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

PHYSICS

1. The density of a material in the form of a cube is measured using its dimensions and mass. If the error in measurement of length and mass is 0.6% and 1.2% respectively, the maximum error in calculation of density is

(A) 3.0%
(B) 4.0%
(C) 4.5%
(D) 6.0%

2. If m is the mass of a body and E its kinetic energy, then its linear momentum is

(A) $m\sqrt{E}$
(B) $2\sqrt{mE}$
(C) $\sqrt{mE}$
(D) $\sqrt{2mE}$

3. The separation between carbon and oxygen in CO molecule is 0.12 nm. What is the distance of the center of mass from the carbon atom?

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

4. In a Young's double slit experiment, let S_1 and S_2 be two slits and C be the center of the screen. If angle $\angle S_1CS_2 = \theta$, and λ is the wavelength, the fringe width will be

(A) $\frac{\lambda}{\theta}$
(B) $\lambda\theta$
(C) $\frac{2\lambda}{\theta}$
(D) $\frac{\lambda}{2\theta}$

5. For a series RLC circuit driven with voltage of amplitude V_m and frequency $\omega_o = \frac{1}{\sqrt{LC}}$, the current exhibits resonance. The quality factor, Q of the circuit is given by

(A) $\omega_o L/R$
(B) $\omega_o R/L$
(C) $R/(\omega_o L)$
(D) CR/ω_o

6. The half-life of ^{215}At is 100 μs. The time taken for the radioactivity decay of a sample of ^{215}At to 1/16th of its initial value is

(A) 400 μs
(B) 6.3 μs
(C) 40 μs
(D) 300 μs

7. The shortest wavelength of X-rays emitted from an X-ray tube depends on

(A) the current in the tube
(B) the voltage applied to the tube
(C) the nature of the gas in the tube
(D) the atomic number of the target material

8. The electromagnetic waves detected using a thermopile and used in physiotherapy are

(A) X - rays
(B) γ – rays
(C) ultraviolet radiations
(D) infrared radiations

9. If the wavelength of an electromagnetic wave is about the diameter of an apple, the region of radiation is

(A) X-ray
(B) UV
(C) infrared
(D) microwave

10. In an AC circuit containing a pure resistor and an inductor in series, the phase lag between current and voltage is

(A) dependent on the AC frequency
(B) independent of AC frequency
(C) always zero
(D) always 90°

11. Kirchhoff's junction rule is a reflection of

(A) conservation of energy
(B) conservation of charges
(C) conservation of momentum
(D) conservation of current density

12. If the carrier power of a 100% modulated AM wave is suppressed, the percentage saving in power will be

(A) 50%
(B) 100%
(C) 66.66%
(D) 75%

13. White X-rays are called "white" because

(A) they are produced most abundantly in X-ray tubes
(B) they have a nature similar to visible white light
(C) they have a continuous range of frequencies
(D) they can be converted into visible light coated screens

14. An antenna uses electromagnetic waves of frequency 5 MHz. For proper working, the size of the antenna should be

(A) 15 m
(B) 3 km
(C) 60 m
(D) 300 m

15. The rectangular Cartesian components of grad φ are

(A) $\frac{\partial\phi}{\partial x}, \frac{\partial\phi}{\partial y}, \frac{\partial\phi}{\partial z}$

(B) $\frac{\partial\phi}{\partial x^2}, \frac{\partial\phi}{\partial y^2}, \frac{\partial\phi}{\partial z^2}$

(C) $\frac{\partial^2\phi}{\partial x^2}, \frac{\partial^2\phi}{\partial y^2}, \frac{\partial^2\phi}{\partial z^2}$

(D) $\varphi,\ \varphi^2, \varphi^3$

16. An ideal gas undergoes a thermodynamic process such that $dW = 0$ and $dQ < 0$. Then for the gas

(A) the temperature will decrease
(B) the temperature will increase
(C) the volume will increase
(D) there is no change in temperature

17. Optical fibres transmit light signals from one place to another place by

(A) internal conical refraction
(B) double refraction
(C) interference of light signals
(D) total internal reflection

18. When the source and the listener move in the same direction with a speed equal to the half of the speed of sound, the change in frequency of the sound is

(A) zero
(B) 25%
(C) 50%
(D) 75%

19. Two vectors A and B are said to be parallel to each other if

(A) $A \times B \neq 0$
(B) $A \times B = 0$
(C) $A \times B = B \times A$
(D) $A \times B = AB$

20. Two protons are kept at a separation of 10 nm. If F_e and F_n represent the electromagnetic force and nuclear force, then

(A) $F_e » F_n$
(B) F_e and F_n differ only slightly
(C) $F_e = F_n$
(D) $F_e « F_n$

21. An inductor of inductance L and a resistor R are joined in series and connected to a source of frequency ω. The power dissipated in the circuit is

(A) $\frac{V^2 R}{R^2 + \omega^2 L^2}$
(B) $\frac{V^2 R}{\sqrt{R^2 + \omega^2 L^2}}$
(C) $\frac{R^2 + \omega^2 L^2}{V}$
(D) $\frac{V^2}{R^2 + \omega^2 L^2}$

22. Find the odd one out

(A) silicon
(B) gallium arsenide
(C) barium titanate
(D) Cadmium sulphide

23. The two nearest harmonics of a tube closed at one end and open at other end are 220 Hz and 260 Hz. What is the fundamental frequency of the system?

(A) 10 Hz
(B) 20 Hz
(C) 30 Hz
(D) 40 Hz

24. If a stone and a pencil are dropped simultaneously in vacuum from the top of a tower, which of the two will reach the ground first?

(A) Pencil
(B) Stone
(C) Both will reach the ground simultaneously
(D) Either stone or pencil depending on which is heavier

25. A conductor AB = r carries a current i in a magnetic field B. The force on the conductor F is

(A) $F = r \times B$
(B) $F = i\,(r \times B)$
(C) $F = i\,(B \times r)$
(D) $|F| = i\,(r.B)$

26. Three small identical spheres having charges -8.4×10^{-16} C, -7.2×10^{-16} C and 0.6×10^{-16} C are brought in contact and then separated. Now the number of electrons on each ball is

(A) 3375
(B) 3125
(C) 2925
(D) 2775

27. Nichrome wire has been used as heating element because of its

(A) low melting point
(B) high conductivity
(C) low specific resistance
(D) high specific resistance

28. The torque on a rectangular coil placed in an uniform magnetic field is large, when the

(A) number of turns is large
(B) number of turns is less
(C) plane of the coil is perpendicular to the field
(D) area of the coil is small

29. When a moving coil galvanometer is shunted with a resistance of 30 Ohms, then its deflection is reduced to half. The actual resistance of the galvanometer is

(A) 10 Ohms
(B) 15 Ohms
(C) 20 Ohms
(D) 30 Ohms

30. Canal rays were discovered by

(A) Neil Bohr
(B) J.J. Thomson
(C) Millikan
(D) Eugen Goldstein

31. Which of the following transition produces the spectral line of maximum wavelength in hydrogen atom?

(A) $4 \rightarrow 3$
(B) $3 \rightarrow 2$
(C) $5 \rightarrow 4$
(D) $6 \rightarrow 5$

32. The bandwidth of the amplitude modulation is

(A) equal to the signal frequency
(B) twice the signal frequency
(C) thrice the signal frequency
(D) four times the signal frequency

33. Which one of the following of carrier wave remains constant in amplitude modulation?

(A) amplitude and phase
(B) frequency and phase
(C) amplitude and frequency
(D) phase and time

34. What will be the input current when a step up transformer has a power input of 23 kW at 230 volts?

(A) 1 A
(B) 10 A
(C) 52.9 A
(D) 100 A

35. In an AC generator, the current from the coil is transferred to the external circuit through

(A) split rings
(B) slip rings
(C) O-rings
(D) field magnet

36. A long solenoid having N turns, length (l), area of cross section A, carrying a current I is placed in a magnetic field of inductance B. The total magnetic flux is

