[4719]-1

F.Y. B.Sc.

BIOTECHNOLOGY

Bb-101 : Fundamentals of Chemistry

(2008 Pattern)

Time : 3 Hours]   *[Max. Marks : 80*

Instructions to the candidates:

1) *Neat diagrams must be drawn wherever necessary.*
2) *Figures to the right indicate full marks.*
3) *All questions carry equal marks.*
4) *Use of logarithmic tables slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.*
5) *All questions are compulsory.*

Q1) Answer the following: **[16]**

a)   State and explain the Avogadro's Law.

b)   The kinetic energy at N_2 gas at 25°C is 7.482 k.J. Calculate No. of moles of gas

[given R = 8.314 Jk^{-1} mole $^{-1}$].

c)   Define transport number. How is the transport number is related to speed of ions?

d)   Explain the term plane of symmetry and give the suitable example.

e)   Explain the formation of co-ordinate bond with suitable examples.

f)   Define the term component and determine how many components are present in the following system

i) $NH_4Cl_{(s)} \rightleftharpoons NH_{3(g)} + HCl_{(g)}$

ii) $CaCO_{3(s)} \rightleftharpoons CaO_{(s)} + CO_{2(g)}$

[Inclosed vessel]

g)   Explain representation of an organic molecule by using Sawhorse formula and Newman projection formula.

h)   How will you determine the rate constant at 1st order and 2nd order reaction by plotting graph?

P.T.O.

Q2) Attempt the following (Any Four): **[4 x 4 = 16]**

a) Explain any four postulates of kinetic theory of gases.

b) What is meant by cryoscopic constant? Explain how depression of freezing point of solvent may be used to determine the molecular weight of the dissolved substance.

c) What are buffer solutions? Explain different types of buffer and respective mechanism of buffer.

d) Draw the phase diagram of water (CH_2O) and apply the Gibb's phase rule to it.

e) Explain different types of molecular velocities and derive relation between them.

f) What does mean by half life period? Derive the expression for half life period of the first order and second order reaction.

Q3) Attempt the following (Any Four): **[4 x 4 = 16]**

a) Explain the Hydrogen bonding and types of Hydrogen bonding briefly as well as explain it's effect over physical and chemical properties.

b) A second order reaction is 30% completed within 500 sec. How long it will take to complete 50% and 70%?

c) Explain the term lowering of vapour pressure, vapour pressure with the help of Raoult's law.

d) What is eutectic point? Explain the phase diagram of two component system.

e) What are chemical cell? Derive an expression for emf of chemical cell without transferance.

f) Explain the QSAR theory and the synthesis of the following organ molecules with reaction

   i) Aspirin   ii) Paracetamol

Q4) Attempt the following (Any Four): **[4 x 4 = 16]**

a) Comment on the stability and energy of conformational isomers at n-Butane with the help of energy profile diagram.

b) What are geometrical isomers? Explain the following physical properties of the following geometrical isomers.

   i) Maleic acid   ii) Fumaric acid

   and discuss the stability at above isomers.

c) Explain the chemical reactions taking place in the following cell and calculate EMF of the cell at 25°C

$$Cd_{(Hg)} \quad | \quad \begin{matrix} CdSO_4 \\ solution \end{matrix} \quad | \quad Cd_{(Hg)}$$

   [a = 0.1]   [a = 0.01]

d) Give the difference between sigma and pi bond.

e) Write a note on optical isomerism.

f) Explain with the help of molecular orbital energy level diagram that oxygen is paramagnetic where as Nitrogen is di-magnetic.

Q5) Attempt the following (Any Two): **[2 x 8 = 16]**

a) What do you mean by single electrode potential? Describe construction and working of glass electrode and explain how it is used to determine pH of the solution.

b) Explain the following types of organic reactions.

   i) Addition reaction   ii) Substitution reaction

   iii) Elemination reaction   iv) Oxidation reaction

c) Write a brief note on the following:

   i) Conductometric titrations.

   ii) Common ion effect.

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[4719]-1001

F.Y. B.Sc.
BIOTECHNOLOGY
Bb-101 : Fundamentals of Chemistry
(2013 Pattern)

Time : 3 Hours]　　　　　　　　　　　　　　　　　　*[Max. Marks : 80*

Instructions to the candidates:

　　1)　Neat diagrams must be drawn wherever necessary.

　　2)　Figures to the right indicate full marks.

　　3)　All questions carry equal marks.

　　4)　Use of logarithmic tables, slide rule, Mollier charts, electronic pocket calculator and steam tables is allowed.

　　5)　All questions are compulsory.

Q1) Answer the following:　　　　　　　　　　　　　　　　**[8 x 2 = 16]**

　　a)　Explain the Boyle's Law and Charle's Law as well as deduce it from kinetic gas equation.

　　b)　Define and explain the pseudounimolecular reaction.

　　c)　Define and explain the colligative property of the solution.

　　d)　State and explain the Gibb's phase rule.

　　e)　State and explain the specific and equivalent conductance.

　　f)　Define the EMF and give the expression for EMF of electrochemical cell having reaction $A + B \rightleftharpoons C + D$.

　　g)　Define and explain the optical isomerism.

　　h)　Explain the oxidation and reduction reaction with examples.

