ENTRANCE EXAMINATION 2015

M.Sc. Ocean and Atmospheric Sciences

Date: 11.02.2015
Time: 10.00-12.00

Marks: 75

Instructions for the candidates:

1. All questions carry equal marks.

2. Write your Hall Ticket Number on the OMR Answer Sheet given to you. Also write the Hall Ticket Number in the space provided on the question paper booklet.

3. The question paper consists of Objective Type questions of one mark each.

4. The question paper consists of Part 'A' and Part 'B'.

5. **There is negative marking. Each wrong answer carries -0.33 mark.**

6. Answers are to be marked on the OMR answer sheet following the instructions provided there upon.

7. Hand over the OMR answer sheet at the end of the examination.

8. No additional sheets will be provided. Rough work can be done in the question paper itself / space provided at the end of the booklet.

9. Non-programmable calculators are allowed.

PART-A

1. A given vector C is the resultant of two perpendicular vectors, one along the X-Axis and of magnitude 25 units, and the other along Y Axis and of magnitude 60 Units. The resultant magnitude, and the tangent of the angle α between this vector and the x-axis are given by

   A. 65, 25/60
   B. 35,60/25
   C. 65, 60/25
   D. 35, 25/60

2. When a bullock pulls a cart, the force that helps the bullock to move forward is the foci exerted by

        A. the ground on the cart
        B. the ground on the bullock
        C. the cart on the bullock
        D. the bullock on the ground

3. A matrix is called a diagonal matrix if

        A. all its diagonal elements are zero
        B. all its non-diagonal elements are zero
        C. all its diagonal elements are identical
        D. it is a single column matrix

4. Which of the following functions of x is an even function?

        A. $\sin(x)$
        B. x
        C. $\cos(x)$
        D. $4x^3$

5. The atomic radius is the distance between

        A. the centre of its nucleus and electrons in the last orbit.
        B. twice the centre of its nucleus and electrons in the last orbit.
        C. twice the distance between nuclei of two adjacent atoms
        D. twice the distance between the last orbital electrons of two atoms

6. An anion is

        A. Always smaller than the corresponding atom
        B. Same as the corresponding atom
        C. Always larger than the corresponding atom
        D. is formed by removal of one or more electrons from an atom.

7. When a particle moves in a circle with uniform speed

        A. its velocity and acceleration both change
        B. its velocity and acceleration both are constant
        C. its velocity changes but acceleration is constant
        D. its velocity is constant but acceleration changes

8. If the mass of a uniform solid cylinder is M its radius is R, and its length is L, the moment of inertia about is axis is given by

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

9. If $\begin{vmatrix} 3 & x \\ x & 1 \end{vmatrix} = \begin{vmatrix} 3 & 2 \\ 4 & 1 \end{vmatrix}$, then $(x)^2$ equals

        A. 8
        B. 3
        C. 9.
        D. 18

10.   Divergence of a the curl of a vector V is

        A. $(\nabla)^2 V$
        B. 0
        C. V^2
        D. ∇V

11. Nitrous oxide gas
   A. is not a supporter of combustion
   B. cannot be used as anaesthetic even when mixed with oxygen
   C. disassociates into N_2 and O_2 between 500~900 °C
   D. is not soluble in hot water.

12. Covalent compounds
   A. are insoluble in water
   B. are insoluble in non-polar solvent.
   C. do not exhibit space isomerism
   D. have high melting and boiling points

13. In case of a neutral equilibrium, on slightly being displaced, the centre f mass
   A. goes lower
   B. Goes higher
   C. stays at the same height
   D. Goes higher or lower

14. The observed value of acceleration due gravity is minimum at
   A. Poles
   B. Equator
   C. 45° latitude
   D. Changes with the seasons

15. $\lim_{x \to 3} \frac{8x^2}{1+\sqrt{x}}$ is
   A. $\frac{72}{1+\sqrt{3}}$
   B. $\frac{8}{1+\sqrt{3}}$
   C. Does not exist
   D. 0

