Department of Chemistry
Siksha-Bhavana, Visva-Bharati
Santiniketan-731235
M.Sc Adimission Test 2014

Time: 90 minutes **Full Marks: 100**

For Office Use Only		To be filled by the candidate
Groups	**Marks**	**Roll number**
Group A: Organic Chemistry		
Group B: Inorganic Chemistry		**Category:** (GEN/OBC/SC/ST/PH)
Group C: Physical Chemistry		
Total:		**% of Marks in B.Sc (Hons)**
% of Marks in B.Sc (Hons)		
Grand Total		**Contact Number:**

There are all objective type questions (multiple choice). Division of marks for each group is: Group A: 34; Group B: 34 and Group C: 32. Use tick mark (√) for your answer in the appropriate place. Wrong answers will carry **NEGETIVE** marks and 50% mark will be deducted for each wrong answer.

Group: A

(Organic Chemistry)

Answer all questions. Each question carries 2 marks

1. The number of signals observed in ^1H NMR spectrum of 3,5-dibromotoluene is
   (A) 3 (B) 4 (C) 2 (D) 6

2. Toluene when refluxed with Br_2 in the presence of light mainly gives
   (A) *o*-bromotoluene (B) *p*-bromotoluene
   (C) mixture of *o* and *p*- bomotoluene (D) benzylbromide

3. Optically active 2-octanol rapidly loses its optical activity when exposed to
   (A) dilute acid (B) dilute base (C) light (D) humidity

4. When methyl α - D-glucopyranoside reacts with periodic acid, how many moles of the oxidising agents are consumed per mole of sugar ?
   (A) 1 (B) 2 (C) 3 (D) 4

5. The reaction of 4-bromobenzyl chloride with sodium cyanide in ethanol leads to
   (A) 4-bromobenzyl cyanide (B) 4-cyanobenzyl chloride
   (C) 4-cyanobenzyl cyanide (D) 4-bromo-2-cyanobenzyl chloride

6. Which one of the following reactions will not result in the formation of anisole?
   (A) phenol and Me_2SO_4 in the presence of base (B) reaction of CH_2N_2 with phenol
   (C) sodium phenoxide treated with methyliodide (D) reaction of MeMgI with phenol

7. 4-Pentenoic acid when treated with I_2 and $NaHCO_3$ gives
   (A) 4,5-diiodopentanoic acid (B) 5-iodomethyl-dihydrofuran-2-one
   (C) 5-iodo-tetrahydropyran-2-one (D) 4-pentenoyliodide

8. The most stable conformation of ethylene glycol is
   (A) Anti (B) Gauche (C) Partially eclipsed (D) Fully eclipsed

9. Treatment of furan-2-carboxaldehyde with NaOH yields
(A) Furoin (B) Furoic acid
(C) Furfuryl alcohol and sodium salt of furane-2-carboxylic acid (D) No reaction

10. The name reaction involves for the conversion of acetopheone to phenylacetate is
(A) Favorskii rearrangement (B) Birch reduction
(C) Beckmann rearrangement (D) Baeyer-Villiger oxidation

11. An example of [3,3] sigmatropic rearrangement is
(A) Claisen rearrangement (B) Diels-Alder reaction
(C) Ene reaction (D) Dienone-Phenol rearrangement

12. Methylcyclohexene can be converted to *trans*-2-methylcyclohexanol by
(A) Acid catalyzed hydration (B) oxymercuration followed by reduction
(C) hydroboration followed by oxidation (D) epoxidation followed by LAH reduction

13. Reaction of (*R*)-2-butanol with *p*-toluenesulphonyl chloride and pyridine by LiBr gives
(A) (*R*)-2-butyl tosylate (B) (*S*)-2-butyl tosylate
(C) (*R*)-2-butyl bromide (D) (*S*)-2-butyl bromide

14. How many stereoisomers are there for tartaric acid
(A) 2 (B) 3 (C) 4 (D) 8

15. Pyridine undergoes nucleophilic addition preferentially at the position of
(A) 2 (B) 3 (C) 4 (D) none

16. The one among the compounds given below, with highest dipole moment is
(A) naphthalene (B) phenanthrene (C) anthracene (D) azulene

17. The most convenient spectroscopic technique to establish the present of inter-molecular hydrogen bonding in hydroxyl compound is
(A) UV (B) IR (C) EPR (D) Mass

GROUP-B
(Inorganic Chemistry)

For each question, only one of the four options is the correct answer. ***Put tick mark (√) on the correct answer.*** *A correct answer will earn 2 marks, a wrong answer will earn (-1) mark and an unattempted question will earn 0 marks.*

1. The electronegativities of the elements Zn, Cd and Hg follow the order

(a) Zn 〉 Cd 〉 Hg (b) Hg 〉 Cd 〈 Zn

(c) Zn 〉 Hg 〈 Cd (d) Hg 〉 Cd 〉 Zn

2. The d_π-p_π bonding efficiency of the oxyanions SiO_4^{4-}, PO_4^{3-}, SO_4^{2-} and ClO_4^- runs in the sequence

(a) SiO_4^{4-} 〉 PO_4^{3-} 〉 ClO_4^- 〉 SO_4^{2-} (b) ClO_4^- 〉 SO_4^{2-} 〉 PO_4^{3-} 〉 SiO_4^{4-}

(c) SiO_4^{4-} 〉 PO_4^{3-} 〉 SO_4^{2-} 〉 ClO_4^- (d) ClO_4^- 〉 PO_4^{3-} 〉 SO_4^{2-} 〉 SiO_4^{4-}

3. $M(CO)_3$ is isolobal with

(a) CH (b) CH^- (c) CH_2 (d) CH_2^+

4. The Lewis acid strength of $Al(CH_3)_3$, $B(CH_3)_3$ and $B(C_6H_5)_3$ follows the order

(a) $B(CH_3)_3$ 〉 $Al(CH_3)_3$ 〉 $B(C_6H_5)_3$ (b) $B(CH_3)_3$ 〉 $B(C_6H_5)_3$ 〉 $Al(CH_3)_3$

(c) $Al(CH_3)_3$ 〉 $B(CH_3)_3$ 〉 $B(C_6H_5)_3$ (d) $B(C_6H_5)_3$ 〉 $Al(CH_3)_3$ 〉 $B(CH_3)_3$

5. The selectivity sequence of Crown-6 to the metal ions Li^+, Na^+ and K^+ is

(a) $Li^+ > Na^+ > K^+$ (b) $Na^+ > Li^+ > K^+$

(c) $K^+ > Li^+ > Na^+$ (d) $K^+ > Na^+ > Li^+$

6. The uranocene $U(\eta^8\text{-}C_8H_8)_2$ belongs to the point group

(a) D_{4h} (b) D_{4d} (c) D_{8h} (b) D_{8d}

7. The replicate data of chromium content in a steel sample obtained from chemical analysis are 1.12, 1.15, 1.11, 1.16 and 1.12%. The standard deviation in the data is:

(a) ±0.015% (b) ±0.022% (c) ±0.025% (d) ±0.031%

8. The pH of 0.24 mol.dm^{-3} $Al(ClO_4)_3$ solution (pK_a of $Al(aq)^{3+}$ = 4.85) is

(a) 2.01 (b) 2.72 (c) 4.73 (d) 5.54

9. The volume of 67% HNO_3 (sp. gr. 1.40) should be taken to prepare 5 litres of 0.1 N solution is

(a) 25.6 ml (b) 30.2 ml (c) 33.5 ml (d) 35.3 ml

10. The crystal file splitting pattern of the d-orbitals of a central metal ion in a square pyramidal coordination follows the energy order

(a) $d_{xz} \approx d_{yz} < d_{xy} < d_{z2} < d_{x2-y2}$

(b) $d_{x2-y2} \approx d_{xy} < d_{z2} < d_{xz} < d_{yz}$

(c) $d_{xz} \approx d_{yz} < d_{x2-y2} \approx d_{xy} < d_{z2}$

(d) $d_{x2-y2} < d_{xy} < d_{z2} < d_{xz} \approx d_{yz}$

11. If, ^{238}U ($t_{1/2} = 4.5\times10^9$ yr) and ^{226}Ra ($t_{1/2} = 1.6\times10^3$ yr) are in equilibrium in an ore, then ratio of ^{238}U to ^{226}Ra should be:

(a) 2.53×10^5 (b) 3.17×10^6 (c) 2.87×10^6 (d) 1.84×10^7

12. The pale green aqueous solution of commercial $CrCl_3.6H_2O$ on prolonged standing turns blue-violet due to the formation of:

(a) [*trans*-$CrCl_2(OH_2)_4$]Cl

(b) [*cis*-$CrCl_2(OH_2)_4$]Cl

(c) $[CrCl(OH_2)_5]Cl_2$

(d) $[Cr(OH_2)_6]Cl_3$

13. A face-centered cubic lattice of identical solid spheres has the lattice parameter 4.2 Å. The radius of the sphere is

(a) 1.48 Å (b) 1.82 Å (c) 2.15 Å (d) 3.20 Å

14. The number of spin allowed transitions in $[Ti(H_2O)_6]^{2+}$ complex are

(a) 1 (b) 2 (c) 3 (d) 4

15. Among Mn^{2+}, V^{2+}, Ni^{2+}, and Ti^{2+}, the cation having the highest hydration energy to form aqua complex $[M(H_2O)_6]^{2+}$ is

(A) Mn^{2+} (B) V^{2+} (C) Ni^{2+} (D) Ti^{2+}

16. $MgSO_4$, on reaction with NH_4OH and Na_2HPO_4, forms a white crystalline precipitate.