(A) $\varphi = \mu_o N I$
(B) $\varphi = \mu_o N I / l$
(C) $\varphi = \mu_o N I A / l$
(D) $\varphi = \mu_o N^2 I A / l$

37. In Raman spectrum, the intensity of Stokes lines will be _____ the intensity of corresponding anti Stokes lines.

(A) greater than
(B) less than
(C) equal to
(D) greater or less than

38. In an X-ray tube, when 35 kV is applied, the minimum wavelength of the emitted radiation is

(A) 3.0 Å
(B) 1.5 Å
(C) 0.821 Å
(D) 0.333 Å

39. The half-life period of a particle is 624 s. Its mean life is

(A) 11.3 s
(B) 22.6 s
(C) 90 s
(D) 900 s

40. What will be the energy of the thermal neutrons?

(A) few MeV
(B) few keV
(C) few eV
(D) 0.025 eV

41. Which one of the following is not purely an electrostatic accelerator?

(A) Betatron
(B) Linear accelerator
(C) Van de Graff generator
(D) Cockcroft-Walton accelerator

42. The moment of inertia of a disc of mass M and radius R about its diameter as axis is

(A) $MR^2/2$
(B) $MR^2/4$
(C) MR^2
(D) $(3/4)\ MR^2$

43. An electron beam is moving horizontally towards east. If this beam is passed through a uniform magnetic field directed vertically upwards, then the direction of the deflected beam is

(A) east
(B) west
(C) north
(D) south

44. A pn-junction diode works as insulator if it is connected

(A) in forward bias
(B) in reverse bias
(C) to a.c.
(D) to d.c.

45. A passenger is sitting in a fast moving car. The car blows horn with a frequency of f Hz. If the apparent frequency of the sound heard by the passenger is f' Hz, then

(A) $f' = f$
(B) $f' < f$
(C) $f' > f$
(D) $f' = 1/f$

46. Let v_{max} and a_{max} are the maximum velocity and maximum acceleration of a simple harmonic oscillator respectively, then its time period in terms of v_{max} and a_{max} is

(A) zero
(B) 2π
(C) $\left[2\pi v_{max}\right]/\alpha_{max}$
(D) $\left[2\pi \alpha_{max}\right]/v_{max}$

47. A red paper illuminated by green light appears

(A) black
(B) blue
(C) green
(D) yellow

48. A thermodynamics system goes from state (i) P_1, V to 2 P_1, V (ii) P_1, V to P_1, 2 V. Then the work done in the two cases will be

(A) zero and $P_1 V$
(B) $P_1 V$ and zero
(C) $P_1 V$ and $P_1 V$
(D) zero and zero

49. Which one of the following pair of physical quantities do not have same dimension?

(A) Planck's constant and Angular momentum
(B) Impulse and moment of force
(C) Force and rate of change of linear momentum
(D) Pressure and Young's modules

50. The exponential law of radioactive decay is

(A) $\frac{N}{N_0} e^{-\lambda/t} = 1$
(B) $\frac{N_0}{N} e^{-\lambda/t} = 1$
(C) $\frac{N_0}{N} e^{\lambda/t} = 1$
(D) $\frac{N}{N_0} e^{\lambda t} = 1$

51. Which of the following is the universal gate?

(A) NOT
(B) OR
(C) AND
(D) NAND

52. When metals combine with non-metals, then

(A) electrons of the outer shells are shared
(B) electrons in the outer shells of non-metals are transferred to metals
(C) electrons in the outer shells of metals are transferred to the non-metals atoms
(D) hydrogen gas is given off

53. The Compton shift is maximum for scattering angle of

(A) 0°
(B) 45°
(C) 90°
(D) 180°

54. A stone released with zero velocity from the top of a tower, reaches the ground in 4 s. The height of the tower is (g = 10 m/s^2)

(A) 20 m
(B) 40 m
(C) 80 m
(D) 120 m

55. Swimming is possible on account of

(A) first law of motion
(B) second law of motion
(C) third law of motion
(D) Newton's law of gravitation

56. A steel wire is stretched to double its length, then its Young's modulus

(A) becomes half
(B) becomes double
(C) remains same
(D) becomes one-fourth

57. Thermoelectric thermometer is based on

(A) Photoelectric effect
(B) Seebeck effect
(C) Compton effect
(D) Joule effect

58. The number of degrees of freedom for each atom of a monatomic gas is

(A) 3
(B) 5
(C) 6
(D) 1

59. The capacity of parallel plate capacitor depends on

(A) metal used to make plates
(B) thickness of plate
(C) potential applied across the plate
(D) area of plate

60. A hydrogen atom is paramagnetic. A hydrogen molecule is

(A) diamagnetic
(B) paramagnetic
(C) ferromagnetic
(D) ferrimagnetic

61. 10 cm is a wavelength corresponding to the spectrum of

(A) infrared rays
(B) ultraviolet rays
(C) microwaves
(D) X-rays

62. In a semiconductor, the forbidden energy gap between the valance band and conduction band is of the order of

(A) 1 MeV
(B) 0.1 MeV
(C) 1 eV
(D) 5 eV

63. The mass of a ship is 2×10^7 kg. On applying a force of 25×10^5 N, it is displaced through 25 m. After the displacement, the velocity acquired by the ship will be

(A) 12.5 m/s
(B) 5 m/s
(C) 3.7 m/s
(D) 2.5 m/s

64. A system consists of 3 particles each of mass m located at points (1, 1), (2, 2) and (3, 3). The coordinates of the centre of mass are

(A) (6, 6)
(B) (3, 3)
(C) (1, 1)
(D) (2, 2)

65. If a spring extends by 'x' on loading, then the energy stored by the spring is (if T is tension in the spring and k is spring constant)

(A) $T^2/2x$
(B) $T^2/2k$
(C) $2x/T^2$
(D) $2T^2/k$

66. A simple pendulum is executing simple harmonic motion with a time period T. If the length of the pendulum is increased by 21%, the percentage increase in the time period of the pendulum of increased length is

(A) 10%
(B) 21%
(C) 30%
(D) 50%

67. If a diamagnetic substance is brought near north or south pole of a bar magnet, it is

(A) attracted by the poles
(B) repelled by the poles
(C) repelled by the north pole and attracted by the south pole
(D) attracted by north pole and repelled by south pole

68. The inductive reactance of an inductor of $1/\pi$ Henry at 50 Hz frequency is

(A) $50/\pi$ Ohm
(B) $\pi/50$ Ohm
(C) 100 Ohm
(D) 50 Ohm

69. How fast a person should drive his car so that the red signal of light appears green (λ_{red} = 6200 Å, λ_{green} = 5400 Å)

(A) 1.5×10^8 m/s
(B) 7×10^7 m/s
(C) 3.9×10^7 m/s
(D) 2×10^8 m/s

70. The position of a particle is given by $x = a \sin \omega t$, $y = a \cos 2\omega t$. The trajectory is

(A) parabola
(B) hyperbola
(C) straight line
(D) cycloid

71. If an annular disc of radii r_1 and r_2 is heated, then

(A) r_1 increases, r_2 decreases
(B) r_2 increases, r_1 decreases
(C) both r_1 and r_2 increase
(D) r_1 increases, r_2 remains unchanged

72. Velocity of sound in air is 332 m/s. Its velocity in vacuum is

(A) > 332 m/s
(B) 3×10^8 m/s
(C) 332 m/s
(D) zero

73. A steady current flows in a metallic conductor of non-uniform cross-section. The quantity/quantities constant along the length of the conductor is/are

(A) current, electric field and drift velocity
(B) drift speed only
(C) current and drift speed
(D) current only

74. A convex lens is dipped in a liquid whose refractive index is equal to refractive index of the lens. Then its focal length will

(A) remain unchanged
(B) be 0
(C) be infinity
(D) be small but non zero

75. AND gate can be produced using two gates of

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

CHEMISTRY

76. Iodine crystals are

(A) electrical conductors
(B) insulators
(C) semiconductors
(D) high melting

77. In an ionic solid with the larger anions and smaller cations, the ions that form close packed structure are

(A) anions
(B) cations
(C) half of total anions
(D) half of total cations

78. When a piece of copper is added to concentrated hydrochloric acid,

(A) it remains insoluble
(B) it readily dissolves
(C) it slowly dissolves
(D) it dissolves with the release of hydrogen

