
18	B	48	C	78	A	108	B	138	D	168	D	198	D	228	D		
19	C	49	C	79	C	109	C	139	D	169	A	199	B	229	D		
20	D	50	C	80	B	110	D	140	C	170	B	200	D	230	D		
21	A	51	A	81	A	111	C	141	D	171	B	201	D	231	B		
22	A	52	B	82	A	112	B	142	A	172	D	202	A	232	D		
23	D	53	B	83	A	113	B	143	C	173	B	203	C	233	B		
24	B	54	C	84	A	114	B	144	A	174	A	204	A	234	D		
25	A	55	C	85	B	115	C	145	C	175	C	205	D	235	B		
26	B	56	B	86	A	116	A	146	A	176	C	206	A	236	C		
27	D	57	D	87	A	117	B	147	C	177	D	207	B	237	B		
28	D	58	C	88	C	118	A	148	C	178	A	208	A	238	A		
29	B	59	A	89	A	119	B	149	D	179	D	209	D	239	A		
30	D	60	C	90	C	120	C	150	A	180	D	210	A	240	D		