The precipitate is

(a) $Mg(NH_4)PO_4$ (b) $Mg_3(PO_4)_2$ (c) $Mg(OH)_2$ (d) $MgHPO_4$

17. Which of the following cation does not have orbital contribution to the magnetic moment with high spin configuration in an octaheral environment

(a) V^{3+} (b) Cr^{3+} (c) Co^{2+} (d) Co^{3+}

Group C

Physical Chemistry

1. Put tick mark on the correct answer $10 \times 2 = 20$

(i) In the Joule-Thomson experiment a gas obeying the equation of state P(V-b)=RT (symbols have usual meaning) shows

(a) the heating effect (b) the cooling effect (c) both the heating and the cooling effects (d) no change in temperature

(ii) The derivative, $(\frac{\partial V}{\partial T})_P$ (symbols have usual meaning), for a closed thermodynamic system is a

(a) state function (b) path function (c) quantity that depends on properties of the two equilibrium state of the system (d) none of these

(iii) If E_0 is the zero point energy of a harmonic oscillator of frequency ν and h is Planck's constant then it's energy in the $n = 2$ state will be

(a) $E_0 + h\nu$ (b) $2E_0$ (c) $4E_0$ (d) $E_0 + 2h\nu$

(iv) The wave function of a particle trapped in space between $x = 0$ and $x = l$ is given by $\psi(x) = A\sin(\frac{2\pi x}{l})$, where A is a constant. The probability of finding the particle is maximum at position(s)

(a) $\frac{l}{4}$ (b) $\frac{l}{2}$ (c)$\frac{l}{6}$ and $\frac{l}{3}$ (d) $\frac{l}{4}$ and $\frac{3l}{4}$

(v) The average velocity of the gas molecules of an one dimensional gas having velocity distribution $\rho(v) = Ae^{-\frac{m(v-v_0)^2}{2k_BT}}$ (symbols have usual meaning) is

(a) zero (b) v_0 (c) $2v_0$ (d) $-v_0$

(vi) For a van der Waal's gas (which is at below the critical temperature) the volume has

(a) single value at low pressure (b) three values at any pressure (c) single value upto the pressure at which the liquefaction of the gas starts (d) none of these

(vii) Consider the range of pressure and temperature such that the mean free path of the gas molecules (of an ideal gas) is less than that of size of the container of the gas. Under this constraint the viscosity of the gas

(a) is zero for all possible temperature and pressure (b) decreases with increase in temperature and pressure (c) rises with increase in temperature and pressure (d) does not depend on both temperature and pressure

(viii) The mechanism of a uni molecular reaction at a given temperature

(a) changes with decrease in pressure (b) changes with increase in pressure (c) does not depend on pressure (d) none of these

(ix) The electrical conductivity of an electrolytic solution at the regime of low applied potential gradient

(a) does not depend on the applied potential gradient (b) rises with increase in the applied potential gradient (c) decreases with increase in the applied potential gradient (d) none of these

(x) The EMF calculated based on the Nernst equation corresponds to the experimental value if we measure it

(a) at zero current situation (b) at low current situation (c) at high current situation (d) none of these

2. Put tick mark on the correct answer $3 \times 4 = 12$

(i) If the average molar kinetic energy of the nitrogen gas is 3.74 kJ then the uncertainty in the molecular speed is

(a) 6.347 m/s (b) 200.67 m/s (c) 200.67 cm/s (d) 100.67 m/s

(ii) If a mono atomic ideal gas under goes a process in which the ratio of P to V is at any instant of time is constant and one then molar heat capacity of the is

(a) 2R (b) $\frac{3}{2}R$ (c) $\frac{5}{2}R$ (d) none of these

(iii) If average osmotic pressure of human blood is 7.7 atm. at 40^oC then the approximate freezing temperature of the blood at normal pressure is (the magnitude of k_f for water in c,g.s. unit is 1.86)

(a) -1.058^oC (b) -0.558^oC (c) -2.568^oC (d) 0^oC

d

VISVA-BHARATI

M.Sc. Physics Admission Test - 2014

28^{th} June, 2014

Total number of questions: 20 Full marks: 100 Time: 90 minutes
ROLL No.: _____
ROLL No. in words _____

Note: ***Use the answer sheet attached at the end to record your answers.*** Tick ($\surd$) only **one** circle ($\bigcirc$). **DO NOT use pencil.** For a correct answer the score is +5, for no answer it is 0 and for a wrong answer the score is -2. The backside of the question paper and the extra sheets provided at the end may be used for calculations and rough work.
(c = *velocity of light* $= 3 \times 10^{10} cm/sec$, $h = 2\pi\hbar$ = *Planck constant*, k_B = *Boltzmann constant*, μ_0 = *magnetic permeability* $= 4\pi \times 10^{-7}$ Henry/metres, g = *acceleration due to gravity* $= 9.8 ms^{-2}$)

$me = 9.1 \times 10^{-31}$ kg
$mc^2 = 0.51$ MeV
$1\,\text{Å} = 10^{-10}$ m
$1eV = 1.6 \times 10^{-19}$ Joule

1. If the momentum of a particle moving with a velocity $0.9c$ is increased by 1% then the increase in its energy is:
(a) 0.81% (b) 0.9% (c) 1.0% (d) None of these

2. The time dependence of q_1 and q_2 for the Lagrangian: $L = \frac{1}{2}m\dot{q}_1^2 + \frac{1}{2}m\dot{q}_2^2 - q_1^2 - q_2^2 - q_1 q_2$ can be expressed as (where A_1 and A_2 are arbitrary constants) :
(a) $A_1 \sin\left(\sqrt{\frac{3}{m}}t\right) + A_2 \sin\left(\sqrt{\frac{1}{m}}t\right)$, $A_1 \sin\left(\sqrt{\frac{3}{m}}t\right) - A_2 \sin\left(\sqrt{\frac{1}{m}}t\right)$
(b) $A_1 \sin\left(\sqrt{\frac{2}{m}}t\right) + A_2 \sin\left(\sqrt{\frac{1}{m}}t\right)$, $A_1 \sin\left(\sqrt{\frac{2}{m}}t\right) - A_2 \sin\left(\sqrt{\frac{1}{m}}t\right)$
(c) $A_1 \sin\left(\sqrt{\frac{4}{m}}t\right) + A_2 \sin\left(\sqrt{\frac{2}{m}}t\right)$, $A_1 \sin\left(\sqrt{\frac{4}{m}}t\right) - A_2 \sin\left(\sqrt{\frac{2}{m}}t\right)$
(d) None of these

3. Choose the correct solution of the differential equation (c_1 and c_2 are arbitrary constants)

$$x\frac{d^2y}{dx^2} + x\left(\frac{dy}{dx}\right)^2 - \frac{dy}{dx} = 0$$

(a)$\log(2x^2 + c_1) + c_2$ (b) $\log(x^2 + 2c_1) + c_2$ (c) $\log(x^2 + c_1 x) + c_2$
(d) None of these

4. The singularities of the function $f(z) = \tanh z$ will be at (n is an integer):
(a) $n\pi i$ (b)$\left(n + \frac{1}{2}\right)\frac{\pi}{2}i$ (c)$\left(n + \frac{1}{2}\right)\pi i$ (d) None of these