79. The electrode potential of a half cell

(A) does not vary with concentration of the solution
(B) depends on the concentration of the solution
(C) depends on the rate of diffusion of the cation
(D) depends on the rate of diffusion of the anion

80. A catalyst

(A) decreases the ΔG of a reaction
(B) increases the ΔG of a reaction
(C) does not alter the ΔG of a reaction
(D) shifts the equilibrium of the reaction

81. As per the Freundlich's adsorption isotherm, the amount adsorbed per gram of the adsorbent is independent of pressure, when

(A) $n = 0$
(B) $n > 1$
(C) $n = 1$
(D) $1/n = 0$

82. When an ideal solution is formed from pure n-hexane and n-heptane, the wrong statement is

(A) no heat is evolved
(B) no volume change occurs
(C) large quantity of heat is evolved
(D) it obeys Raoult's law

83. If cells placed in sodium chloride solution shrink, the solution is called

(A) hypertonic
(B) hypotonic
(C) isotonic
(D) azeotropic

84. The van't Hoff's factor for ethanoic acid in benzene is equal to

(A) zero
(B) close to 0.5
(C) unity
(D) two

85. When a dilute solution of KI is added to a dilute solution of $AgNO_3$,

(A) a positively charged sol results
(B) a negatively charged sol results
(C) a neutral sol results
(D) both the positive and negative sol particles result

86. Hardy – Schulze rule states that the ease of coagulation of a negatively charged colloid with the cations varies in the order

(A) $Fe^{3+} > Mg^{2+} > K^+$
(B) $K^+ > Mg^{2+} > Fe^{3+}$
(C) $Mg^{2+} > Fe^{3+} > K^+$
(D) $Fe^{3+} > K^+ > Mg^{2+}$

87. For the following reaction, the initial concentration of HI (0.005 mol L^{-1}) becomes half of it after 25 min. The rate of decomposition of HI is equal to

$2HI_{(g)} \rightarrow H_{2(g)} + I_{2(g)}$

(A) –0.0005 mol L^{-1} min^{-1}
(B) 0.00005 mol L^{-1} min^{-1}
(C) –0.0001 mol L^{-1} min^{-1}
(D) +0.000.2 mol L^{-1} min^{-1}

88. When acetone is added to ethanol, the solution shows

(A) positive deviation from Raoult's law
(B) negative deviation from Raoult's law
(C) no deviation from Raoult's law
(D) ideal behavior

89. For the Daniel cell of emf 1.1 V, if an external emf of 1.5V is applied,

(A) the copper electrode will dissolve
(B) the zinc electrode will dissolve
(C) the electrode reactions will be ceased
(D) copper will be deposited

90. The material that shows increase in conductivity with increase in temperature is

(A) copper
(B) silver
(C) alumina
(D) titania

91. One mole of a gas expands from 6 m^3 to 8 m^3 in a container against a constant external pressure of 3 Pa at 300 K. The work done on the gas, w, is

(A) –2 J
(B) –6 J
(C) +575 J
(D) –575 J

92. The latent heat of phase change from ice to water is 80 cal per gram at 0 °C. Then change in entropy (in eu) for the surrounding, when 1 mole water freezes at 0 °C

(A) ≈ –5.3 eu
(B) ≈ 5.3 eu
(C) ≈ 0.3 eu
(D) zero

93. At 25 °C, *p*Kw is 14. The degree of dissociation of water is nearly

(A) 10^{-4}
(B) 1.8×10^{-9}
(C) 10^{-7}
(D) 5.6×10^{-6}

94. Which one of the following uranium isotopes is used as atomic fuel?

(A) $^{233}U_{92}$
(B) $^{235}U_{92}$
(C) $^{236}U_{92}$
(D) $^{238}U_{92}$

95. Most abundant element in the earth crust is

(A) O
(B) Al
(C) Fe
(D) Si

96. Soda acid type fire extinguishers contain H_2SO_4 and

(A) $NaHCO_3 + Na_2CO_3$
(B) $NaHCO_3$ solution
(C) Na_2CO_3
(D) $CaCO_3$

97. The correct order of electronegativity of N, O, F and P is

(A) F > O > N > P
(B) F > N > P > O
(C) F > O > P > N
(D) N > O > P > F

98. Find the correct order of electron affinity on the following elements.

S, O and Se

(A) S > O > Se
(B) O > S > Se
(C) S > Se > O
(D) Se > O > S

99. The solution of sodium metal in liquid ammonia acts as a strong reducing agent due to the presence of

(A) Sodium atoms
(B) Solvated electrons
(C) Sodium hydroxide
(D) Sodium azide

100. The isostructural group with I_3^- ion is

(A) NO_2^-, XeF_2, N_3^-
(B) ICl_2^-, XeF_2, N_3^-
(C) NH_2^-, NO_2^-, ICl_2^-
(D) BH_3, CO_2, ICl_2^-

101. The diamagnetic metal complex ion is

(A) $[NiCl_4]^{2-}$
(B) $[CoCl_4]^{2-}$
(C) $[CoF_6]^{3-}$
(D) $[Ni(CN)_4]^{2-}$

102. The CFSE of cobalt(II) in complex ion $[CoCl_4]^{2-}$ is

(A) $0.6\Delta t$
(B) $1.2\Delta t$
(C) $1.8\Delta t$
(D) $2.4\Delta t$

103. The species in which the colour is not due to d-d transitions is

(A) $[Ti(H_2O)_6]^{3+}$
(B) $[CoF_6]^{3-}$
(C) $[Cu(NH_3)_4]^{2+}$
(D) $[CrO_4]^{2-}$

104. Per ton of the material consumed, which is expected to produce the greatest quantity of $SO_2(g)$?

(A) Burning coal
(B) Burning natural gas
(C) Smelting zinc sulphide
(D) Smelting lead sulphide

105. The acceptable value for the missing quantum number in the following set of quantum numbers is:

$n = 3$, $l = ?$, $m_l = 2$, $m_s = +½$

(A) $l = 3$
(B) $l = 1$
(C) $l = 2$
(D) $l = 0$

106. Which must possess greater velocity to produce matter waves of same wavelength?

(A) protons
(B) neutrons
(C) electrons
(D) α-particles

107. Which of the following ions has a trigonal planar shape?

(A) SO_3^{2-}
(B) PO_4^{3-}
(C) PF_6^-
(D) CO_3^{2-}

108. Number of angular nodes for 4*d* orbital is

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

109. What type of radioactive decay causes the atomic number of a nucleus to increase by one unit?

(A) Electron capture
(B) α-emission
(C) β-emission
(D) γ-ray emission

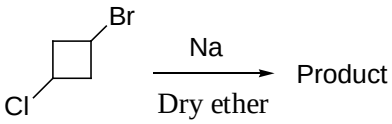
110. The type of hybridization of each carbon in the compound, $H_3C–CH=C=CH–CH_3$ is

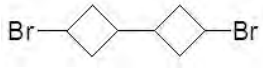
(A) sp^3, sp^2, sp^2, sp^2, sp^3
(B) sp^3, sp^2, sp, sp^2, sp^3
(C) sp^3, sp, sp, sp, sp^3
(D) sp^3, sp, sp^2, sp, sp^3

111. If the sodium fusion extract of an organic compound gives violet colour upon treatment with sodium nitroprusside, then which of the following statement is correct?