16. The function $f(x)=x^2-5x+6$ changes sign from positive to negative at
   A. 0
   B. 5
   C. 2
   D. 1

17. Which of the following is not a sugar?
   A. Cane sugar
   B. Lactose
   C. Sucrose
   D. Starch

18. Solubility of solids in liquids is significantly not affected by
   A. temperature
   B. pressure
   C. type of the solute
   D. type of the solvent

19. A sine wave is travelling in a medium. A particle has zero displacement at a particular instant. If we denote the wave length by L, The particle closest to it also having zero displacement is at a distance
   A. L/4   B. L
   C. 2L   D.L/2

20. Speed of sound in the air increases with
    A. decreasing temperature
    B. decreasing humidity
    C. not sensitive to humidity or temperature changes
    D. increasing humidity

21. The absolute maximum and minimum values of a function f given by
    $f(x) = 2x^3 - 15x^2 + 36x + 1$ on the interval [1, 5] are
    A. 5, and 1
    B. -56, and 0
    C. $-\infty$, and $+\infty$
    D. -56, and 24

22. Critical points of the function $f(x) = 3x^4 - 8x^3 + 6x - 1$ are
    A. -1, and 1
    B. -1, and 0
    C. 0, and 1
    D. -2, and 2

23. The boiling point of benzene is 353.23 K. When 1.80 g of a non-volatile solute was dissolved in 90 g of benzene, the boiling point is raised to 354.11 K. Calculate the molar mass of the solute. K_b, the boiling point elevation constant for benzene is 2.53 K kg mol^{-1}
    A. 58 kg mol^{-1}
    B. 58 g mol^{-1}
    C. 0
    D. 1.8 g mol^{-1}

24. Two solutions having same osmotic pressure at a given temperature are called
    A. isotonic solutions
    B. Hypertonic solutions
    C. Hypotonic solutions
    D. Osmotic solutions

25. The speed of light in vacuum is 3.0×10^8 m.s^{-1}. If the refractive index of glass is 1.5, then the speed of light in glass would be
    A. 3.0×10^8 m.s^{-1}
    B. 6.0×10^8 m.s^{-1}
    C. 2.0×10^8 m.s^{-1}
    D. 0

PART B

26. The speed of light depends
    A. on elasticity of the medium only
    B. On inertia of the medium only
    C. Neither on elasticity nor on the inertia
    D. Both elasticity as well as inertia.

27. An object moving in a straight line has velocity $v = 5t^4 + 3t^2$ at time t. Between t=1 and t=2, the unit distances travelled by the object are
    A. 38
    B. 300
    C. 1
    D. 0

28. Let P be the point (1, 0) and Q a point on the locus $y^2 = 8x$. The locus of midpoint of PQ is

  A. $y^2 - 4x + 2 = 0$
  B. $y^2 + 4x + 2 = 0$
  C. $x^2 + 4y + 2 = 0$
  D. $x^2 - 4y + 2 = 0$

29. One of the following does not fit into polymer classification based on basis of magnitude of intermolecular forces present.

  A. Elastomers
  B. Linear polymers
  C. Thermoplastic polymers
  D. Thermosetting polymers

30. One of the following is not the property of Physical absorption

  A. It arises because of van der Waals' forces.
  B. It is not specific in nature.
  C. It is reversible in nature.
  D. Enthalpy of adsorption is high (80-240 kJ mol^{-1}).

31. Which of the following properties indicates that light is a transverse wave?

  A. Polarization
  B. Diffraction
  C. Interference
  D. Reflection

32. If a thin transparent sheet is placed in front of a Young's double slit, the fringe-width will

  A. Remain same
  B. become non-uniform
  C. increase
  D. there will be no fringe

33. Let one root of $ax^2 + bx + c = 0$ where a,b,c are integers be $3 + \sqrt{5}$, then the other root is.

  A. 3
  B. $3 - \sqrt{5}$
  C. $\sqrt{5}$
  D. $\sqrt{15}$

34. Mathematically, what is a differential?

  A. Difference between two quantities.
  B. A gear box on the back end of your car.
  C. A method of directly relating how changes in an independent variable affect changes in a dependent variable.
  D. A method of directly relating how changes in a dependent variable affect changes in an independent variable.