5. The normalized eigenvectors of the matrix $\begin{pmatrix} 3 & 2 \\ 2 & 0 \end{pmatrix}$ are:
(b) $\frac{1}{\sqrt{5}}\begin{pmatrix} 1 \\ 2 \end{pmatrix}$ and $\frac{1}{\sqrt{13}}\begin{pmatrix} 2 \\ -3 \end{pmatrix}$ (b) $\frac{1}{\sqrt{10}}\begin{pmatrix} 1 \\ 3 \end{pmatrix}$ and $\frac{1}{\sqrt{10}}\begin{pmatrix} -3 \\ 1 \end{pmatrix}$
(c) $\frac{1}{\sqrt{5}}\begin{pmatrix} 2 \\ 1 \end{pmatrix}$ and $\frac{1}{\sqrt{5}}\begin{pmatrix} -1 \\ 2 \end{pmatrix}$ (d) None of these

6. A mass attached to the end of a string moves on a frictionless table and the string passes through a hole in the table. Initially the mass moves in a circle with kinetic energy E_0. The string is then slowly pulled until the radius of the circle is halved. The amount of work done is:
(a) E_0 (b) $3E_0$ (c) $2E_0$ (d) None of these

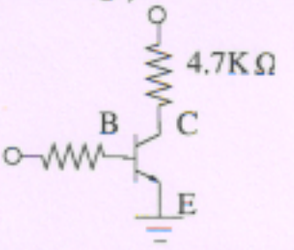
7. A rod of length L_0 moves with relativistic speed v along the horizontal direction ($x-$axis). The rod makes an angle θ_0 with the x-axis of the moving frame. The angle θ between the rod and the x-axis of the stationary frame is $\left(\gamma = \frac{1}{\sqrt{1-\frac{v^2}{c^2}}}\right)$:
(a) $\tan^{-1}\left(\frac{1}{\gamma}\tan\theta_0\right)$ (b) $\tan^{-1}\left(\gamma\sin\theta_0\right)$
(c) $\tan^{-1}\left(\gamma\tan\theta_0\right)$ (d) None of these

8. Three capillaries of lengths $8L$, $0.2L$ and $2L$ with radii r, $0.2r$ and $0.5r$, respectively, are connected in series. If the total pressure across the system in an experiment is P, the pressure across the shortest capillary is:
(a) $\frac{25}{33}P$ (b) $\frac{25}{36}P$ (c) $\frac{25}{44}P$ (d) None of these

9. Water enters a house through a pipe of diameter 2.0 cm and at absolute pressure 4.0×10^5 Pascals. A 1.0 cm diameter pipe leads to the second floor of the house at height 5.0 m. When the flow speed at the inlet is 1.5 m/s, the flow pressure of water at the second floor is (results up to first decimal):
(a) 4.6×10^5 Pascals (b) 3.3×10^5 Pascals
(c) 3.8×10^5Pascals (d) None of these

10. The electric potential at the centre of a circle of radius a (embedded in three dimensional space) carrying a line charge density $\lambda = \lambda_0 \cos^2\theta$ will be (ϵ_0 being the dielectric constant):
(a) $\frac{\lambda_0}{4\epsilon_0}$ (b) $\frac{\lambda_0}{2\epsilon_0}$ (c) zero (d) None of these

11. From the following figure, obtain the minimum value of I_B that will produce saturation. (V_{CE} at the saturation is $0.2V$ and $\beta = 200$, the symbols bear their usual meanings):



(a) $5.325\mu A$ (b) $1.065\mu A$ (c) $10.425\mu A$ (d) None of these

12. A full wave rectifier is designed with identical diodes, each having a forward resistance of 200Ω. It delivers power to load of $1K\Omega$. The input supply is $240V$ rms AC. The efficiency of this rectifier in percent is:
(a) 50.5 (b) 67.5 (c) 81.2 (d) None of these

13. The electric field of an electromagnetic wave is given by superposition of two waves $\vec{E}_1 = E_0 \cos(kz - \omega t)\hat{i}$ and $\vec{E}_2 = E_0 \cos(kz + \omega t)\hat{i}$. The associated magnetic field $\vec{B}$ will be:

(a) $\frac{E_0}{c}\left[\cos(kz - \omega t) - \cos(kz + \omega t)\right] j$

(b) $\frac{E_0}{c}\left[\cos(kz + \omega t) - \cos(kz - \omega t)\right] \hat{j}$

(c) $\frac{E_0}{c}\left[\cos(kz - \omega t) + \cos(kz + \omega t)\right] \hat{j}$

(d) None of these

14. An air-cored solenoid has a diameter of 5 cm and 500 turns wound over a length of 30 cm. The self inductance of the solenoid is (upto second decimal place):
(a) 0.5 milli Henry (b) 2.05 Henry (c) 2.05 milli Henry
(d) None of these

15. A beam of electron of mass m with kinetic energy E is diffracted as it passes through a polycrystalline metal foil. The metal has a cubic crystal structure with a spacing of d. The Bragg angle corresponding to the first order diffraction maximum is:
(a) $\sin^{-1}\left(\frac{h}{d\sqrt{2mE}}\right)$ (b) $\sin^{-1}\left(\frac{h}{d\sqrt{4mE}}\right)$
(c) $\sin^{-1}\left(\frac{h}{d\sqrt{8mE}}\right)$ (d) None of these

16. A discrete system has only two states 1 and 2 with energies $-\epsilon_0$ and ϵ_0 respectively. We assume that the system is in contact with a heat bath of temperature T. The internal energy as a function of the temperature of the heat bath is:
(a) $-2\epsilon_0 \tanh\left(\frac{\epsilon_0}{k_B T}\right)$ (b) $-\epsilon_0 \tanh\left(\frac{\epsilon_0}{k_B T}\right)$
(c) $-\epsilon_0 \tanh\left(\frac{2\epsilon_0}{k_B T}\right)$ (d) None of these

17. The wave function Ψ of a quantum mechanical system described by a Hamiltonian H is expressed as a linear combination of eigen-functions of H, $\Phi_1$and Φ_2 with eigenvalues E_1 and E_2 respectively ($E_2 > E_1$). At $t = 0$, the system is prepared in the state $\Psi_0 = \frac{4}{5}\Phi_1 + \frac{3}{5}\Phi_2$ and then allowed to evolve with time. The wave function at time $T = \frac{1}{2}\frac{h}{(E_2 - E_1)}$ is:
(a) $\left(\frac{4}{5}\Phi_1 + \frac{3}{5}\Phi_2\right) e^{-iE_1T/\hbar}$ (b) $\left(\frac{4}{5}\Phi_1 + \frac{3}{5}\Phi_2\right) e^{i(E_1+E_2)T/\hbar}$
(c) $\left(\frac{4}{5}\Phi_1 - \frac{3}{5}\Phi_2\right) e^{-(E_1+E_2)T/\hbar}$ (d) None of these

18. The ratio of the de Broglie wavelength to the Compton wavelength of a particle moving with velocity v is:
(a)$\left(\left(\frac{c}{v}\right)^2 - 1\right)^{1/2}$ (b)$\left(1 - \left(\frac{v}{c}\right)^2\right)^{1/2}$ (c) $\left(1 - \frac{v}{c}\right)^{1/2}$ (d) None of these

19. If R be the radius of curvature of the path of a particle inside the *dees* of a cyclotron and N be the number of times the particle has been accelerated across the space between the dees, then R will vary with N as:
(a) $R \propto N$ (b) $R \propto N^{1/2}$ (c) $R \propto N^{-1/2}$ (d) None of these

20. A laser beam of intensity $50 Watt/cm^2$ falls on a perfectly reflecting plane mirror for an hour across the area of $0.5 cm^2$. Calculate the average force imparted on the mirror:
(a) $6.0 \times 10^{-4} Newton$ (b) $1.67 \times 10^{-4} Newton$
(c) $1.67 \times 10^{-7} Newton$ (d) None of these

Subject: Mathematics **M. A./M. Sc. Admission Test-2014** **Paper Code: ATAMA**

Department of Mathematics, Visva-Bharati, Santiniketan-731 235

Time: $1\frac{1}{2}$ Hours *Date: 28 June, 2014* **Full Marks: 100**

Attempt all questions. Each question carries five (5) *marks. Choose the correct alternative(s) and write your answer(s) in the sheet provided. Five* (5) *marks will be awarded for each correct answer, while one and half* (1.5) *marks will be deducted for each incorrect answer.*

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1. The function, which is a metric on $\mathbb{R}$, is
   (a) $d(x,y) = \min\{3,\ |x-y|\}$, (b) $d(x,y) = |x^2 - y^2|$, (c) $d(x,y) = |\sin\ (x-y)|$,
   (d) $d(x,y) = \max\{1,\ |x-y|\}$.