Q2) Answer the following (Any Four):   [4 x 4 = 16]

a)   State and explain briefly the Markownikoff's rule as well as Anti-Markownikoff's rule.

b)   Give the difference between sigma and pi bond.

c)   What does mean by half life time? Derive an expression for half life time of first order and second order Reaction.

d)   Explain paramagnetic nature of Oxygen and di-magnetic nature of Nitrogen with the help of molecular orbital energy level diagram.

e)   What does mean by lowering of vapour pressure? Explain relative lowering of vapour pressure of solvent with the help of Raoult's Law.

f)   Draw schematically the phase diagram for water and apply Gibb's phase rule.

Q3) Answer the following (Any Four):   [4 x 4 = 16]

a)   Give the difference between order and molecularity of a reaction.

b)   In the first order reaction, 50% of reaction completed in 75 min; calculate time required for 75% completion of reaction.

c)   Explain the mean free path and different types of molecular velocities as well as give the relation between them.

d)   Draw the phase diagram of Silver-Lead system and apply Gibb's phase rule to it.

e)   Give the cell reaction and calculate EMF of the following cell at 25°C
     (Given: $E^o_{Cd} = 0.403V$ and $E^o_{Ag} = 0.799V$)
     $Cd/Cd^{+2}//Ag^+/Ag$ (R = 8.314 JK^{-1} $mole^{-1}$)

f)   Give the types of substitution reaction and explain each type briefly (SN^1 and SN^2).

Q4) Answer the following (Any Two): **[2 x 8 = 16]**

a) What does mean by single electrode potential? Give different types of electrodes and explain any two types briefly.

b) What is Hydrogen bonding? Explain the types of Hydrogen bonding and it's effect on physical as well as chemical properties.

c) Write a note on QSAR theory and give the synthesis of Aspirin, Paracetamol, Benzocaine and methyl orange.

d) State the Faraday's Laws of electrolysis and write a note on conductometric titrations.

Q5) Attempt the following (Any One): **[1 x 16 = 16]**

a) Give and explain the postulates of Kinetic theory of the Gases and derive Kinetic gas equation $E = \dfrac{3}{2}(nRT)$.

b) What does mean by isomerism? Give the classification of isomerism and explain each class briefly.

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[4719]-1002
F.Y.B.Sc.
BIOTECHNOLOGY
Bb - 102: Fundamentals of Physics
(2013 Pattern)

Time : 3 Hours]   *[Max. Marks :80*

Instructions to the candidates:
  1) *All questions are compulsory.*
  2) *Figures to the right indicate full marks.*
  3) *Use of calculators is allowed.*
  4) *Neat diagrams must be drawn wherever necessary.*

Q1) Attempt all of the following: **[8x2=16]**

  a)   Define atomic mass unit (amu).

  b)   What is more elastic, iron or rubber? Why?

  c)   State Pascal's principle.

  d)   Define electric lines of force.

  e)   Define molar heat capacity. Give its unit.

  f)   If the efficiency of a refrigerator is 20% then find its coefficient of performance.

  g)   Define angle of contact. When it is acute and when it is obtuse?

  h)   Define beat. Give two applications of beat.

Q2) Attempt any four of the following: **[4x4=16]**

  a)   Define standard units for current and temperature.

  b)   Give relevance of elasticity to life sciences.

c) Define surface tension. State applications of surface tension.

d) What is meant by a transverse wave. State characteristics of transverse waves.

e) Define pressure in a fluid. Obtain expression for pressure energy.

f) Define coefficient of viscosity. There is a 1 mm thick layer of glycerin between a flat plate of area 100 cm² and a big plate. If the coefficient of viscosity of glycerin is 1.0 kg/m-sec, then how much force is required to move the plate with a velocity of 7 cm/sec.

Q3) Attempt any four of the following: [4x4=16]

a) Define calorie. Give relations among various heat units.

What do you mean by international practical temperature scale.

b) Define critical constants P_c, V_c, T_c and critical coefficient of the gas.

c) Distinguish between Fraunhofer and Fresnel diffraction.

d) State Coulomb's law. Calculate the force between two balls each having a charge of 12 μc and are 8 cm apart.

e) The maximum value of the permeability of some metal is 0.130T - m/A. Find the value of relative permeability and susceptibility.

(Given : $\mu_0 = 4\pi \times 10^{-7}$ T - m/A).

f) State and explain characteristics of laser.

Q4) Attempt any two of the following: [2x8=16]

a) Define magnetic field. State Gauss's law for magnetism. Give its importance. Discuss nuclear magnetism. Give its application in the medical field.

b) State conditions for laser action. Discuss the properties of laser.

c) State different musical instruments that work on vibration of air particles. Show that only odd harmonics are present in the vibrations of column in a closed organ pipe.

d) i) Explain the term thermal equilibrium.

   ii) Differentiate between polarized and unpolarized light.

[4719]-1002   **2**

Q5) Attempt the following: **[2x8=16]**

    a)   Show that the relationship between Young's modulus bulk modulus and Poisson's ratio is $Y = 3K(1-2\sigma)$.

    b)   i)   Define entropy. Explain the change in entropy during reversible process.

           ii)   Calculate the change in entropy when 8 gm. of ice at $0^{\circ}C$ is converted into water at the same temperature (Given: Latent heat of ice = 80 cal/gm)

<p align="center">OR</p>

    a)   Give four applications of surface tension. A big drop of water of radius R is formed by combining 1000 small droplets of water of radius r each. What will be the change in surface energy.

    b)   With the help of suitable diagram explain principle, construction and working of Pitot's tube. Derive necessary formula for rate of flow of liquid.

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[4719]-1003

F.Y.B.Sc.