(A) Nitrogen is present in the compound and the violet colour is due to the formation of $[Fe(CN)_6]^{4-}$
(B) Both nitrogen and bromine are present in the compound and the violet colour is due to the formation of $(NH_4)_2MoO_4$
(C) Sulfur is present in the compound and the violet colour is due to the formation of $[Fe(CN)_5NOS]^{4-}$
(D) Both nitrogen and sulfur are present in the compound and the violet colour is due to the formation of $[Fe(SCN)]^{2+}$

112. Major product of the following reaction is



(A) 

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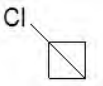
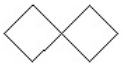
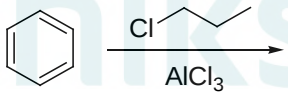
(C) 

(D) 

113. When propyne is treated with mercuric sulphate and dilute sulfuric acid at 60 °C, it forms

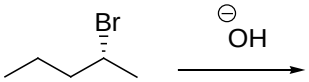
(A) acetone through anti-Markovnikov addition of water
(B) propionaldehyde through Markovnikov addition of water
(C) acetone through Markovnikov addition of water
(D) propionaldehyde through anti-Markovnikov addition of water

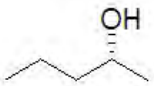
114. Major product formed in the following reaction is

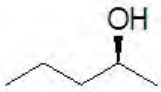


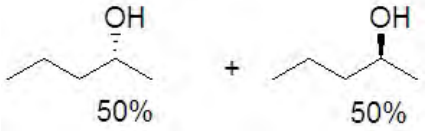
(A) *n*-propylbenzene
(B) isopropylbenzene (cumene)
(C) 1-phenylpropene
(D) 1,3-di-(*n*-propyl)benzene

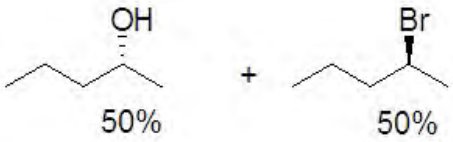
115. The product(s) of the following bimolecular nucleophilic substitution reaction is (are)



(A) 

(B) 

(C) 

(D) 

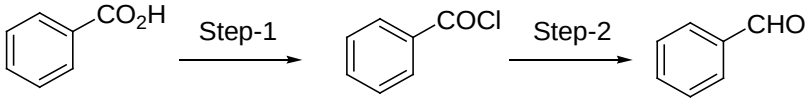
116. A compound P with molecular formula C_9H_{12} upon air oxidation gives compound Q, which upon treatment with dilute acid gives compounds R and S. R gives violet colour when treated with neutral $FeCl_3$. S gives an yellow precipitate on reaction with iodine in the presence of NaOH. The compounds P and S are

(A) P = *n*-propylbenzene and S = acetone
(B) P = *n*-propylbenzene and S = phenol
(C) P = isopropylbenzene (cumene) and S = acetone
(D) P = 1,2,4-trimethylbenzene and S = phenol

117. The major product formed in the nitration of anisole (methoxybenzene) is

(A) *o*-nitroanisole
(B) *p*-nitroanisole
(C) *m*-nitroanisole
(D) 3,4-dinitroanisole

118. Suitable reagents to perform the following transformations are

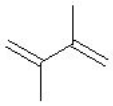


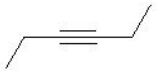
(A) For step-1: $SOCl_2$ and for step-2: H_2, Pd-$BaSO_4$
(B) For step-1: $SOCl_2$ and for step-2: $NaBH_4$
(C) For step-1: Cl_2 and for step-2: H_2, Pd-$BaSO_4$
(D) For step-1: PCl_5 and for step-2: $LiAlH_4$

119. A compound P with molecular formula C_6H_{10} decolorizes bromine water and undergoes oxidation with acidified $KMnO_4$ to give a dicarboxylic acid with the same number of carbon atoms. The dicarboxylic acid serves as an important precursor in the manufacture of nylon-6,6. The compound P is

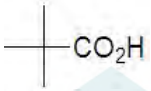
(A) 

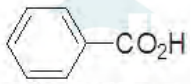
(B) 

(C) 

(D) 

120. Which one of the following carboxylic acids would undergo Hell-Volhard-Zelinsky reaction?

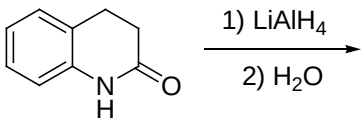
(A) 

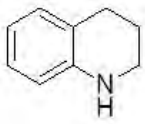
(B) 

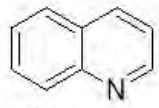
(C) 

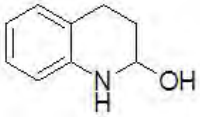
(D) CF_3CO_2H

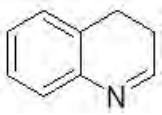
121. Major product formed in the following reaction is



(A) 

(B) 

(C) 

(D) 

122. Gabriel phthalimide synthesis cannot be used for introducing the NH_2 group in

(A) *n*-butylamine
(B) benzylamine
(C) aniline
(D) 2-aminopropanoic acid

123. In amylose,

(A) α-D-(+)-glucose units are linked through C1-C4 glycosidic linkage
(B) α-D-(+)-glucose units are linked to β-D-(–)-fructose through C1-C2 glycosidic linkage
(C) α-D-(+)-glucose units are linked through C1-C2 glycosidic linkage
(D) β-D-(+)-glucose units are linked through C1-C4 glycosidic linkage

124. The Ziegler-Natta catalyst is

(A) Et_2Zn and $TiCl_4$
(B) Et_3Al and $SnCl_4$
(C) Et_2Zn and $SnCl_4$
(D) Et_3Al and $TiCl_4$

125. Which one of the following is not a tranquilizer?

(A) Meprobamate
(B) Ranitidine
(C) Valium
(D) Serotonin

MATHEMATICS

126. The value of x with $\log\frac{1}{2}x \geq \log\frac{1}{3}x$ lies in

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

127. If $\alpha \in \left(0, \frac{\pi}{2}\right)$, then the expression $\sqrt{x^2+x} + \frac{\tan^2 \alpha}{\sqrt{x^2+x}}$ is always greater than or equal to

(A) $2 \tan \alpha$
(B) 2
(C) 1
(D) $\sec^2 \alpha$

128. If $\left|z - \frac{4}{z}\right| = 2$, then the maximum value of $|z|$ is

(A) $\sqrt{3}+1$
(B) $\sqrt{5}+1$
(C) 2
(D) $2+\sqrt{2}$

129. If α, β are roots of the equation $x^2 - 2x + 4 = 0$, then $\alpha^n + \beta^n$ is equal to

(A) $2^n \cos\left(\frac{n\pi}{3}\right)$
(B) $2^n \sin\left(\frac{n\pi}{3}\right)$
(C) $2^{n+1} \cos\left(\frac{n\pi}{3}\right)$
(D) $2^{n+1} \sin\left(\frac{n\pi}{3}\right)$

130. If $\log_{\cos x} \tan x + \log_{\sin x} \cot x = 0$, then the most general solutions of x are

(A) $n\pi + \frac{\pi}{4}, n \in I$
(B) $2n\pi + \frac{\pi}{4}, n \in I$
(C) $2n\pi - \frac{3\pi}{4}, n \in I$
(D) $2n\pi - \frac{\pi}{2}, n \in I$

131. The value of $\left|\sqrt{2i} - \sqrt{-2i}\right|$ is

(A) 2
(B) $\sqrt{2}$
(C) 0
(D) $2\sqrt{2}$

132. $\int_{-\frac{\pi}{2}}^{\frac{\pi}{2}} \frac{\cos x}{1+e^x} dx$ is equal to

(A) -1
(B) 0
(C) 1
(D) None of these

133. The centre of the circle passing through the point (0, 1) and touching the curve $y = x^2$ at (2, 4) is

(A) $\left(-\frac{16}{5}, \frac{27}{10}\right)$
(B) $\left(-\frac{16}{7}, \frac{53}{10}\right)$
(C) $\left(-\frac{16}{5}, \frac{53}{10}\right)$
(D) $\left(-\frac{16}{7}, -\frac{53}{10}\right)$

134. If $z_1 = 8+4i$, $z_2 = 6+4i$ and $\arg\left(\frac{z-z_1}{z-z_2}\right) = \frac{\pi}{4}$, then z satisfies

(A) $|z-7-4i| = 1$
(B) $|z-4i| = 8$
(C) $|z-7-5i| = \sqrt{2}$
(D) $|z-4i| = \sqrt{18}$