2. If x^m be an integrating factor of the differential equation $\left(\sqrt{x}D^2 + 2xD + 3\right) y = x,\ D \equiv d/dx$, then the value of m is
   (a) 1/2, (b) 0, (c) 1, (d) $-1/2$.

3. The number of units in $\mathbb{Z}_{12}$ is (a) 4, (b) 6, (c) 1, (d) 3.

4. A point P describes an equiangular spiral $r = a\exp(\theta\cot\alpha)$ with a constant angular velocity about the pole O. If $OP = r$, then the acceleration varies as
   (a) $\sqrt{r}$, (b) $r^{3/2}$, (c) r, (d) $1/r$.

5. If a function $f(x)$ be such that $f(x) = \sum_{n=0}^{\infty}\phi_n(x)$, where $\phi_n(x) = (1-x)x^n,\ 0 \le x \le 1$. Then
   (a) The series does not converge uniformly on [0, 1], (b) $f(x)$ is continuous on [0, 1], (c) The series may or may not converge uniformly on [0, 1], (d) The series converges uniformly on [0, 1].

6. The value of $\nabla^2 f(r)$, where $r = \sqrt{x^2+y^2+z^2}$ is
   (a) $\partial^2 f/\partial r^2 + (1/r)\partial f/\partial r$, (b) $\partial^2 f/\partial r^2 + (1/r^2)\partial f/\partial r$, (c) $\partial^2 f/\partial r^2 + (2/r)\partial f/\partial r$, (d) $\partial^2 f/\partial r^2 + (2/r^2)\partial f/\partial r$.

7. The functional values corresponding to n distinct equispaced values of the argument are in arithmetic progression (A.P.). Then the degree of the interpolating polynomial and the order of the error involved in it (h being the space length) are
   (a) n, $O\left(h^{n+1}\right)$; (b) $n-1$, $O\left(h^{n}\right)$; (c) $n-1$, $O\left(h^{n-1}\right)$; (d) none of these.

8. A complex valued function $f(z)$ is defined by $f(z) = (x+\lambda y)^2 + 2i\,(x-\lambda y)$, where λ is a constant. Then
   (a) $f(z)$ is analytic only on the lines $x \pm y = \mp 1$, (b) $f(z)$ is analytic everywhere, (c) $f(z)$ is not analytic anywhere, (d) none of these.

9. The particular integral of the differential equation $\left(D^2 - 1\right) y = x\sinh x$ is
   (a) $(x/4)\sinh x - (x^2/4)\cosh x$, (b) $(x^2/4)\cosh x - (x/4)\sinh x$, (c) $(x/4)\cosh x - (x^2/4)\sinh x$,
   (d) $(x^2/4)\sinh x - (x/4)\cosh x$.

10. Two unequal masses M and M', rest on two rough planes inclined at angles α and β to the horizon, are connected by a fine string passing over a small pulley of mass m and radius r, which is placed at the common vertex of the two planes. Then the acceleration of either mass with μ, μ' denoting the coefficients of friction, k the the radius of gyration of the pulley about its axis and M the mass which moves downwards is
    (a) $\left[g/\left(M + M' + mk^2/r^2\right)\right]\left[M\left(\sin\alpha - \mu\cos\alpha\right) - M'\left(\sin\beta + \mu'\cos\beta\right)\right]$,
    (b) $\left[g/\left(M + M' + mk^2/r^2\right)\right]\left[M\left(\sin\alpha + \mu\cos\alpha\right) - M'\left(\sin\beta - \mu'\cos\beta\right)\right]$,
    (c) $\left[g/\left(M + M' + mk^2/r^2\right)\right]\left[M\left(\sin\alpha - \mu\cos\alpha\right) - M'\left(\sin\beta - \mu'\cos\beta\right)\right]$,
    (d) none of these.

11. A particle moves in a curve under a central acceleration so that its velocity at any point is equal to that in a circle at the same distance and under the same attraction. Then the law of force F with r denoting the distance of the particle from the center of force is of the form
(a) $F \propto 1/r$, (b) $F \propto 1/r^2$, (c) $F \propto 1/r^3$, (d) $F \propto r^3$.

12. Let A and B be two $n \times n$ real matrices. Then
(a) Trace (AB)=Trace (BA) and det $(A+B)$ = det A+ det B, (b) if A is invertible, the characteristic polynomials of AB and BA are the same, (c) if A and B are invertible, so are AB and $A+B$, (d) $AB - BA = I_n$.

13. Let a function $f(x)$ be defined as

$$f(x) = \begin{cases} \frac{1}{2^n}, & \frac{1}{2^{n+1}} < x \leq \frac{1}{2^n}, \quad n = 0, 1, 2, \cdots \\ 0, & x = 0. \end{cases}$$

Then (a) f is not Riemann integrable on [0, 1], (b) f is Riemann integrable on [0, 1] and the value of the integral can not be evaluated, (c) f is Riemann integrable on [0, 1] and the value of the integral is 1/3, (d) f is Riemann integrable on [0, 1] and the value of the integral is 2/3.

14. The partial differential equation $x\frac{\partial f}{\partial x} = f(x,y) + y\frac{\partial f}{\partial y}$, after being transformed to an another equation by applying the transformation $f = \phi/y$, has a solution of the form
(a) $\psi(xy)$, (b) $\psi(x^2y)$, (c) $\psi(x^2y^2)$, (d) $\psi(xy^2)$.

15. The order of convergence of the iterative scheme, given by

$$x_{n+1} = [x_0 f(x_n) - x_n f(x_0)] / [f(x_n) - f(x_0)],$$

for finding a simple root of the equation $f(x) = 0$ is (a) 1, (b) 2, (c) 3, (d) none of these.

16. Let G be a group. Then
(a) if G has a nontrivial center C, G/C has a trivial center, (b) if $|G| = p^3$ for some prime p, G is abelian, (c) if G is nonabelian, $\exists$ a nontrivial isomorphism $h : G \longrightarrow G$, (d) if $G \neq \{e\}$, $\exists$ a nontrivial homomorphism $h : \mathbb{Z} \longrightarrow G$.

17. The solution of the partial differential equation $x\frac{\partial f}{\partial y} - y\frac{\partial f}{\partial x} = f(x,y)$ with an initial condition $f(x,0) = \phi(x)$, $x \geq 0$ is
(a) $\phi\left(\sqrt{x^2+y^2}\right)\exp\left[\pi/2 - \sin^{-1}(x/c)\right]$, (b) $\phi\left(x^2+y^2\right)\exp\left[\pi/2 - \sin^{-1}(x/c)\right]$,
(c) $\phi\left(x^2+y^2\right)\exp\left[-\sin^{-1}(x/c)\right]$, (d) $\phi\left(\sqrt{x^2+y^2}\right)\exp\left[-\sin^{-1}(x/c)\right]$.

18. The value of the sum $f_{k-1} + \Delta f_{k-2} + \Delta^2 f_{k-3} + \cdots + \Delta^n f_{k-n-1} + \cdots$, where f_k denotes the k-th iterated value of the function f and Δ^n the n-th order forward difference operator, is
(a) f_{k+1}, (b) f_k, (c) Δf_k, (d) f_{k+1}.

19. Let

$$A = \begin{pmatrix} 1 & 2 & 3 & a \\ 0 & 1 & b & 2 \\ 0 & 0 & 1 & 2 \end{pmatrix}$$

be a matrix. Then
(a) $\exists$ a, $b \in \mathbb{R}$, such that the column vectors of A are linearly independent, (b) $\exists$ a, $b \in \mathbb{R}$ for which rank $(A) = 2$, (c) $\forall$ a, $b \in \mathbb{R}$, the row vectors of A span a three-dimensional subspace of $\mathbb{R}^5$, (d) None of these.

20. The number of functional values, required to approximate the integral $\int_0^1 \frac{dx}{1+x}$ with an accuracy of 10^{-6}, when evaluated directly by Simpson's $\frac{1}{3}$ rule, is
(a) 9, (b) 11, (c) 13, (d) 15.

M.Sc. Admission Test 2014
Subject: Statistics
Time: 1 hour 30 Minutes
Full Marks: 100
Date: 28.06.2014
ROLL NO. : .....

Answer any **ten** questions, each carrying 10 marks.
Notations carry their usual meanings.

(1) Prove that $b_2 - b_1 - 1 \geq 0$, symbols having usual meanings. Also discuss about the case of equality.

(2) Use the method of separation of symbols to prove
$U_x = U_{x-1} + \Delta U_{x-2} + \Delta^2 U_{x-3} + \ldots + \Delta^{n-1} U_{x-n} + \Delta^n U_{x-n}$.