BIOTECHNOLOGY

Bb - 103: Basics of Plant and Animal Science

(2013 Pattern)

Time : 3 Hours]   *[Max. Marks :80*

Instructions to the candidates:

    1)   *Answer to the two sections should be written in separate answer books.*

    2)   *All questions are compulsory.*

    3)   *Neat diagrams must be drawn wherever necessary.*

    4)   *Figures to the right indicate full marks.*

SECTION - I

Q1) Answer the following questions: **[8]**

    a)   What are pteridophytes? Give one example.

    b)   What are suckers? Give one example.

    c)   Give any two unique characters of plant cell.

    d)   Define photoperiodism.

Q2) Write short notes on (Any two):   **[8]**

    a)   Write a note on modified leaves.

    b)   Write important features of gymnosperms.

    c)   What is diffusion? Explain on significance of diffusion.

Q3) Write short notes on(Any two):   **[8]**

    a)   What is permeability? Explain on factors affecting permeability.

    b)   Describe salient features of a plant cell.

    c)   Write short note on Internal anatomy of monocot leaf.

Q4) Answer in details (Any two): **[16]**

    a)   Describe the dark reaction of photosynthesis.

    b)   What is ascent of sap? Describe the mechanisms of ascent of sap.

    c)   Describe in detail the Kreb's cycle.

SECTION - II

(Zoology)

Q5) Answer the following: **[8]**

    a)   Enlist two examples of echinodermata.

    b)   Define endoparasite.

    c)   What is the difference between hormones & pheromones.

    d)   What is connective tissue?

Q6) Write short notes on (Any two): **[8]**

    a)   Sericulture.

    b)   Morphology of Honey bee.

    c)   Control of malaria.

Q7) Attempt the following (Any two): **[8]**

    a)   Comment on effect of temperature on oxyhaemoglobin dissociation curve.

    b)   Economic importance of insects.

    c)   Chemical nature of hormones.

Q8) Answer the following in detail (Any two): **[16]**

    a)   Give an illustrated account of life cycle of fasciola hepatica.

    b)   Explain colony organization in Honey bee.

    c)   Give detail account on circulatory system of frog.

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[4719] - 1004

F.Y. B.Sc.

BIOTECHNOLOGY

Bb - 104 : Mathematics and Statistical Methods for Biologists

(2013 Pattern)

Time : 3 Hours] *[Max. Marks : 80*

Instructions to the candidates:

    1)   All questions are compulsory.

    2)   Figures to the right indicate full marks.

    3)   Use of non-programmable scientific calculator is allowed.

    4)   Solve each section on separate answer paper.

SECTION - I

(Mathematics)

Q1) Attempt each of the following: **[5 × 2 = 10]**

    a)   Find modulus and principal argument of $\dfrac{i+i^2+i^4}{1+i}$.

    b)   If $A=\begin{bmatrix} 4 & 1 & 3 \\ -2 & 0 & 1 \end{bmatrix}, B=\begin{bmatrix} 1 & -2 \\ 0 & 5 \\ 1 & 1 \end{bmatrix}$ then find determinant of (AB).

    c)   If $Z = \log(xy)$, then find $Z_x + Z_y$.

    d)   Examine the convergence of the series $\sum\limits_{n=1}^{\infty}\dfrac{2n-1}{3n+5}$.

    e)   Write degree and order of the following differential equation

$$\frac{d^2x}{dt^2}+4\left(\frac{dx}{dt}\right)^3+5x=0.$$

Q2) Attempt any four of the following: [4 × 2½ = 10]

a) Find rank of the matrix

$$\begin{bmatrix} 1 & 2 & -3 & 1 \\ 2 & 5 & -8 & 4 \\ 3 & 8 & -13 & 7 \end{bmatrix}$$

b) Using De' Moivre's theorem show that

$$\cos4\theta = \cos^4\theta - 6\cos^2\theta \sin^2\theta + \sin^4\theta.$$

c) Test the convergence of the series $\displaystyle\sum_{n=1}^{\infty} \frac{2n}{n!}$.

d) Determine whether the set of vectors $\{(1, 1, 1), (1, 2, 3), (2, -1, 1)\}$ is linearly dependent in $\mathbb{R}^3$.

e) If $u = \tan^{-1}(xy)$, then show that $u_x + u_y = (x + y)\cos^2 u$.

f) Show that $W = \{(x,0)|x \in \mathbb{R}\}$ is a subspace of $\mathbb{R}^2$.

Q3) Attempt any two of the following: [2 × 5 = 10]

a) Solve the following system of linear equations.

$x + 2y + 2z = -1$

$x + 3y + z = 4$

$x + 3y + 2z = 3$

b) Show that the following sequence is convergent

$$x_1 = \sqrt{2}, x_n = \sqrt{2x_{n-1}}, n \geq 2$$

c) Find the stationary points and examine for minimum and maximum value for the function $f(x, y) = x^2 - xy + y^2 - 2x + y$.

Q4) Attempt any one of the following: **[1 × 10 = 10]**

a) Determine whether the matrix A is diagonalizable. If so, find P and P⁻¹AP where

$$A = \begin{bmatrix} 1 & 1 & 1 \\ 0 & 2 & 1 \\ 0 & 2 & 3 \end{bmatrix}$$

b) i) Solve the differential equation:

$(x^2 + y^2)dx = 2xy\ dy$.

ii) Solve $x^4 + 1 = 0$.