135. Which of the following is a non-abelian group?

(A) Cube roots of unity under multiplication
(B) $(Z, +)$
(C) $(Z_n, +_n)$
(D) 2×2 non-singular matrices under matrix multiplication

136. The equation of the parabola with its focus at (3, 4) and vertex at the focus of the parabola $y^2 - 12x - 4y + 4 = 0$ is

(A) $x^2 - 6x - 8y - 25 = 0$
(B) $x^2 - 6x + 8y - 25 = 0$
(C) $x^2 - 6x - 8y + 25 = 0$
(D) $x^2 + 6x - 8y - 25 = 0$

137. The locus of z satisfying $\text{Im}(z^2) = 4$ is

(A) a circle
(B) a rectangular hyperbola
(C) a pair of straight lines
(D) an ellipse

138. The solution of the differential equation $\left(x\sin\left(\frac{y}{x}\right)\right)dy - \left(y\sin\left(\frac{y}{x}\right) - x\right)dx = 0$ is

(A) $\cos\left(\frac{y}{x}\right) = 0$

(B) $\sin\left(\frac{y}{x}\right) = 0$

(C) $\cos\left(\frac{y}{x}\right) - \log x = c$

(D) $\sin\left(\frac{y}{x}\right) - \log x = c$

139. If a, b, c are in A.P. and a^2, b^2, c^2 are in H.P., then

(A) $a = b = c$
(B) $2b = 3a + c$
(C) $b^2 = \sqrt{ac/8}$
(D) $2b = a$

140. If x, y, z are three positive real numbers, then the value of $(x+y)(y+z)(z+x)$ is

(A) $\geq 8xyz$
(B) $< 8xyz$
(C) $= 8xyz$
(D) $\leq xyz$

141. The product $(32)(32)^{1/6}(32)^{1/36}...\infty$ is equal to

(A) 16
(B) 64
(C) 32
(D) 0

142. The harmonic mean of the roots of the equation $\left(5+\sqrt{2}\right)x^2-\left(4+\sqrt{5}\right)x+8+2\sqrt{5}=0$ is

(A) 2
(B) 4
(C) 6
(D) 8

143. If $ax^2+bx+c=0$ and $2x^2+3x+4=0$ have a common root where $a,b,c\in$ □ (set of natural numbers), the least value of $a+b+c$ is

(A) 13
(B) 11
(C) 7
(D) 9

144. If $x=\sqrt{7+4\sqrt{3}}$, then $x+\frac{1}{x}$ is equal to

(A) 4
(B) 6
(C) 3
(D) 2

145. If α,β,γ are the roots of $x^3+64=0$, then the equation whose roots are $\left(\frac{\alpha}{\beta}\right)^2$ and $\left(\frac{\alpha}{\gamma}\right)^2$ is

(A) $x^2-4x+16=0$
(B) $x^2+x+1=0$
(C) $x^2+4x+16=0$
(D) $x^2-x+1=0$

146. The roots of the equation $(x-a)(x-b)=abx^2$ are always

(A) real
(B) imaginary
(C) rationals
(D) irrationals

147. Which of the following functions is nonperiodic?

(A) $f(x) = x - [x]$

(B) $f(x) = \begin{cases} 1 \text{ if } x \text{ is a rational number} \\ 0 \text{ if } x \text{ is an irrational number} \end{cases}$

(C) $f(x) = \sqrt{\frac{8}{1+\cos x} + \frac{8}{1-\cos x}}$

(D) $\log(1+|x|)$

148. If $\log_{10} x + \log_{10} y \geq 2$, then the smallest possible value of $x + y$ is

(A) 10
(B) 30
(C) 20
(D) 40

149. The only value of x satisfying the equation $6\sqrt{\frac{x}{x+4}} - 2\sqrt{\frac{x+4}{x}} = 11$ where $x \in R$ is

(A) $16/3$
(B) $-16/3$
(C) $4/35$
(D) $-4/35$

150. The number of real values of a for which the system of equations $x + ay - z = 0$, $2x - y + az = 0$, $ax + y + 2z = 0$ has a non-trivial solution is

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

151. In the binomial expansion of $(a-b)^n$, $n \geq 5$ the sum of the 5^{th} and 6^{th} terms is zero. Then, $\frac{a}{b}$ equals

(A) $\frac{n-5}{6}$
(B) $\frac{n-4}{5}$
(C) $\frac{5}{n-4}$
(D) $\frac{6}{n-5}$

152. The coefficient of t^{24} in the expansion of $\left(1+t^2\right)^{12}\left(1+t^{12}\right)\left(1+t^{24}\right)$ is

(A) ${}^{12}C_6 + 2$
(B) ${}^{12}C_5$
(C) ${}^{12}C_6$
(D) ${}^{12}C_7$

153. The equation $z^2 + \overline{z}^2 - 2|z|^2 + z + \overline{z} = 0$, where z is a complex number, represents

(A) a straight line
(B) a circle
(C) an ellipse
(D) a parabola

154. Let $A = \begin{bmatrix} 1 & -1 & 1 \\ 2 & 1 & -3 \\ 1 & 1 & 1 \end{bmatrix}$ and $10B = \begin{bmatrix} 4 & 2 & 2 \\ -5 & 0 & \alpha \\ 1 & -2 & 3 \end{bmatrix}$. If B is the inverse of A, then α is

(A) –2
(B) 1
(C) 2
(D) 5

155. If [ ] denotes the greatest integer function, then $\left[\left(\sqrt{2}+1\right)^6\right]$ is equal to

(A) 196
(B) 197
(C) 198
(D) 199

156. $\tan\theta \sin\left(\frac{\pi}{2}+\theta\right)\cos\left(\frac{\pi}{2}-\theta\right) =$

(A) 1
(B) -1
(C) $\frac{1}{2}\sin 2\theta$
(D) None of the above

157. If $\sin(A+B)\ \sin(A-B)$ is equal to

(A) $\sin^2 A - \cos^2 B$
(B) $\sin\left(A^2 - B^2\right)$
(C) $\sin^2 A - \sin^2 B$
(D) $\cos^2 A - \cos^2 B$

158. If $\cos\theta + \sqrt{3}\sin\theta = 2,$ then the minimum value of θ is

(A) $\pi/3$
(B) $2\pi/3$
(C) $4\pi/3$
(D) $5\pi/3$

159. $\lim_{x\to\pi/3} \frac{2\sin(x-\frac{\pi}{3})}{1-2\cos x}$ is

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

160. The value of $\tan^{-1}\frac{1}{2} + \tan^{-1}\frac{1}{3}$ is

(A) 0
(B) $\pi/3$
(C) $\pi/6$
(D) $\pi/4$

161. If $\binom{2n}{3} : \binom{n}{2} = 44 : 3$, then the value of n is

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

162. If $\sin\left\{\frac{1}{5}\cos^{-1} x\right\} = 1$, then $x =$

(A) 0
(B) 1
(C) –1
(D) ∞

163. In a ΔABC, $b = \sqrt{3}+1$, $c = \sqrt{3}-1$, $\angle A = 60°$, then the value of $\tan\frac{1}{2}(B-C)$ is

(A) 2
(B) $1/2$
(C) 1
(D) 3

164. If $\begin{vmatrix} x^n & x^{n+2} & x^{n+3} \\ y^n & y^{n+2} & y^{n+3} \\ z^n & z^{n+2} & z^{n+3} \end{vmatrix} = (y-z)(z-x)(x-y)\left(\frac{1}{x}+\frac{1}{y}+\frac{1}{z}\right)$, then n is equal to

(A) 2
(B) –2
(C) –1
(D) 1

165. If $f(x) = |\log_{10} x|$ then at $x = 1$,

(A) f is not continuous
(B) f is continuous but not differentiable
(C) f is differentiable
(D) the derivative is 1