(3) Show that the equality AB - BA = I does not hold whatever the square matrices A and B may be.

(4) Test for the convergence of the series

$$1 + \frac{1}{2} + \frac{1.3}{2.4} + \frac{1.3.5}{2.4.6} + \cdots$$

(5) Let X_1, X_2 be i.i.d. $U(0,1)$ variates. Find the distribution of $X_1 - X_2$.

(6) Suppose the number of eggs laid by an insect has the Poisson distribution with parameter λ and the probability that an egg developing is p. Show that the number of eggs surviving has also a Poisson distribution with parameter λp .

(7) Let (X, Y) have joint p.d.f.

$$f(x,y) = \frac{1}{6\sqrt{7}\pi} \exp\left[-\frac{8}{7}\left(\frac{x^2}{16} + \frac{y^2}{9} + \frac{xy}{8} - \frac{31}{32}x - \frac{4}{3}y + \frac{71}{16}\right)\right]; \; -\infty < x, y < \infty$$

Find the expectation and variance of both X and Y. Also find the correlation between X and Y.

P.T.O.

(8) Let X_i denote the lifetime (in days) of the $i\ th$ bulb chosen at random from a lot ($i = 1,2 \ldots n$). Assume that X_i s are i.i.d $Exp(\theta)$. But instead of the actual lifetime figures, we only know the number of bulbs surviving up to 100 days (Y). Find the maximum likelihood estimate of θ based on this information.

(9) The pdf of X is given by $f(x) = \frac{1}{\theta}, 0 < x < \theta$. Let the null hypothesis be $H_0 : \theta = \frac{4}{3}$ against the alternative hypothesis $H_1 : \theta > \frac{4}{3}$. We have a random sample of one observation. The critical region is defined by $w = \{x : x > 1\}$.

(i) Find the size of the test.

(ii) Find the power of the test for $\theta = \frac{7}{3}$ and $\theta = \frac{10}{3}$

(10) What is Gross Reproduction Rate? Show that Gross Reproduction Rate is less than or equal to Net Reproduction Rate.

(11) Describe how one will construct a control chart for fraction defectives for varying subgroup sizes.

(12) If the observed value of the F statistic in the one-way anova model is less than unity, then what will be your conclusion? Explain with reasons.

(13) Let $X_1, X_2, \ldots$ be a sequence of random variables with corresponding distribution functions given by

$$\begin{aligned} F_n(x) &= 0, \text{if } x < -n \\ &= \frac{x+n}{2n}, \quad \text{if } -n < x < n \\ &= 1, \quad \text{if } x > n \end{aligned}$$

Does F_n converges to a distribution function?

(14) In a $(2^4, 2^2)$ experiment with four factors A, B, C and D, the following treatment combination of the key block in a replicate are given: acd, abd. Find the other treatment combinations of the key block and identify the confounded effects.

(15) Using a biased coin how will you select one unit from a population of 3 units such that each unit has the same probability $\left(= \frac{1}{3}\right)$ of being selected? You may toss the coin as many times as you like.

----- Best of Luck-----

Department of Computer and System Sciences
Visva-Bharati

Time: 90 minutes Attempt all questions Full marks: 100

Name:

Roll No.

1. (a) State the basic differences between
   (i) Superkey and candidate key (ii) 3NF and BCNF 2+2

   (b) Write down the SQL statement corresponding to the relational algebra expression:

   $$\pi_{A,B,C}(\sigma_{C>T}(R(A,B,C) \infty S(P,B,T)))$$ 3

   (c) Given the relation R(A,B,C,D,E) with functional dependencies:

   A → BC, CD → E, B → D, E → A. Obtain candidate keys. 3

2. (a) How many bytes are required to store "a"? Write its storage structure. 2x5=10

(b) Write a function in C that can check if an input year is a leap year

(c) Write the output of the following program fragment:

```
for(i=1; i<5; i++)
 {
        for(j=1; j<5; j++)
            printf("%d ", (i/j)*(j/i));
        printf("\n");
 }
```

(d) Distinguish between 'class' and 'object' in C++

(e) Explain the purpose of 'friend' function in C++

3. (a) For a binary tree, it is found that the Inorder traversal and Preorder traversal are generating the same sequence. Comment on the structure of the tree. 3

(b) Justify or falsify - "Out of the Inorder, Preorder and Postorder traversals, if any two are known, then the third one can be determined always. 3

(c) Write down the steps to insert an element in an ordered singly or doubly linked list, preserving the order after the insertion. 4

4. (a) Does swapping increase the operating system overheads? Justify your answer. 3
   (b) Write a program to create one parent and one child process. Parent and child should show different message in standard output. 3
   (c) Consider the following page reference string: 5,4,3,2,1,4,3,5,4,3,2,1,5. Calculate the total number of page faults with respect to three frames for FIFO algorithm. 4

5. (a) Obtain the solution of the recurrence relation $T(n) = 2\,t(n/2-1)+1$ in O notation. 5+5=10
(b) Prove that sorting by comparison has lower bound $\Omega(n \log n)$, where n is the number of elements to be sorted.

6. (a) Show that $ab' + a(b+c)' + b.(b+c)' = ab'$, where a,b, and c are Boolean variables. 2x5=10

(b) How many address lines are required to address 4 GB memory locations ?

(c) If the value of hit ratio is 0.6, then what is the value of miss ratio?

(d) If A=04H and B=02H, then what would be the values of A and B after the execution of ADD B.

(e) Write down the simplified Boolean expression from the following four-variable Karnaugh Map:

0	0	0	0
0	0	1	0
1	1	1	1
0	1	1	1

7. (a) Construct an FA equivalent to the regular expression $(a+b)^*(aa+bb)(a+b)^*$ 4

(b) Let G=({S,A}, {a,b,c}, P,S) 3
where P consists of S→aSAc, S→ abc, cA→Ac, bA→bb. Find L(G).

(c) Reduce the following grammar into Chomsky Normal Form: 3
G is S→aAD, A → aB, A → bAB, B → b, D →d.

8. (a) Among the two Ethernet LAN's of link speed 1 Mbps and 10 Mbps, which one should have less cable length? Justify your answer. Assume that the frame length and speed of signal within the medium are same for both. 3
(b) Round Trip Time and Frame size of a Stop-and-Wait ARQ entity are 100 ms and 40 bytes. What is the average throughput for frame error rate =0.1? Assume that all ACK's are error-free and system resets after 3 retransmissions. 3
(c) A host is connected to an Ethernet LAN using static IP addressing and ARP. Mention the application layer, transport layer and network layer protocols involved during opening a basic HTML webpage hosted outside the LAN, along with the respective purposes. 4

9. (a) Prove that there are infinite number of primes. 2+2+3+3
(b) Prove that a tree with n vertices has n- 1 edges.
(c) Prove or disprove that there is no bridge in an Euler graph
(d) A derangement is a permutation f: S→S from a set onto itself where f(s)#s for any s ∈ S. Find the recurrence relation for the number of derangement on a finite set.

10. (a) Justify whether the following register transfer statement is correct or not. 2
xT: PC → AR, PC ← PC+1
(b) What is control memory in CPU? 2
(c) Distinguish between Program-controlled I/O and Interrupt-control I/O. 2
(d) Consider a cache consisting of 32 blocks having 8 words each and corresponding main memory is of 1K blocks having 8 words each. Explain how the memory address is divided into various fields (TAG, Block, Word and Set) in set-associative mapping. 4

Admission Test for M.Sc. (Environmental Science) 2014
Department of Environmental Studies, Visva-Bharati

Name: Marks Obtained:

Roll No./S.No: Signature of the Examiner:

Time: One Hour Full Marks: 100

I. Put Tick (√) mark on the MOST appropriate answer (35 x 2 = 70)

1. Which of the following parameters is not a good indicator of contamination in groundwater?

(A) BOD (B) Nitrates (C) Silica (D) Chlorides

2. Which state of Cr (Chromium) is most toxic?

(A) Cr^{4+} (B) Cr^{3+} (C) Cr^{5+} (D) Cr^{6+}

3. *Azolla pinnata* is a

(A) Blue green algae (B) Green algae (C) Red algae (D) Fern

4. Which one of the following does not contribute to climate change?

(A) NO (B) O_3 (C) SF_6 (D) HFCs

5. Which pyramid is always upright?

(A) Pyramid of biomass (B) Pyramid of number
(C) Pyramid of energy (D) Pyramid of number and biomass

6. Which year was declared as International Year of Biodiversity?

(A) 2002 (B) 2010 (C) 2000 (D) 1972

7. Which of the following is a correct match?

(A) Periyar – Kerala (B) Ranthambore – M.P.
(C) Panna – U.P. (D) Bandhvgarh – Bihar

8. The instrument used for determination of transparency of water is

(A) Spectrophotometer (B) Ekman dredge
(C) Conductivity bridge (D) Sechhi disc

9. The Air (Prevention and Control of Pollution) Act, 1981 was first amended in the year

(A) 1986 (B) 1987 (C) 1988 (D) 1990

10. In the Earth Summit at Rio de Janeiro, 1992, which of the following was not an agenda?

(A) Ozone depletion (B) Global warming
(C) CO_2 reduction targets (D) Biodiversity conservation

11. Acid rain has pH
(A) < 7.6 (B) < 7 (C)≤5.6 (D) < 1.6

12. Agenda 21 is blue-print for environment & development. Agenda 21 was an outcome of the meeting at
(A) Rio de Janeiro (B) Stockholm (C) Vienna (D) Johannesburg

13. In nitrogen cycle elemental nitrogen returned to the atmosphere by the following process.
(A) Nitrogen fixing bacteria. (B) Nitrogen fixation by bluegreen algae.
(C) Nitrification process. (D) Denitrification process.