SECTION - II

(Statistics)

Q5) Attempt the following: **[5 × 2 = 10]**

a) Define probability of an event using classical approach.

b) State additive property of Binomial distribution.

c) Define "mode" and state formula for continuous frequency distribution.

d) Explain the term regression.

e) State two requisites of good measures of central tendency.

Q6) Attempt any four: **[4 × 2½ = 10]**

a) Find median of the following data:

C.I.	0-10	10-20	20-30	30-40	40-50
Freq.	6	13	20	14	7

b) Distinguish between variance and coefficient of variation.

c) For certain Poisson distribution $P(X = 1) = \frac{1}{2} P(X = 2)$, find $P(X \le 2)$.

d) If $P(A) = P(B) = 0.5$, $P(A \cap B) = 0.2$, find $P(A^C \cap B^C)$, $P(A \cap B^C)$.

e) State hypothesis and statistics for testing independence of attributes.

Q7) Attempt any two: [2 × 5 = 10]

 a) Find regression line of Y on X for the following data: $n = 100$,
   $\Sigma x_i = 450$, $\Sigma y_i = 600$, $r = 0.8$, $\sigma_X = 4\sigma_Y$.

   Estimate Y for X = 4.

 b) Explain the following terms with one illustration

   i) Dispersion

   ii) Correlation.

 c) Test equality of two population means for the following data

Sample	Size	Mean	Sd
1	6	68	4
2	8	72	5

Q8) Attempt any one: [1 × 10 = 10]

 a) Explain t-test for testing equality of two population means if two
   populations are dependent.

 b) Define Binomial distribution, Poisson distribution, normal distribution.
   Give real life example of each.

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[4719]-1005

F.Y.B.Sc.

BIOTECHNOLOGY

Bb - 105: Fundamentals of Biological Chemistry

(2013 Pattern)

Time : 3 Hours]   *[Max. Marks :80*

Instructions to the candidates:

   1)   *All questions are compulsory.*

   2)   *Draw neat and labelled diagrams wherever necessary.*

   3)   *Figures to the right indicate full marks.*

Q1) Attempt all the following: **[8x2=16]**

   a)   Define pH.

   b)   What are non-reducing sugars? Give an example.

   c)   What is a zwitterion? Give an example.

   d)   What is a glycosidic bond?

   e)   What are unsaturated fatty acids? Give an example.

   f)   What are aliphatic amino acids? Give an example.

   g)   Define the term enthalpy.

   h)   What are biological buffers.

Q2) Answer any four of the following: **[4x4=16]**

   a)   Explain the importance of water in the biological system.

   b)   What are co-enzymes? Give the role of Thiamine and Riboflavin.

   c)   Explain the tertiary structure of protein with reference to myoglobin.

   d)   Giving a suitable example explain non-competitive inhibition of enzyme.

   e)   Describe the nucleotide structure.

   f)   Differentiate between active site and allosteric site of an enzyme.

Q3) Answer any four of the following: **[4x4=16]**

   a)   Describe the lock and key hypothesis for enzyme activity.

   b)   Explain the structure of t - RNA.

   c)   Write a note on proteoglycan matrix.

   d)   Write a note on complex lipids?

   e)   Describe the structure of a phospho-diester bond.

   f)   Explain the importance of oxidation - reduction reaction in biological
        system.

Q4) Answer any two of the following: **[2x8=16]**

   a)   Describe the various forces stabilising DNA structure.

   b)   Describe different types of isomerisms observed in monosaccharides.

   c)   Give a detailed account of the secondary structure of a protein.

Q5) Answer any one of the following: **[16]**

   a)   Classify standard amino acids on the basis of their 'R' group (side chain).
        Explain any three properties of amino acids.

   b)   Describe in detail the Sangers method of protein sequencing. Enlist the
        disadvantages of this method.

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[4719]-1006

F.Y.B.Sc.

BIOTECHNOLOGY

Bb. - 106: Biophysics and Instrumentation

(2013 Pattern)

Time : 3 Hours] *[Max. Marks :80*

Instructions to the candidates:

1) *All questions are compulsory.*

2) *Draw neat and labelled diagrams wherever necessary.*

3) *Figures to the right indicate full marks.*

4) *Use of scientific calculator is allowed.*

Q1) Attempt all of the following: **[8x2=16]**

a) State Beer's law.

b) Define:

   i) Half life period of radioactive isotope.

   ii) Electromagnetic spectrum.

c) Explain numerical apperture.

d) Define: Action potential.

e) State Pauli's exclusion principle.

f) Enlist different types of thermometers.

g) What are quantum numbers? Enlist them.

h) Enlist various types of electrodes used in pH meter.

Q2) Answer any four of the following: **[4x4=16]**

a) Write a note on biological applications of radioactive isotopes.

b) Explain passive transport system across the cell membrane .

c) Write a note on bimetallic thermometers.

d) What is radioimmunoassay? Give its applications.

e) Explain the properties of electromagnetic waves.

f) Calculate k.E and p.E of first orbit of hydrogen atom, if $e = 1.6 \times 10^{-19}$ c & $r = 0.53 \times 10^{-10}$m.

Q3) Attempt any four of the following: **[4x4=16]**

a) Explain the principle and working of centrifuge.

b) Write a note on chromatic aberrations.

c) Describe the properties of alpha, beta and gamma ray.

d) Give an account of Hertz experiment to demonstrate electromagnetic wave.

e) Give principle of mass spectroscopy and any two biological applications of it.

f) Explain the term Biopotential, and give principle of any one instrument to measure it.