166. If the ratio of the roots of $ax^2+bx+c=0,\ a\neq 0$ is $4:5$, then $\frac{b^2}{ac}$ is equal to

(A) $\frac{20}{49}$

(B) $\frac{49}{20}$

(C) $\frac{81}{20}$

(D) $\frac{20}{81}$

167. The locus represented by $|Z-1|=|Z+i|$ is

(A) a circle of radius 1

(B) an ellipse with foci at (1, 0) and $(0,-1)$

(C) a straight line through the origin

(D) a circle on the line joining $(1,0),(0,1)$ as diameter

168. The solution set of the equation $\begin{vmatrix} 2 & 3 & x \\ 2 & 1 & x^2 \\ 6 & 7 & 3 \end{vmatrix}=0$ is

(A) ϕ

(B) $\{0, 1\}$

(C) $\{1, -1\}$

(D) $\{1,-3\}$

169. A square root of $3+4i$ is

(A) $\sqrt{3}+1$

(B) $2+i$

(C) $-2+i$

(D) None of the above

170. The sum of the series $1+\frac{5}{2!}+\frac{9}{3!}+\frac{17}{4!}+\infty$ is

(A) $e(e+1)$

(B) $e(1-e)$

(C) $e(e-1)$

(D) e^2+e-4

171. If $(1+3p)/3$, $(1-p)/4$ and $(1-2p)/2$ are the probabilities of three mutually exclusive events, then the set of all values of p is

(A) $-1 \le p \le 1/5$
(B) $-2 \le p \le 1/3$
(C) $1/3 \le p \le 1/2$
(D) $1/4 \le P \le 1/3$

172. If $2\alpha + 3\beta + \gamma = 0$, then the line $\alpha x + 5\beta y + 2\gamma = 0$ passes through the fixed point

(A) $\left(4, \frac{6}{5}\right)$
(B) $\left(\frac{6}{5}, 4\right)$
(C) $\left(-4, -\frac{6}{5}\right)$
(D) $\left(-\frac{6}{5}, -4\right)$

173. If $f(x) = \cos(\log x)$, then $f\left(x^2\right) f\left(y^2\right) - \frac{1}{2}\left[f\left(x^2/y^2\right) + f\left(x^2 y^2\right)\right]$, has the value of

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

174. A and B are two independent events. Then probability that both A and B occur, is $1/6$ and the probability that none of them occurs, is $1/3$. The minimum value of probability of occurrence of A, is

(A) $1/2$
(B) $1/3$
(C) $1/4$
(D) $1/5$

175. The equation of the directrix of the parabola $(x-\alpha)^2 = 4a(y-\beta)$ is

(A) $x + a = \alpha$
(B) $x + a = \beta$
(C) $y + a = \beta$
(D) $y + a = \alpha$

176. The minimum value of $27\tan^2\theta + 3\cot^2\theta$ is

(A) 9
(B) 18
(C) 27
(D) 30

177. The interval in which the function $y = \frac{x-1}{x^2-3x+3}$ transforms the real line is

(A) $(0, \infty)$
(B) $(-\infty, \infty)$
(C) [0, 1]
(D) $\left[-\frac{1}{3}, 1\right]$

178. The rank of the matrix $\begin{pmatrix} 2 & 3 & 4 \\ 2a & 3a & 4a \\ 2a^2 & 3a^2 & 4a^2 \end{pmatrix}$ is

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

179. Twelve tickets are numbered from 1 to 12. One ticket is drawn at random, then the probability of the number to be divisible by 2 or 3, is

(A) 2/3
(B) 7/12
(C) 5/6
(D) 3/4

180. $\lim_{x\to 0}\left\{\sin x - x/x^3\right\}$ equals

(A) 1/3
(B) −1/3
(C) 1/6
(D) −1/6

181. If $f(x) = \log_3 x$ and $g(x) = x^2$, then the composite function $f\left(g(x)\right)$ is equal to

(A) $2f(x)$
(B) $\left(f(x)\right)^2$
(C) $g(x)$
(D) $2g(x)$

182. The projection of the vector $2\hat{i} + \hat{j} - 3\hat{k}$ on the vector $\hat{i} - 2\hat{j} + \hat{k}$ is

(A) $\frac{-3}{\sqrt{14}}$
(B) $\frac{3}{\sqrt{14}}$
(C) $-\sqrt{\frac{3}{2}}$
(D) $\frac{3}{\sqrt{2}}$

183. The smallest positive x satisfying the equation $\log_{\cos x} \sin x + \log_{\sin x} \cos x = 2$ is

(A) $\pi/2$
(B) $\pi/3$
(C) $\pi/4$
(D) $\pi/6$

184. The median of a set of 9 distinct observation is 20.5. If each of the largest 4 observations of the set is increased by 2, then the median of the new set

(A) is increased by 2
(B) is decreased by 2
(C) is two times the original median
(D) remains the same as that of the original set

185. The position vector of the points A, B, C are $2\hat{i} + \hat{j} - \hat{k}$, $3\hat{i} - 2\hat{j} + \hat{k}$ and $\hat{i} + 4\hat{j} - 3\hat{k}$ respectively. These points

(A) form an isosceles triangle
(B) form a right angled triangle
(C) are collinear
(D) for a scalene triangle

186. The statement $p \to (q \to p)$ is equivalent to

(A) $p \to (p \leftrightarrow q)$
(B) $p \to (p \to q)$
(C) $p \to (p \vee q)$
(D) $p \to (p \wedge q)$

187. If $y = \log\big(\log(\log x)\big)$, then $\frac{dy}{dx}$ is equal to

(A) $\log(\log x)$
(B) $\log x.\log(\log x)$
(C) $\frac{1}{x.\log x.\log(\log x)}$
(D) $\frac{1}{\log x.\log(\log x)}$

188. Slope of the tangent to the curve $xy - 3x + 2y = 6$ at the point (2, 3) is

(A) 1
(B) $\frac{1}{2}$
(C) ∞
(D) 0

189. If $z = x^2 \tan^{-1}\left(\frac{y}{x}\right) - y^2 \tan^{-1}\left(\frac{x}{y}\right)$, then $\partial^2 z / \partial x \partial y =$

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

190. The argument of the complex number -5 is

(A) 0
(B) $-\pi$
(C) $\frac{\pi}{2}$
(D) π

191. One function is selected from all the function $F: S \to S$, where $S = \{1, 2, 3, 4, 5, 6\}$. The probability that it is onto function is

(A) $5/81$
(B) $5/162$
(C) $5/324$
(D) $7/324$

192. The equation of the tangent to the curve $y = 4 + \sin^2 x$ at $x = 0$ is $y =$

(A) 2
(B) 3
(C) 4
(D) 6

193. The non-zero vectors $\vec{a}, \vec{b}$ and $\vec{c}$ are related by $\vec{a} = 8\vec{b}$ and $\vec{c} = -7\vec{b}$. Then, the angle between $\vec{a}$ and $\vec{c}$

(A) 0
(B) $\pi/4$
(C) $\pi/2$
(D) π

194. The point P is equidistant from $A(1, 3)$, $B(-3, 5)$ and $C(5, -1)$. Then PA is equal to

(A) 5
(B) $5\sqrt{5}$
(C) 25
(D) $5\sqrt{10}$

195. The area bounded by the curves $x+2|y|=1$ and $x = 0$ is

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

196. If $a > 1$, then the roots of the equation $(1-a)x^2+3ax-1=0$ are

(A) both positive
(B) both negative
(C) opposite in sign
(D) imaginary conjugate

197. The tangent from the origin to the parabola $y^2+4=4x$ are inclined at an angle

(A) $\pi/6$
(B) $\pi/4$
(C) $\pi/3$
(D) $\pi/2$

198. If the points $(-2,0)$, $\left(-1,\frac{1}{\sqrt{3}}\right)$ and $(\cos\theta,\sin\theta)$ are collinear, then the number of values of $\theta=[0,2\pi]$ is

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

199. The contrapositive of the statement "I go to school if it does not rain" is

(A) if it rains, I do not go to school
(B) if I do not go to school, it rains
(C) if it rains, I go to school
(D) if I go to school, it rains