35. One of the following is not a cidal antibiotic

  A. Penicillin
  B. Erythromycin
  C. Aminoglycosides
  D. Ofloxacin

36. A gas expands against a constant pressure of 3 atm from 5 litres to 22 litres. The work done by the gas is
    A. 51 litres atm
    B. 22 litres atm
    C. 9 litres atm
    D. 17 litres atm

37. A point object placed at a distance of 30 cm from a convex mirror with focal length of 30 cm, the image will fall
    A. pole
    B. 15 cm behind the mirror
    C. focus
    D. Infinity

38. The time period of a particle in simple harmonic motion is equal to the time between consecutive appearances of the particle at a particular point in its motion, which is
    A. between the mean position and positive extreme position
    B. at the mean position
    C. at an extreme position
    D. between the mean position and negative extreme position

39. The 2nd derivative of a function at point P is 0, and concavity is positive for values to the right of P. What must the concavity be to the left of P for P to be an inflection point?
    A. The concavity must also be positive.
    B. The concavity must be negative.
    C. The concavity must be neutral (0).
    D. The concavity must be imaginary.

40. Does $f(c) = (c + 2)^3 - 2$ have an inflection point? If so, where is it located?
    A. Yes, at (-2, -2).
    B. Yes, at (2, -2).
    C. Yes, at (8, -2).
    D. No.

41. The process in which heat is neither allowed to enter nor leave the system, but in which the temperature changes is known as
    A. isobaric
    B. diabatic
    C. adiabatic
    D. isochoric

42. what will be the amount of $^{128}I_{53}$, whose half-life is 25 minutes, left after 50 minutes?
    A. zero
    B. one-fourth
    C. one-third
    D. one-eighth

43. A barometer kept in a lift at rest reads 76 cm. If the lift moves up with increasing speed, the reading will be
    A. 76 m
    B. 0
    C. greater than 76 m
    D. Less than 76 m

44. If a 700 gm solid cube having an edge of length 10 cm floats in water, how much of the cube would be outside the water. The density of water is 1000 kg.m^{-3}.
   A. 200 cm^3
   B. 300 cm^3
   C. 200 cm^3
   D. 1000 cm^3

45. The solution of dy/dx=-3xy, with y=1 when x=0 is
   A. y=exp(3x^2/2)
   B. y= exp(-3x^2/2)
   C. y= exp(-2x^2/3)
   D. y= exp(-3x/2)

46. A partial differential equation has
   A. one independent variable
   B. two or more independent variables
   C. more than one dependent variable
   D. equal number of dependent and independent variables

47. The IUPAC name of Glycerol is
   A. Propan-1-ol
   B. Propan-2-ol
   C. Butan-1-ol
   D. Propane -1, 2, 3-triol

48. The metal present in Vitamin B$_{12}$ is:
   A. Copper
   B. Iron
   C. Cobalt
   D. Manganese

49. Dimensions ML^{-1}T^{-2} correspond to
   A. Coefficient of viscosity
   B. Moment of force
   C. Modulus of elasticity
   D. Surface tension

50. The temperature at which the saturation vapour pressure is equal to the present vapour pressure is called
   A. Dew point
   B. Minimum temperature
   C. Triple point
   D. Melting point

51. The following is true for the following partial differential equation

$$\frac{\partial w}{\partial t} + \frac{\partial^3 x}{\partial x^3} - 6w\frac{\partial w}{\partial x} = 0$$

   A. linear; first order
   B. nonlinear; first order
   C. linear; third order
   D. Non-linear; third order

52. The following partial differential equation is classified as

$$5\frac{\partial^2 z}{\partial x^2} + 6\frac{\partial^2 z}{\partial y^2} = xy$$

    A. non-linear; third order

    B. parabolic

    C. Elliptic

    D. Hyperbolic

53. Which of the following elements is poisonous to living systems even in small quantities?

    A. Na

    B. Hg

    C. P

    D. Zn

54. The element present in Chlorophyll is

    A. Mg

    B. Fe

    C. Zn

    D. Cu

55. The pressure of a gas kept in an isothermal container is 200 kPa. If half the gas is removed from it, the pressure will be