Q4) Attempt any two of the following: **[2x8=16]**

a) Explain principle and working of UV-VIS -spectrophotometer and support it with ray diagram.

b) Explain the Bohr's atomic model and give it's salient features.

c) Explain construction and working principle of bright and dark field microscope.

d) Give principle, working and applications of G.m counter.

Q5) Attempt any one of the following: **[1x16=16]**

a) Explain:
   i) Emission spectra with respect to sodium (Na) atom.
   ii) Atomic Absorption spectrometer.

b) i) Explain in detail fluid mosaic model of cell membrane.
   ii) Write a note on active transport across cell membrane.

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[4719] - 1007

F.Y.B.Sc.

BIOTECHNOLOGY

Bb -107: Microbiology

(2013 Pattern) (New)

Time : 3 Hours]   *[Max. Marks : 80*

Instructions to the candidates:
1) *All questions are compulsory.*
2) *All questions carry equal marks.*
3) *Figures to the right indicate full marks.*
4) *Neat diagrams must be drawn wherever necessary.*

Q1) Answer the following .   **[2×8 = 16]**

   a)   What is Tundalization?

   b)   What is mixed culture.

   c)   State two distinguishing characteristics of protozoa.

   d)   State two functions of flagella.

   e)   What is mutualism? Give one example.

   f)   Differentiate between enriched & enrichment media.

   g)   Define stain. Give two examples of acidic stain.

   h)   Define archaebacteria. Give one example.

Q2) Answer the following. (Any Four).   **[4×4 = 16]**

   a)   Differentiate between Archaebacteria and Eubacteria.

   b)   What is differential staining? Give principle of spore staining.

   c)   Give importance of Bergy's manual in microbiology.

   d)   Enlist component of nutrient agar and state role of each component.

   e)   Draw neat labelled diagram of autoclave and explain its principle.

   f)   Enlist different methods of quantification of growth. Explain Breed's
        count in detail.

Q3) Answer the following. (Any Four) [4×4 = 16]

a) With neat labelled diagram describe lytic cycle in bacteriophage.

b) Classify bacteria depending on their pH requirement for growth.

c) Explain in detail asexul reproduction in microorganism.

d) Describe in detail preservation of microorganism.

e) A spoiled food sample was analyzed and following data was obtained

   i) Volume of sample plated: 0.1 ml

   ii) Dilution of sample: 10^{-4}

   iii) Number of colonies obtained: 98

      Calculate TVC of sample.

f) Describe colony formation pattern of bacteria with respect to elevation and margin.

Q4) Answer the following (Any Two) [2×8 = 16]

a) Give an account on contribution of Louis Pasteur in microbiology.

b) With neat labelled diagram describe a typical bacterial growth curve in batch culture.

c) Describe in detail the ultrastructure of flagella.

d) Explain various biosafety measures to be conduct in microbiology laboratory.

Q5) Answer the following (Any One) [16]

a) Describe in detail, bacterial classification on the basis of their nutritional requirement.

b) Explain different theories of staining. Describe procedure of Gram staining.

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[4719] - 1008

F.Y.B.Sc.

BIOTECHNOLOGY

Bb-108: Computers and Applications

(2013 Pattern)

Time : 3 Hours]

[Max. Marks : 80

Instructions to the candidates:

  1)   *All questions are compulsory.*

  2)   *Draw neat and labeled diagrams whenever necessary.*

  3)   *Figures to the right indicate full marks.*

Q1) Attempt all of the following.   **[8×2 = 16]**

   a)   What is a mini computer? Where it is used?

   b)   Define the following terms:

      i)   ROM

      ii)   EPROM

   c)   Define operating system.

   d)   List any four types of graphs available in MS- Excel to represent data.

   e)   Differentiate between a virus and worm.

   f)   Give use of a Hub and Router.

   g)   Explain network data model.

   h)   What is an entity set?

Q2) Attempt any FOUR of the following: **[4×4 =16]**

   a)   Explain working of an optical Mouse.

   b)   What are storage devices available in computer? Compare them with respect to capacity and access time.

   c)   Explain services provided by an operating system.

   d)   Write a short note on coaxial cable and twisted pair.

   e)   What is an attribute? Explain its types with example.

Q3) Attempt any FOUR of the following: **[4×4 = 16]**

a)   What are the advantages of DBMS over file system?

b)   What are output devices? Explain working of Inkjet printer.

c)   Explain LAN and WAN.

d)   What are Biological databases? Explain any one in detail.

e)   Explain any four unix commands.

Q4) Attempt any TWO of the following: **[2×8 = 16]**

a)   Write a short note on formatting toolbar in MS-WORD.

b)   Draw a block diagram of a computer. Explain its components in detail.

c)   Write a short note on MS-Excel.

Q5) Attempt all of the following: **[2×8 = 16]**

a)   Write an algorithm and draw a flow chart to add odd numbers between n1 and n2.

<div align="center">OR</div>

Write an algorithm and draw a flow chart to display a table of a given number.

b)   Write an algorithm and draw a flow-chart to check a given number is prime or not.

<div align="center">OR</div>

Explain in detail generations of computers.

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[4719]-2
F.Y.B.Sc.
BIOTECHNOLOGY
Bb - 102: Fundamentals of Physics
(2008 Pattern)

Time : 3 Hours]   *[Max. Marks :80*

Instructions to the candidates:
   1)   All questions are compulsory.
   2)   Figures to the right indicate full marks.
   3)   Use of calculators is allowed.
   4)   Neat diagrams must be drawn wherever necessary.