14. Development of 'Green Belts' around industries are
(A) to control ground leachates (B) to mitigate the gaseous pollutant
(C) to increase bioaesthetic (D) all of the above

15. One of the following is not an *In- situ* conservation measures.
(A) Biosphere reserve (B) National Parks
(C) Protected areas (D) Breeding under confined areas

16. Biodiesel is produced in India presently from
(A) *Calotropis* sp (B) *Catharanthus* sp
(C) *Jatropha* sp (D) *Delonix* sp

17. Mauna Loa, in Hawaii is famous for
(A) Botanical Garden
(B) Monitoring sea level rise since 1950
(C) Biggest collection of mammal's fossils
(D) Continuous monitoring of atmospheric CO_2 since 1957.

18. Which is correct arrangement in order of decreasing soil particle size
(A) Sand, clay, silt (B) Silt, sand, clay
(C) Sand, silt, clay (D) Clay, silt, sand

19. Maximum density of water is at
(A) 0°C (B) 100°C (C) – 4°C (D) 4°C

20. 'Gahirmatha' is a part of the ----------Sanctuary
(A) Bhitarkanika (B) Buxa (C) Similipal (D) Padma

21. Most threatened among Indian serpents, this one is considered `endangered`
(A) Reticulated Python (B) Saw scaled viper
(C) Russel`s viper (D) King Cobra

22. At a place, one is exposed to two noises of 90dB and 40dB simultaneously. What is the resultant noise?
A) 130 dB B) 50 dB C) 110 dB D) 90 dB

23. The half-life of a radioactive element depends upon:
A) Amount of the element present B) Temperature C) Pressure D) None of these

24). Match the following vitamins and the corresponding deficiency symptoms

1.	Retinol	i) night blindness and dry skin
2.	Riboflavin	ii) bowed legs and a deformed spine
3.	K	iii) bleeding, swollen or infected gums
4.	Calciferol	iv) ulcers in their mouth and cracked lips
5.	Ascorbic acid	v) bleeding

	1	2	3	4	5
a)	i	iii	ii	iv	v
b)	i	iv	v	ii	iii
c)	ii	i	iii	v	vi
d)	iv	ii	iii	iv	i

25) Who proposed the "Gaia Hypothesis", which claims that the earth is alive and functions as a super organism?
A) Richard Dawkins B) James Lovelock C) James Hutton D) Lewis Thomas

26) Where did the first life appear on earth?
A) Deserts B) Ocean surface C) Oceanic volcanic vents D) Ice caps

27) Which of the following is not an arsenic affected district in West Bengal?
A) Malda B) Purulia C) Burdwan D) Hoogly

28) Who coined the term 'sustainable development' in the year 1987?
A) Indira Gandhi B) G.H. Brundtland C) Rachel Carson D) Al Gore

29) The S.I. Unit of Pressure (Pascal) is equivalent to
A) N/m^2 B) $Dyne/cm^2$ C) N/cm^2 D) 760 mm of Hg

30) According to Big Bang Theory, how old is our universe?
A) 15 billion years B) 15 million years C) 4.5 billion years D) 150 billion years

31) At what altitudes, high level clouds are normally found?
A) 2-7 Km B) 5-13 Km C) 15-20 Km D) 40-50 Km

32) The smallest unit of the gene which codes for an amino acid is
A) Cistron B) Muton C) Recon D) Codon

33) A vehicle covers the distance between two cities at a speed of 60 km/hr. On return the vehicle covers the same distance at a speed of 40km/hr. What is the average speed of the vehicle?

A) 50 km/hr B) 52 km/hr C) 48 km/hr D) 46 km/hr

34) Which of the following is not an Operating System?

A) WINDOWS B) LINUX C) UNIX D) FORTRAN

35) One Kilobyte is equal to how many bytes

A) 512 B) 1000 C) 1024 D) 1048

II. Fill in the blanks (5 x 2 = 10)

36) The full form of IPCC is: _____

37) _____is the present Minister for Environment and Forest in India.

38) _____ is the only Biosphere Reserve of West Bengal.

39) _____Protocol is related to reduction in greenhouse gases.

40) The theme for this year's (2014) World Environment Day was _____.

III. Write Short notes on <u>any four</u> (4 X 5 = 20)

41. a) Components of environment

b) Indoor air pollution

c) Earthquakes

d) Solar Photovoltaic Cell (SPV)

e) Deforestation

f) Ozone layer

g) EIA (Environmental Impact Assessment)

VISVA-BHARATI
Department of Botany
M. Sc. Admission Test - 2014

Time: One hour **Full Marks: 100**

Name: **Roll No:** **Category:**

[ANY OVER WRITTING/ REWRITTING WILL BE DISCREDITED]

Section I (30 Marks)
For each positive answer two marks will be awarded and for each negative answer one mark will be deducted

1. The unique component of fungal cell wall is:
   a) Cellulose c) Chitin
   b) Cutin d) Ergosterol

2. Which of the following organisation protects the trade of endangered species at international level:
   a) IBWL c) WWF
   b) CITES d) IUCN

3. Which of the following is a plant steroid hormone:
   a) Ergosterol c) Corticosteroid
   b) Brassinosteroid d) Aldosteron

4. The enzyme which maintains the chromosome from being shortened with each round of replication is :
   a) Telomerase c) Helicase
   b) Reverse transcriptase d) Topo isomerse

5. Following is the pigment which absorbs blue light is:
   a) Phytochrome c) Chlorophyll- a
   b) Cryptochrome d) Xanthophyll

6. Which of the following is an example of non-heterocystous N_2-fixing cyanobacteria:
   a) Nostoc c) Lyngbya
   b) Tolypothrix d) Anabaena

7. Carnitine Shuttle is related with:
   a) Protein synthesis c) Calvin Cycle
   b) β- oxidation of fatty acids d) Photorespiration

8. Which one of the following is not an aflatoxin producing fungus:
   a) *Aspergillus niger*
   b) *Aspergillus parasiticus*
   c) *Aspergillus flavus*
   d) *Aspergillus fumigatus*

9. Choose the correct pair:
   a) Haplostele-Dicot stem
   b) Plectostele-*Psilotum*
   c) Eustele-*Lycopodium*
   d) Amphiphloic siphonostele-*Marsilea*

10. Living organisms can be best studied by:
   a) Electron microscope
   b) Compound microscope
   c) Phase contrast microscope
   d) Inverted microscope

11. Edible portion of an orange is the:
   a) Epicarp
   b) Placenta and pericarp
   c) Fleshy hair of endocarp
   d) Mesocarp

12. Ecology is the study of reciprocal relationship between:
   a) Animals and Plants
   b) Organisms and Man
   c) Animals and Man
   d) Organisms and Environment

13. Which one represents the correct manner of DNA replication:

   a)

   b)

   c)

   d)

14. Which of the following was an Indian Paleobotanist:
   a) Acharya J.C. Bose
   b) P. Agarkar
   c) Birbal Sahani
   d) S. R. Bose

15. The methods of genetic recombination in bacteria is known as:
   a) Conjugation
   b) Transformation
   c) Transtuction
   d) All of them

Section II (30 Marks)
Fill in the blanks

1. Leucoplastids which store oil are called: _____

2. The chromosome number in a somatic cell of *Arabidopsis thaliana* is: _____

3. The ideal size of a herbarium sheet is : _____ x _____

4. The chemo attractant compound _____ secreted from the wounds of dicot plants is responsible for attracting *Agrobacterium tumifaciens*