    A. 100 kPa

    B. 800 kPa

    C. 200 kPa

    D. 400 kPa

56. If C_p and C_v represent the molecular heat capacities of an ideal gas at constant pressure and constant pressure respectively, the universal constant cab be represented as

    A. $C_p + C_v$

    B. $C_p - C_v$

    C. C_p / C_v

    D. $C_v - C_p$

57. A "periodic function" is given by a function which

    A. has a period $T = 2\pi$

    B. satisfies $f(t+T) = f(t)$

    C. satisfies $f(t+T) = -f(t)$

    D. has a period $T = \pi$

58. A differential equation is considered to be ordinary if it has

    A. one dependent variable

    B. more than one dependent variable

    C. one independent variable

    D. more than one independent variable

59. Which of the following is an essential amino acid?

    A. Glutamic acid

    B. Glycine

    C. Luecine

    D. Aspartic acid

60. The mean distance between Sun and Earth in light years is
        A. 8.311 minutes
        B. 8.3 Months
        C. 8. 3 years
        D. 149,598,000 years

61. The light from the Sun has maximum intensity near 470×10^{-9} m. Assuming that the surface of Sun emits as a blackbody, the temperature of the sun would be 6130 K following
        A. Stefan-Boltzmann Law
        B. Planck's Law
        C. Kirchoff's Law
        D. Wein's displacement Law

62. *A dielectric slab is inserted between the plates of an isolated charged capacitor. Which of the following quantities remains the same?*
        A. The charge on the capacitor
        B. The stored energy in the capacitor
        C. the potential difference between the plates
        D. the electric filed in the capacitor.

63. For the comparison of variability between two data sets set1:[10,20,30,40,50,60), set-2[100,200,300,400,500,600] which measure of dispersion is useful? ?
        A. Standard deviation.
        B. Coefficient of variation.
        C. Inter quartile range
        D. Mean

64. The percentile of your score in a common entrance test is say 95, it means that approximately
        A. you scored 95% marks.
        B. 95% of the people scored less than you.
        C. 95 % of the people scored more than you
        D. 5% of the people scored less than you

65. The epoch when Modern man appeared is
        A. Olgoscene
        B. Paleoscene
        C. Holoscene
        D. Plioscene

66. Tsunamis occur due to
        A. Cloud burst
        B. Monsoonal wind reversals
        C. Solar cycle changes
        D. Earthquakes

67. As the temperature of a metallic resistor is increased, the product of its resistivity and conductivity
        A. Remains constant
        B. May increase or decrease
        C. Increases
        D. decreases

68. Magnetic meridian is
   A. a point
   B. a line along north-south
   C. a vertical plane
   D. a horizontal plane

69. To reduce the size of confidence interval in a future study, which of the following should be done?
   A. increase the sample size
   B. decrease the sample size
   C. Select homogeneous samples
   D. increase confidence level

70. A correlation coefficient between in-semester test marks and end-semester test marks of 30 students is 8.639. This means
   A. There is strong positive correlation between these two tests
   B. No correlation
   C. There is a negative correlation between the two tests
   D. Problem with computation

71. The average height of tropopause, in Kilometres is, is
   A . 5
   B. 13
   C. 80
   D. 1

72. Which one of the following gases constitutes the major portion of the atmosphere?
   A. Oxygen
   B. Argon
   C. Nitrogen
   D. Carbon dioxide

73. In a semiconductor, the electric conduction takes place due to
   A. both electrons and holes
   B. neither electrons nor wholes
   C. electrons only
   D. holes only

74. A correlation coefficient for 20 pairs of data is calculated to be 0. Then,
   A. there is positive correlation between the variables.
   B. the regression line has a negative slope.
   C. there is negative correlation between the variables.
   D. the regression line has a slope of zero.

75. The gas that is transparent to incoming solar radiation and opaque to outgoing terrestrial radiation?
   A. Oxygen
   B. Helium
   C. Nitrogen
   D. Carbon dioxide