Q1) Attempt all of the following: **[8x2=16]**

   a)   State Hooke's law. What is elastic limit?

   b)   What is meant by isothermal and adiabatic change?

   c)   Define angle of contact. State under what conditions it is zero.

   d)   What is meant by turbulent flow?

   e)   State the principle of superposition of waves.

   f)   State zeroth law of thermodynamics.

   g)   What are coherent sources.

   h)   Determine the magnetic length of a bar magnet having pole strength 200 Am and magnetic moment 100 Am^2.

Q2) Attempt any four of the following: **[4x4=16]**

   a)   On the basis of band theory, compare conductor, semi conductor and insulator.

   b)   Distinguish between paramagnetic and diamagnetic substances.

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c) Describe construction and working of air compression type refrigerator.

d) Derive an expression for the work done during an adiabatic change.

e) Write a note on applications of ultrasonic waves.

f) Polarizing angle for air and transparent material is 58°. Calculate refractive index of the medium. What is the angle of refraction in the medium.

Q3) Attempt any four of the following: [4x4=16]

a) Write a note on factors affecting surface tension.

b) What is relevance of viscosity to life sciences?

c) Explain the use of mercury barometer to measure atmospheric pressure.

d) What do you mean by S.I. system of units? How many fundamental and derived units are there in S.I. system.

e) Define life sciences. Which fields are included in life sciences? Give significance of them.

f) The original length of rubber strip is 100cm. and it is stretched to 105 cm by applying external force. Due to this diameter of strip changes from 0.5 cm to 0.495 cm. Calculate the Poisson's ratio.

Q4) Answer any two of the following: [2x8=16]

a) Explain in brief the characteristics of a laser beam. State four applications of laser.

b) Write a note on applications of Doppler effect.

A motor car approaches towards a crossing with a velocity of 75 km/hr. A police man standing at the crossing hears a horn of frequency 260 cycles per second from the car. What is the original frequency of the horn. (Given v = 332 meter / sec).

c) State and explain Bernoulli's theorem.

d) Describe soap bubble method for determination of surface tension of soap solution.

Q5) Attempt the following:

a) State Pascal's principle and show that the work done W on the input piston by the applied force is equal to the work done W by the output piston in lifting the load placed on it. **[8]**

b) Derive Van der Waal's equation of state for real gases. Mention the defects in this equation. **[8]**

OR

a) Differentiate between Fresnel and Fraunhofer diffraction.

A slit of variable width is illuminated by red light of wavelength 6500 $\overset{\circ}{A}$. At what width of the slit the first minimum will fall at $\theta = 30^\circ$? **[8]**

b) State Coulomb's law. Explain what is dielectric constant.

Calculate the force between two balls each having a charge of 12 μc and placed 8 cm apart. **[8]**

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[4719] - 3
F.Y. B.Sc.
BIOTECHNOLOGY
Bb - 103 : Basic Biosciences
(2008 Pattern)

Time : 3 Hours]   *[Max. Marks : 80*
Instructions to the candidates:
    1)   *All questions are compulsory.*
    2)   *Draw neat & labelled diagram wherever necessary.*
    3)   *Answers to the two sections should be written in two separate answer books.*
    4)   *Figures to the right indicate full marks.*

SECTION - I

(Botany)

Q1) Answer the following questions: **[8]**

    a)   Explain the term <u>in</u> - <u>vivo</u> morphogenesis.

    b)   Give two biotechnologically important Algae.

    c)   Define in sectivorous plants.

    d)   Explain the term tuber with respect to stem & give example.

    e)   Explain Apical Meristem.

    f)   Define plant growth regulators.

    g)   Define Nitrogen Metabolism.

    h)   Give unique features of plant cell.

Q2) Write short notes on <u>any</u> <u>three</u> of the following: **[12]**

    a)   Simple tissue.

    b)   Aurin.

    c)   Jhallus organization in algae.

    d)   Root & its modification.

    e)   Special Inflorence.

Q3) Attempt <u>any two</u> of the following: [10]

    a)   Describe different types of fruits.

    b)   Define phylochrome & Describe its role in plants.

    c)   Describe formation of seed with suitable example.

Q4) Attempt the following:

Define photosynthesis & give one major pathways of it. [10]

<div align="center">OR</div>

Describe salient features of angiosperm & explain life cycle of angiosperm with suitable example.

<div align="center">

SECTION - II

(Zoology)

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Q5) Answer the following: [8]

    a)   Write any two characteristics of Phylum Protozoa.

    b)   Define Host specificity.

    c)   Enlist two characteristics of Amphibia.

    d)   Enlist two beneficial insects.

    e)   What is bee wax?

    f)   Define Mutualism.

    g)   Define aquaculture.

    h)   Give two key organs of Nervous system.

Q6) Write short notes on (Any three): [12]

    a)   Characteristics of Phylum Arthropoda with examples.

    b)   Apiculture.

    c)   Explain symptoms & control measures of Rice Weevil.

    d)   Economic importance of insects.

Q7) Answer the following: (Any Two)   [10]

    a)   Describe cultivation of mulberry.

    b)   Parasitic Adaptations of Fasciola.

    c)   Comment on Symptoms & control of Malaria.

Q8) Answer the following: [10]

Give detail account on the life cycle of Jawar stem borer.

<div align="center">OR</div>

Compare the excretory system in animals.