200. The function $f(x)=\left[x(x-3)\right]^2$ increases for all values of x lying in the interval

(A) $0<x<3/2$
(B) $0<x<\infty$
(C) $-\infty<x<0$
(D) $1<x<3$

201. Let $f:\square\to\square$ be a positive valued increasing function with $\lim_{x\to\infty}\frac{f(3x)}{f(x)}=1$. Then $\lim_{x\to\infty}\frac{f(2x)}{f(x)}$ is

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

202. If one of the lines of $my^2+\left(1-m^2\right)xy-mx^2=0$ is a bisector of the angle between the lines $xy=0$, then m is

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

203. The number of points on the line $x+y=4$ which are unit distance apart from the line $2x+2y=5$ is

(A) 0
(B) 1
(C) 2
(D) ∞

204. $\int \frac{\sin x - \cos x}{\sqrt{1+\sin 2x}} dx$ is equal to

(A) $\log(\sin x + \cos x) + c$
(B) $-\log(\sin x + \cos x) + c$
(C) $\log \sec\left(x - \frac{\pi}{4}\right) + c$
(D) $-\log \sec\left(x - \frac{\pi}{4}\right) + c$

205. The range of λ for which the circles $x^2 + y^2 = 4$ and $x^2 + y^2 - 4\lambda x + 9 = 0$ have two common tangents, is

(A) $\lambda \in \left(-\frac{13}{8}, \frac{13}{8}\right)$
(B) $\lambda > \frac{13}{8}$ or $\lambda < -\frac{13}{8}$
(C) $1 < \lambda < \frac{13}{8}$
(D) $\lambda \in \left[-\frac{13}{8}, \frac{13}{8}\right]$

206. If $I_n = \int_0^1 \left[(n+1)x^n + nx^{n-1} + \ldots + 2x + 1\right] dx$, then the value of I_n is

(A) $n - 1$
(B) n
(C) $n + 1$
(D) $n + 2$

207. The area of the region bounded by the lines $y = |x - 2|$, $x = 1$, $x = 3$ and the x-axis is

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

208. The value of a for which the difference of the roots of the equation $ax^2 + (a-1)x + 2 = 0$ is min, is given by

(A) $1/5$
(B) 5
(C) $-1/5$
(D) None of the above

209. The line $x - 1 = 0$ is the directrix of the parabola $y^2 - kx + 8 = 0$. Then, one of the value of *k is*

(A) $\frac{1}{8}$
(B) 8
(C) 4
(D) $\frac{1}{4}$

210. Area between the curve $y = 4 + 3x - x^2$ and x-axis is

(A) $\left(\frac{125}{3}\right)$ sq. unit
(B) $\left(\frac{125}{4}\right)$ sq. unit
(C) $\left(\frac{125}{6}\right)$ sq. unit
(D) None of the above

211. The focus of the parabola $y = 2x^2 + x$ is

(A) (0, 0)
(B) $\left(\frac{1}{2}, \frac{1}{4}\right)$
(C) $\left(-\frac{1}{4}, 0\right)$
(D) $\left(-\frac{1}{4}, \frac{1}{8}\right)$

212. The order and degree of the differential equation $y+\left(\frac{d^3y}{dx^3}\right)^2=\sqrt[3]{1+\frac{dx}{dy}}$ are respectively

(A) 3, 5
(B) 3, 6
(C) 3, 2
(D) 5, 4

213. The area bounded by the straight lines $x=0,\ x=2$ and the curve $y=2^x,\ y=2x-x^2$ is

(A) $\frac{4}{3}-\frac{1}{\log 2}$
(B) $\frac{3}{\log 2}+\frac{4}{3}$
(C) $\frac{4}{\log 2}-1$
(D) $\frac{3}{\log 2}-\frac{4}{3}$

214. The number of solutions of the equation $z^2=\overline{z}$, where z is a complex number, is

(A) 2
(B) 3
(C) 4
(D) 6

215. The differential equation of all circles passing through the origin and having their centres on the *x*-axis is

(A) $x^2=y^2+xy\frac{dy}{dx}$
(B) $x^2=y^2+3xy\frac{dy}{dx}$
(C) $y^2=x^2+2xy\frac{dy}{dx}$
(D) $y^2=x^2-2xy\frac{dy}{dx}$

216. Which one of the following function is not periodic?

(A) $e^{\sin x}$

(B) $\dfrac{1}{10+\sin x+\cos x}$

(C) $\log_e(\cos x)$

(D) $\sin\left(e^x\right)$

217. Differential coefficient of $\log_{10} x$ with respect to $\log_x 10$ is

(A) $-\dfrac{(\log 10)^2}{(\log x)^2}$

(B) $\dfrac{(\log_x 10)^2}{(\log 10)^2}$

(C) $\dfrac{(\log_{10} x)^2}{(\log 10)^2}$

(D) $-\dfrac{(\log x)^2}{(\log 10)^2}$

218. The derivative of $\sin^{-1}\left(\dfrac{2x}{1+x^2}\right)$ with respect to $\cos^{-1}\left(\dfrac{1-x^2}{1+x^2}\right)$ is

(A) 11

(B) 1

(C) 2

(D) 4

219. $\lim_{n\to\infty}\left[\dfrac{n!}{n^n}\right]^{1/n}$ equals

(A) e

(B) $1/e$

(C) $\pi/4$

(D) $4/\pi$

220. If $\frac{1}{a}=\frac{1}{b}=\frac{1}{c}=\frac{1}{a+b+c}$ then $\frac{1}{a^5}=\frac{1}{b^5}=\frac{1}{c^5}=$

(A) 0
(B) 1
(C) $1/\left(a^5+b^5+c^5\right)$
(D) None of the above

221. If $x=y\sqrt{1-y^2}$, then $\frac{dy}{dx}$ is equal to

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

222. The solution of $\sec^2 x\tan^2 ydx+\sec^2 y\tan^2 xdy=0$ is

(A) $\frac{\tan x-\tan y}{\tan x\tan y}=c$
(B) $\frac{\tan x+\tan y}{\tan x}=c$
(C) $\frac{\tan x+\tan y}{\tan x\tan y}=c$
(D) $\frac{\tan x+\tan y}{\tan y}=c$

223. A differentiable function $f(x)$ is defined for all $x>0$ and satisfies $f\left(x^3\right)=4x^4$ for all $x>0$. The value of $f'(8)$ is

(A) $\frac{16}{3}$
(B) $\frac{32}{3}$
(C) $\frac{16\sqrt{2}}{3}$
(D) $\frac{32\sqrt{2}}{3}$

224. If $\Delta(n)=\begin{vmatrix} x^n & \sin x & \cos x \\ n! & \sin\frac{n\pi}{2} & \cos\frac{n\pi}{2} \\ \alpha & \alpha^2 & \alpha^3 \end{vmatrix}$, then the value of $\frac{d^n}{dx^n}[\Delta(x)]$ at $x = 0$ is

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

225. The vector in the direction of $3i-4j$ that has magnitude 7 unit is

(A) $\frac{21}{5}i-\frac{28}{5}j$
(B) $\frac{3}{5}i-\frac{4}{5}j$
(C) $21i-28j$
(D) $\frac{21}{5}i+\frac{28}{5}j$

226. If $f(x)=ax+b$ and $g(x)=cx+d$, then $f\{g(x)\}=g\{f(x)\}$ is equivalent to

(A) $f(a)=g(c)$
(B) $f(b)=g(b)$
(C) $f(d)=g(b)$
(D) $f(c)=g(a)$

227. In a ΔABC, $\tan A$ and $\tan B$ are the roots of $pq(x^2+1)=r^2x$. Then ΔABC is

(A) a right angled triangle
(B) an equilateral triangle
(C) an acute angled triangle
(D) an obtuse angled triangle

228. The number of ways in which we can choose a committee from four men and six women so that the committee includes at least two men and at least twice as many women as men is