5. Write the scientific name of a human pathogenic bacterium: _____ _____

6. Write the scientific name of a commercially used hexaploid crop plant: _____ ___

7. Name one signature compound present in cell wall of Gram positive bacteria: _____

8. Lakes which are highly productive and rich in plants are called: _____

9. In the members of Fabaceae _____ type of aestivation is found

10. Mitotic crossing over is common in _____ process of fungi

11. Generative hyphae of the fruit body of edible mushrooms grown the surfaces of sterilized seed grains/other substrates used to cultivate musrooms are called: _____

12. The radioactive element _____ is used in the study of nucleic acid biosynthesis.
13. _____ _____ is an example of fresh water Rhodophyta

14. Telome concept was proposed by _____ in the year 1952

15. Engerix and Recombivax which are able to induce immunity against Hepatitis B in human are_____ vaccine.

16. Immunoglobulins expressed in plants are called: _____

17. Apart from chloroplast, _____ and _____ organelles are involved in photorespiration in plants.

18. Ochraeate stipule is the characteristic feature of _____ family

19. In the angiospermic family Asteraceae, _____ type of inflorescence is found.

20. Reverse transcriptase is a RNA dependent _____ polymerase

21. _____ is an example of unsaturated fatty acid

22. The type of peristome teeth found in *Funaria* is: _____

23. It is a xylem fibre cell, elongated with tapering pointed ends, thick walled with narrow simple pits, its cell lumen is narrow and nearly obliterated. It iscalled:_____

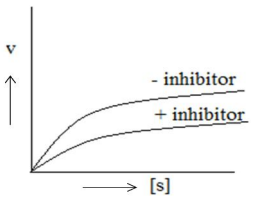
24. These are elongated, columnar or rod shaped, thick walled sclereid cells found in the testa of pulses and other leguminous seeds. These are called: _____

25. *Sellaginella* is an _____ sporangiate Pteridophytic member.

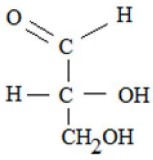
26. Gynobasic style is found in the members of _____ family

Section IV (10 Marks)
DESIGNATE WHETHER THE STATEMENT IS TRUE OR FALSE

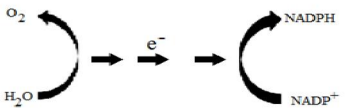
1. Periplasmic space is found in Gram negative bacteria
2. Pseudo-eleters are found only in *Porella*
3. A single amino acid is never be coded by two different codons
4. In the family Brassicaceae, the inflorescence type is cruciform
5. Endosmosis occurs when a cell is immersed in hypertonic solution
6. Plasmids are self replicating extranuclear DNA
7. All test crosses are back cross but all back crosses are not test cross.
8. The main vegetative body of Bryophyta is gametophytic in nature
9. The endosperms of Gymnosperms are triploid
10. Bordeaux mixture was first formulated by John Bordeaux of France.



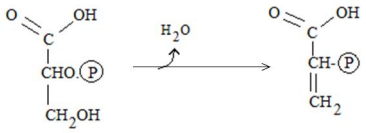
A plot showing kinetics of an enzyme-driven reaction in presence or absence of an inhibitor. Name the type of inhibition



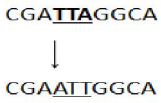
This is the structural formula of a triose aldose sugar. Name the ketose isomer of this sugar



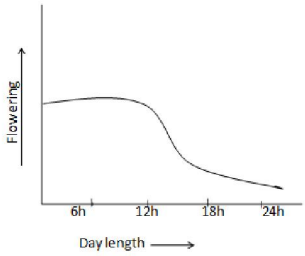
Flowchart showing in brief an electron transport pathway. What is it associated with – photosynthesis or respiration?



This is a reaction step of glycolytic pathway. Name the enzyme catalyzing this reaction.



Original sequence (upper) of a DNA portion is changed to a sequence shown later (lower). Name the type of mutation occurred here.



Plot showing flowering behaviour of a species in response to increasing day length. What photoperiodic class does it belong to – long day plant or short day plant?

Section V (12 Marks)
Answer the following

1. Grey seed colour (**G**) in garden pea is dominant to white seed coat (**g**). In the following crosses the indicated parents with known phenotypes but unknown genotypes produced the listed progeny. Give the possible genotypes of each female parent based on the segregation data.

Parent	**Progeny**		**Female parent genotype**
Female X Male	Grey	White	-------
Grey X White	81	82	??
Grey X Grey	118	39	??
Grey X White	74	00	??
Grey X Grey	90	00	??

4

2. In Jimsonweed, purple flower (P) is dominant to white (p) and spiny pods (S) are dominant to smooth (s). In a cross between Jimsonweed homozygous for white flower and spiny pods and homozygous for purple flower and smooth pods, determine the phenotypes of

   a) the F_1
   b) the F_2
   c) the progeny of a cross of F_1 with the white spiny parents and
   d) the progeny of a cross of F_1 with the purple smooth parent. **6**

3. Plant species **P** has 2n= 18 and species **U** has 2n= 14 chromosomes. A fertile hybrid is formed by crossing these two species. How many chromosomes does it have in the somatic tissues? **2**

Test for Admission to M.Sc. in Zoology, 2014
Department of Zoology, Visva-Bharati

Time: One hour **Full Marks: 100**

Name of the Candidate…….Admit Card Roll No.……...

(Space for Examiners)

Marks obtained…… **Signature of examiners……...**

Instructions: ***Each wrong answer will carry 1 negative mark for all questions. Put Tick (√) with black or blue inked pen against the correct answer only. Do not use pencil for tick marking the answer. After tick marking you cannot change your answer, marking twice or more will carry "0" marks.***

Multiple Choice Questions

Marks: 50 × 2 = 100

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1. The number of pyrrole ring present in one molecule of Haemoglobin is:

a) One *b)* Two
b) Three ***d)* Four**

2. Which of the following is *not* correct?

a) At a carrying capacity per capita birth rates and death rates are equal
b) At a carrying capacity a population has no general tendency either to increase or to decrease
***c)* The carrying capacity is a concept that emerges from the logistic equation**
d) No real population is characterized by a single carrying capacity

3. When huge amount of sewage is dumped into a river, its B.O.D. will:

a) Slightly decrease *b)* Remain unchanged
***c)* Increase** *d)* Decrease

4. Which of the following pair is a sedimentary type of biogeochemical cycle?

a) Phosphorus and nitrogen ***b)* Phosphorus and sulphur**
c) Oxygen and nitrogen *d)* Phosphorus and carbon dioxide

5. The Competitive Exclusion Principle states that:

***a)* If two competing species coexist in a stable environment, they do so as a result of niche differentiation** *b)* If two competing species coexist in an unstable environment, they do so as a result of niche differentiation *c)* Niche differentiation proves that there are coexisting competitors *d)* Competitors can coexist because of environmental heterogeneity

6. Which one of the following steps in the clotting of blood will not occur in the absence of Vitamin K?

a) Formation of thromboplastin *b)* Conversion of prothrombin to thrombin
c) Conversion of fibrinogen to fibrin ***d)* Synthesis of prothrombin**

7. As a result of hydrolysis, one molecule of lactose gives rise to:

a) 1 molecule of fructose & 1 molecule of galactose *b)* Two molecules of galactose ***c)* 1 molecule of glucose & 1 molecule of galactose**
d) Two molecules of fructose

8. The 'regulation' of a population refers to:

a) The means by which its size is determined ***b)*** The means by which its density is determined. ***c)*** The effect of predation on the population
***d)* A tendency to increase in size when small and decrease when large**

9. The correct sequence in vertebrate embryonic development is:

a) gastrocoel – blastocoel – notochord – neural crest. ***b)* blastocoel – gastrocoel – neural crest – notochord.** *c)* gastrocoel – blastocoel – neural crest – notochord. *d)* blastocoel – neural crest – gastrocoel – notochord

10. Protective Ozone layer is:

***a)* Above stratosphere but below mesoshpere** *b)* Between troposphere and stratosphere *c)* Extended beyond stratosphere *d)* In the tropopause

11. In a study, a group of students tested the effect of alcohol on increase or decrease of systolic blood pressure in women. After one month of study, the group wanted to see whether the null hypothesis is accepted or rejected in their study. Which of the following statistical tests best fits to verify the null hypothesis?

a) Chi square test ***b)* Student's *t* test**
c) F- test *d)* Correlation

12. Chief function of Contractile Vacuole in Protozoa is:

a) Nutrition *b)* Respiration
***c)* Osmo-regulation** *d)* Reproduction

13. Blood in Cockroach contains:

a) Haemoglobin *b)* Haemocyanine
c) Haemovanadin ***d)* No respiratory pigment**

14. During glycolysis, conversion of glucose-6-phosphate into fructose-6-phosphate is catalysed under the influence of an enzyme, called:

a) Phosphorylase ***b)* Phospho-glucose isomerase**
c) Phospho-fructokinase ***d)*** Hexokinase

15. The cross used to ascertain whether the organism is homozygous or heterozygous dominant is termed as:

a) Monohybrid cross *b)* Reciprocal cross
***c)* Test cross** *d)* Linkage cross

16. Chromatin consists of:

a) RNA *b)* DNA
c) RNA and proteins ***d)* DNA and histones**

17. In a spermatozoon an ATPase, Dynein is attached to its:

a) acrosomal membrane *b)* central singlet microtubule of the flagellum

***c)* complete ring of the microtubule dublet of the flagellum**

d) Incomplete ring of microtubule dublet of the flagellum.