<div align="center">☛ ☛ ☛</div>

[4719] - 4

F.Y. B.Sc.

BIOTECHNOLOGY

Bb - 104 : Mathematics and Statistical Methods for Biologists

(2008 Pattern)

Time : 3 Hours]   *[Max. Marks : 80*

Instructions to the candidates:

1)   All questions are compulsory.

2)   Figures to the right indicate full marks.

3)   Use of non-programmable scientific calculator is allowed.

4)   Solve each section on separate answer paper.

SECTION - I

(Mathematics)

Q1) Attempt each of the following: **[5 × 2 = 10]**

a)   Find modulus and principal argument of $(1 + i)^2$.

b)   Find adjoint of the matrix $A = \begin{bmatrix} 1 & -1 & 3 \\ 0 & 4 & 2 \\ 7 & 1 & -5 \end{bmatrix}$.

c)   If $Z = \tan^{-1}xy$, then find Z_{xx}.

d)   Using $\in$ -definition prove that $\lim_{n \to \infty} \dfrac{1}{3^n} = 0$.

e)   Solve the differential equation

$(1 + y^2)\, dx + (1 + x^2)dy = 0$.

Q2) Attempt any four of the following: **[4 × 2½ = 10]**

a) Solve $x^3 + 1 = 0$.

b) Find rank of the matrix

$$\begin{bmatrix} 1 & 1 & 2 & 4 \\ 2 & 3 & -1 & 1 \\ 7 & 3 & 4 & 7 \end{bmatrix}.$$

c) Show that the vectors $\{(1, 1, 1), (0, 1, 1), (0, 1, -1)\}$ are linearly independent in $\mathbb{R}^3$.

d) Verify Cayley Hamilton theorem for the matrix $A = \begin{bmatrix} 1 & -1 \\ 2 & 4 \end{bmatrix}$.

e) Test the convergence of the series $\sum_{n=1}^{\infty} \left(\dfrac{n+1}{2n+5} \right)^n$.

f) Check for exactness and hence solve the following differential equation.
$(x^2 - 4xy - 2y^2)\, dx + (y^2 - 4xy - 2x^2)dy = 0.$

Q3) Attempt any two of the following: **[2 × 5 = 10]**

a) Solve the following system of linear equations.
$x + y + z = 4$
$x - y + 2z = 3$
$2x + 3y - z = 6$

b) Show that the following sequence is convergent
$$\sqrt{3}, \sqrt{3\sqrt{3}}, \sqrt{3\sqrt{3\sqrt{3}}}, \cdots$$

c) Find stationary points and examine for extreme values for the function $f(x, y) = 1 + x^2 - y^2$.

Q4) Attempt any one of the following: **[1 × 10 = 10]**

a) Find all eigen values and eigenvectors of the following matrix

$$A = \begin{bmatrix} 2 & 1 & 1 \\ 2 & 3 & 2 \\ 3 & 3 & 4 \end{bmatrix}.$$

b) i) Solve the following linear differential equation

$$(1+x^2)\frac{dy}{dx} + 2xy - 1 = 0$$

ii) If $u = \dfrac{x}{y} + \dfrac{y}{z} + \dfrac{z}{x}$, then prove that $xU_x + yU_y + zU_z = 0$.

SECTION - II

(Statistics)

Q5) Attempt the following: **[5 × 2 = 10]**

a) Define the term mode. State its formula for continuous distribution.

b) If A and B are independent events such that $P(A) = P(B) = 0.6$, then find $P(A^C \cap B^C)$.

c) Explain the term - positively correlated variables.

d) Compute variance if $n = 10$, $\Sigma x_i^2 = 100$, $\Sigma x_i = 30$.

e) Define standard error of statistic. State standarderror of $\overline{X}$. (sample mean).

Q6) Attempt any four: **[4 × 2½ = 10]**

a) It is known that 90% of the product manufactured is non-defective. Find the probability that in a sample of size 5, atleast three are nondefective.

b) Write a short note on scatler diagram.

c) For certain bivariate data of 10 pairs of observations $\Sigma x_i = 25, \Sigma y_i = 30, \Sigma x_i y_i = 90$, compute covariance and comment.

d) Find expected value and $P(X \leq 2)$ for the following probability distribution.

x_i: 1   2   3   4   5

p_i: K   2K   5K   3K   K

e) State three axioms of axiomatic approach of probability. And define conditional probability.

Q7) Attempt any two: **[2 × 5 = 10]**

a) At 5% level of significance can we say that following sample is selected from population with mean = 4.5

3.9, 5.6, 4.8, 4.0, 3.8

b) Explain the following terms with illustration.

    i)   Null hypothesis

    ii)   Standard error

c) Explain:

    i)   Central tendency

    ii)   Dispersion

    iii)   Kurtosis

    iv)   Skewness

    v)   Correlation

Q8) Attempt any one: **[1 × 10 = 10]**

a) Explain the term analysis of variance and explain the procedure for one way ANOVA.

b) i)   Write a short note on scatter diagram.   **[4]**

    ii)   Represent the following data using scatter diagram   **[6]**

        x_i: 45   46   47   48   49

        y_i: 68   74   73   76   80

        and comment.

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F.Y.B.Sc.