(A) 94
(B) 126
(C) 136
(D) 156

229. If $f(x)=\begin{cases}\frac{1-\cos x}{x}, & x\neq 0\\ k, & x=0\end{cases}$ is continuous at $x=0,$ then the value of k is

(A) 0
(B) $\frac{1}{2}$
(C) $\frac{1}{4}$
(D) $-\frac{1}{2}$

230. If $f(2)=4$ and $f'(2)=1,$ then the value of $\lim\limits_{x\to 2}\frac{xf(2)-2f(x)}{x-2}$ is

(A) –3
(B) 1
(C) 3
(D) 2

231. The value of $\lim\limits_{x\to\frac{\pi}{2}}\frac{2x-\pi}{\cos x}$ is equal to

(A) –1
(B) –2
(C) 2
(D) 1

232. The function $f(x)=xe^{1-x}$

(A) strictly increases in the interval $\left(\frac{1}{2},2\right)$
(B) increases in the interval $(0,\infty)$
(C) decreases in the interval $(0,2)$
(D) strictly decreases in the interval $(1,\infty)$

233. If three positive real numbers a,b,c are in A.P. and $abc=4$ then minimum possible value of b is

(A) $2^{3/2}$
(B) $2^{2/3}$
(C) $2^{1/3}$
(D) 1

234. Let $f : N \to Y$ be a function defined as $f(x) = 4x + 3$ where $Y = \{y \in N : y = 4x + 3 \text{ for some } x \in N\}$. Then the inverse of f is

(A) $g(y) = \frac{3y+4}{3}$

(B) $g(y) = 4 + \frac{y+3}{4}$

(C) $g(y) = \frac{y+3}{4}$

(D) $g(y) = \frac{y-3}{4}$

235. The first two terms of a geometric progression add up to 12. The sum of the third and the fourth terms is 48. If the terms of the geometric progression are alternately positive and negative, then the first term is

(A) –4
(B) –12
(C) 12
(D) 4

236. If ω is a cube root of unity, then a root of the equation $\begin{vmatrix} x+1 & \omega & \omega^2 \\ \omega & x+\omega^2 & 1 \\ \omega^2 & 1 & 1+\omega \end{vmatrix} = 0$ is

(A) $x = 1$
(B) $x = \omega$
(C) $x = \omega^2$
(D) $x = 0$

237. Let α and β be two real numbers and the matrix $A = \begin{bmatrix} 0 & \alpha \\ \beta & 0 \end{bmatrix}$ be such that $A^3 + A = 0$.

Then

(A) $\alpha\beta = 2$
(B) $\alpha\beta = 0$
(C) $\alpha\beta = 1$
(D) $\alpha\beta = -1$

238. The number of surjection's from $A=\{1,2,...n\}$, $n\geq 2$, onto $B=\{a,b\}$ is

(A) nP_2
(B) 2^n-2
(C) 2^n-1
(D) None of the above

239. For real numbers x and y, we define xRy if and only if $x-y+\sqrt{2}$ is an irrational number. Then the relation R is

(A) Reflexive
(B) Symmetric
(C) Transitive
(D) None of the above

240. The set of all values of x for which $\log(1+x)<x$ is

(A) $x>0$
(B) $0<x<1$
(C) $x\geq 0$
(D) $x=1$

241. A house has multi-storey's. The lowest storey is 20 ft. high. A stone which is dropped from the top of the house passes the lowest story in 1/4 second. The height of the house is

(A) 100 ft.
(B) 110 ft.
(C) 110.25 ft.
(D) None of the above

242. A particle is projected with a velocity of 39.2 m/sec at an angle of $30°$ to the horizontal. It will move at right angles to the direction of projection after the time.

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

243. The value of $\int_{\frac{1}{\pi}}^{\frac{2}{\pi}} \frac{1}{x^2}\sin\frac{1}{x}dx$ is equal to

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

244. Three houses are available in a locality. Three persons apply for the houses. Each applies for one house without consulting others. The probability that all the three apply for the same house is

(A) $\frac{8}{9}$
(B) $\frac{7}{9}$
(C) $\frac{2}{9}$
(D) $\frac{1}{9}$

245. Last two digits of the natural number 19^{94} is

(A) 29
(B) 39
(C) 90
(D) 19

246. The number of solutions of $\frac{1}{x}+\frac{1}{y}=\frac{1}{6}$, where $x, y \in \square$ is

(A) 9
(B) 18
(C) 21
(D) 28

247. If $(3,2,5)$ is one end of a diameter of the sphere $x^2+y^2+z^2-6x-12y-2z+20=0$, then co-ordinates of the other end of the diameter are

(A) (4, 3, 5)
(B) $(4,3,-3)$
(C) $(4,9,-3)$
(D) None of the above

248. The weighted mean of first n natural numbers whose weights are equal to the squares of corresponding number is

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

(B) $\frac{3n(n+1)}{2(2n+1)}$

(C) $\frac{(n+1)(2n+1)}{6}$

(D) $\frac{n(n+1)}{2}$

249. $\int 5^{5^{5^x}}.5^{5^x}.5^x\,dx$ equal to

(A) $\frac{5^{5^x}}{(\log 5)^3}+c$

(B) $5^{5^{5^x}}(\log 5)^3+c$

(C) $\frac{5^{5^{5^x}}}{(\log 5)^3}+c$

(D) None of these

250. The sum of the coefficients of all those term with integral power of x in the expansion of $\left(1+\sqrt{x}\right)^9$ is

(A) 128
(B) 225
(C) 312
(D) 256

FINAL ANSWER KEY

Subject Name: 101 B TECH 18-S1

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	A	31	D	61	C	91	B	121	A	151	B	181	A	211	C	241	C
2	D	32	B	62	C	92	B	122	C	152	A	182	C	212	B	242	A
3	B	33	B	63	D	93	B	123	A	153	D	183	C	213	D	243	B
4	A	34	D	64	D	94	B	124	D	154	D	184	D	214	C	244	D
5	A	35	B	65	B	95	A	125	B	155	B	185	C	215	C	245	D
6	A	36	C	66	A	96	A	126	A	156	D	186	C	216	D	246	A
7	B	37	A	67	B	97	A	127	A	157	C	187	C	217	D	247	C
8	D	38	D	68	C	98	C	128	B	158	A	188	D	218	B	248	B
9	D	39	D	69	C	99	B	129	C	159	B	189	D	219	B	249	C
10	A	40	D	70	D	100	B	130	B	160	D	190	D	220	C	250	D
11	B	41	A	71	C	101	D	131	A	161	D	191	C	221	C		
12	C	42	B	72	D	102	B	132	C	162	A	192	C	222	C		
13	C	43	C	73	D	103	D	133	C	163	C	193	D	223	B		
14	A	44	B	74	C	104	C	134	C	164	C	194	D	224	B		
15	A	45	A	75	D	105	C	135	D	165	B	195	B	225	A		
16	A	46	C	76	B	106	C	136	C	166	C	196	A	226	C		
17	D	47	A	77	A	107	D	137	B	167	C	197	D	227	A		
18	A	48	A	78	A	108	C	138	C	168	D	198	B	228	C		
19	B	49	B	79	B	109	C	139	A	169	B	199	B	229	A		
20	A	50	D	80	C	110	B	140	A	170	D	200	A	230	D		
21	A	51	D	81	D	111	C	141	B	171	C	201	D	231	B		
22	C	52	C	82	C	112	B	142	B	172	A	202	C	232	D		
23	B	53	D	83	A	113	C	143	D	173	D	203	A	233	B		
24	C	54	C	84	B	114	B	144	A	174	B	204	B	234	D		
25	B	55	C	85	B	115	B	145	B	175	C	205	B	235	B		
26	B	56	C	86	A	116	C	146	A	176	B	206	C	236	D		
27	D	57	B	87	C	117	B	147	D	177	D	207	A	237	D		
28	A	58	A	88	B	118	A	148	C	178	C	208	A	238	B		
29	D	59	D	89	A	119	B	149	B	179	A	209	C	239	A		
30	D	60	A	90	D	120	C	150	D	180	D	210	C	240	C		