18. If in a frog embryo some of the animal blastomeres already specified for ectoderm are grafted at the floor of the blastocoel those will be fated to:

a) ectoderm *b)* mesoderm

***c)* endoderm** *d)* All different cell types.

19. One chordate characteristic found in adult ascidians is the

a) Vertebral column ***b)* Pharyngeal slits**

c) Dorsal hollow nerve cord *d)* Postanal tail

20. Proteins are separated in SDS-electrophoresis on the basis of their

***a)* Molecular size** *b)* Charge *c)* Amino acid composition *d)* Amino acid sequence

21. When two closely related species that are found in the same geographical range reproduce at different times of the year, this is known as:

***a)* Temporal isolation** *b)* Ecological isolation *c)* Behavioural isolation *d)* Hybrid breakdown

22. If a radioactivated DNA molecule is allowed to replicate in a non-radioactivated medium, how many DNA strands will be radioactivated after four generations?

***a)* Two** *b)* Four *c)* Eight *d)* Sixteen

23. Which one of the following features is NOT appropriate for Vitamin C?

a) Water soluble *b)* Anti-Scurvy *c)* **Anti-Beriberi** *d)* Hexose derivative

24. Identify the larva which is only present in the members of gastropods

a) Trochophore ***b)* Veligar** *c)* Glochidium *d)* Muller's larva

25. Bilateral symmetry, metameric segmentation, coelom and open circulatory system are present in

a) Annelida ***b)* Arthropoda** *c)* Platyhelminthes *d)* Mollusca

26. Choose the mismatch

Feature	*Example*
a) Bilateral symmetry …….	fish
b) First triploblastic …….	flatworms
c) Free-living flatworm…….	Planaria
***d)* Radial symmetry …….**	**larvae of echinoderm**

27. Evolutionary changes in one species prompt corresponding changes in other species with which the former interacts ecologically. This process is known as

***a)* Coevolution** *b)* Genetic drift *c)* Parallel evolution

d) Microevolution

28. What are the assumptions of Hardy-Weinberg equilibrium?

a) Small population size, random mating, no selection, no migration, no mutation

b) **Large population size, random mating, no selection, no migration, no mutation**

c) Large population size, random mating, heterozygotes survive the best, no migration, no mutation

d) Large population size, like individuals mate, no selection, no migration, no mutation

29. What will be the consequence if Anaphase promoting complex (APC) of an oocyte is inhibited just after fertilization?

a) CSF will not be degraded *b)* A triploid may develop

c) Second meiosis will not resume ***d)*** **All the consequences may occur.**

30. Cleavage of mammalian egg is termed as rotational cleavage because:

a) Blastomeres rotate clock wise during cleavage

b) Blastomeres rotate anti clock wise during cleavage

c) Blastomeres cleave in holoblastic and meroblastic manner in a rotation

d) **A rotation of the plane of cleavage occurs among the blastomeres in successive divisions.**

31. Which one is a component of corticle granule?

a) **Transglutaminase** *b)* EBR1

c) Bindin *d)* DAG.

32. Miracidium is the free larval stage of:

a) Ascaris lumbricoides ***b) Fasciola hepatica***

c) Wuchereria bancrofti. *d) Taenia solium*

33. The logistic equation *cannot* be written:

a) dN/dt = r N{K - (N/K)} *b) dN/dt = r N{[K - N]/K}*

c) dN/dt = r N{1 - (N/K)} *d) dN/dt (1/N) = r - (r/K)N*

34. As a result of a statistical test, a biologist reports a highly significant relationship between body temperature and the synthesis of particular enzyme of an animal. Biologist reports this in terms of a P-value as follows:

a) $P > 0.50$ *b)* $P < 0.05$

c) $P < 0.10$ ***d)*** $\mathbf{P < 0.01}$

35. Which of the following hormones initiates biological actions by crossing the plasma membrane and then binding to a receptor

a) Glucagon ***b)*** **Estradiol** *c)* Norepinephrine *d)* Insulin

36. Cellular proteins destined for secretion are sorted and packaged in the

a) **Trans golgi network** *b)* Lysomes *c)* Endosomes *d)* Peroxisomes

37. Why does *Ascaris* eggs unlike other nematode eggs do not hatch outside?

a) It does not have enzymes for hatching ***b)*** **It does not obtained required pH for hatching** *c)* The egg shell is very thick *d)* It does not obtained required CO_2

38. Cells with abundant apical microvilli are characteristically found in

a) Exocrine glands *b)* The reticuloendothelial system *c)* Adipose tissue ***d)* Absorptive epithelia**

39. Which of the following types of bonds or interactions are *least* likely to be involved in stabilizing the three-dimensional folding of most proteins?

a) Hydrogen bonds *b)* Electrostatic bonds ***c)* Disulfide bonds** *d)* Hydrophobic interactions

40. The conversion of pyruvate to oxaloacetate is likely to require which of the following coenzymes?

***a)* Biotin** *b)* Vitamin B_{12} *c)* Thiamine pyrophosphate *d)* Pyridoxal phosphate

41. A man with hemophilia (a recessive, sex-linked condition has a daughter of normal phenotype. She marries a man who is normal for the trait. What is the probability that a daughter of this mating will be a hemophiliac?

***a)* 0 %** *b)* 25% *c)* 50% *d)* 75%

42. Proteins that assist the binding of RNA polymerase to the promoter region on DNA strand are called

***a)* Transcription factor** *b)* SSB protein *c)* Sigma factor *d)* All of the above

43. In statistics one or two tail test determines:

a) If the two extreme values (minimum or maximum) of the sample need to be rejected *b)* If the hypothesis has one or two conclusions. ***c)* If the region of rejection is located in one or two directions of the distribution** *d)* If the experiment has one or two ways to interpret

44. Which of the following is *not* a typical characteristic of an *r*-selected species:

a)* Large size** ***b) Many, small offspring *c)* A large allocation of resources to reproduction *d)* Early reproductive maturity rate

45. The term *deuterotoky* is related to:

a) Reproduction ***b)* Parthenogenesis**
c) Cell division *d)* Gametogenesis

46. Hamburger's phenomenon is also named as:

a) Hydrogen shift ***b)* Bicarbonate shift**
c) Chloride shift *d)* Hydrogen shift

47. In *Herdmania*, excretion is carried out by:

a) Kolliker's pit ***b)* Supra-neural gland**
c) Solenocytes *d)* Protonephridia

48. A female is heterozygous for colour blindness. Which of the family members *cannot* contribute to this trait?

a) Father *b)* Maternal grandfather
***c)* Paternal grandfather** *d)* Paternal grandmother

49. Read the consequences leading to eutrophication in a water body:
(I) Release of pollutants into the water body (II) algal bloom (III) nitrogen and phosphorus enrichment (IV) oxygen depletion (V) phytoplankton growth (VI)death of algae and other organisms - *Select the appropriate order of events:*

a) (I)→(II)→(IV)→(VI)→(V)→(III) *b)* (I)→(II)→(III)→(V)→(IV)→(VI)
***c)* (I)→(III)→(V)→(II)→(IV)→(VI)** *d)* (I)→(IV)→(V)→(VI)→(II)→(III)

50. In the Operon concept, the regulator gene regulates chemical reaction in the cell by:

a) Inactivating enzymes in the reaction *b)* Inactivating the substance in the reaction *c)* Inhibiting the migration of mRNA into cytoplasm ***d)* Inhibiting transcription of mRNA**