BIOTECHNOLOGY

Bb - 105: Fundamentals of Biological Chemistry

(2008 Pattern)

Time : 3 Hours]   *[Max. Marks :80*

Instructions to the candidates:

    1)   *All questions are compulsory.*

    2)   *Draw neat and labelled diagrams whenever necessary.*

    3)   *Figures to the right indicate full marks.*

Q1) Attempt all of the following: **[8x2=16]**

    a)   What is a nucleophile?

    b)   Explain the term saponification.

    c)   Fatty acid is an amphipathic molecule. Explain.

    d)   Define optical activity.

    e)   Explain what is dialysis?

    f)   Define active site of an enzyme.

    g)   What are prosthetic groups?

    h)   Define pH and pka.

Q2) Answer any four of the following: **[4x4=16]**

    a)   Explain electrophilic substitution reaction with suitable example.

    b)   Write a note on Allosteric enzymes.

    c)   Write a note on sphingolipid.

    d)   Write an account on structural polysaccharide.

    e)   Explain salting-in and salting out in protein purification.

Q3) Answer any four of the following: **[4x4=16]**

   a)   Describe secondary structure of proteins.

   b)   Explain any two chemical properties of amino acids.

   c)   Write a short note on paper chromatography.

   d)   Give the role of Niacin and Folic acid in biological reactions.

   e)   Explain the structure of t-RNA.

Q4) Answer any two of the following: **[2x8=16]**

   a)   Classify carbohydrates on basis of sugar units.

   b)   Give a brief account of Watson and Crick model of DNA.

   c)   Write a note on Electrophoresis.

Q5) Answer any two of the following: **[2x8=16]**

   a)   Give different functions of carbohydrates.

   b)   Describe determination of primary structure of proteins by Edman's method.

   c)   Explain physical and chemical properties of fatty acids.

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[4719]-6

F.Y.B.Sc.

BIOTECHNOLOGY

Bb - 106: Biophysics and Instrumentation

(2008 Pattern)

Time : 3 Hours]   *[Max. Marks :80*

Instructions to the candidates:

   1)   *All questions are compulsory.*

   2)   *Draw neat and labelled diagrams wherever necessary.*

   3)   *Figures to the right indicate full marks*

   4)   *Use of scientific calculator is allowed.*

Q1) Attempt the following: **[8x2=16]**

   a)   State Pauli's exclusion principle.

   b)   State Lambert's law.

   c)   Write Nernst equation & give it's application.

   d)   Give application radiowave and microwave.

   e)   What is thermister. Give it's types.

   f)   Enlist the types of centrifugation techniques.

   g)   Define Numerical Apperture.

   h)   Enlist any two hazardous effects of radioactive isotopes.

Q2) Attempt any four: **[4x4=16]**

   a)   The Resistance of platinum wire is 5Ω at $0°C$ & 6Ω at $100°C$. Calculate the temperature coefficient of resistance.

   b)   State and explain any four units used for radioactive dose.

   c)   Discuss electromagnetic spectrum in detail.

   d)   Explain energy level diagram of hydrogen atom.

   e)   Explain in brief any one instrument to measure biopotential.

Q3) Attempt any four: **[4x4=16]**

a) Write a note on compound microscope.

b) Explain in brief platinum resistance thermometer.

c) Describe Hertz experiment to demonstrate electromagnetic wave.

d) Explain hazardous effects of radiation on biological system.

e) Describe working principle and application of mass spectroscopy.

Q4) Attempt any two: **[2x8=16]**

a) Explain nuclear magnetic resonance (NMR) spectrometer in detail.

b) Write in detail construction and working principle of G.M. counter.

c) Explain in detail fluid mosaic model of cell membrane.

Q5) Attempt any one: **[16]**

a) Explain RIA with help of following points.

   i) Principle.

   ii) Mechanism.

   iii) Advantage and limitation.

   iv) Application.

b) i) Derive the relation of energy of an electron in Bohr's orbit.

   ii) Explain emission spectra of sodium atom.

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F.Y.B.Sc.
BIOTECHNOLOGY
Bb-107: Microbiology
(2008 Pattern) (Old)

Time : 3 Hours]   *[Max. Marks : 80*

Instructions to the candidates:
1) *All questions are compulsory.*
2) *All questions carry equal marks.*
3) *Figures to the right indicate full marks.*
4) *Neat and labelled diagrams must be drawn wherever necessary.*

Q1) Answer the following: [8×2 = 16]

    a)   Enlist any 4 general characteristics of fungi.

    b)   What is selective media? Give example.

    c)   Define stain. Give examples of basic stains.

    d)   Define coculture.

    e)   What is dry mount?

    f)   Give use of incubator in microbiology laboratory.

    g)   What is mean by biogenesis?

    h)   Enlist different patterns of margin in bacterial colony.

Q2) Attempt any 4:   [4×4 = 16]

    a)   Write in brief contribution of Anton Van Leewenhoek to microbiology.

    b)   Draw a neat labelled diagram of Typical prokaryotic cell.

c) Microbiological analysis of milk sample on nutrient agar gives following observations:

Volume of sample plated - 0.1 ml

Dilution of sample - 10^6

Number of colonies - 60

Calculate cfu/ml in sample.

d) What is differential staining give principle of monochrome staining.

e) Describe in brief Vesicular Arbuscular Mycorrhiza (VAM).

f) Classify bacteria on the basis of their temperature requirement for growth.

Q3) Attempt any four: **[4×4 = 16]**

a) Enlist different methods of preservation of microorganisms and explain any one in detail.

b) Explain in brief streak plate technique of puse culture.

c) Draw a neat labelled diagram of lytic cycle of bacteriophage.

d) What are the basic nutritional requirement of microorganisms.

e) Enlist different methods of enumeration of bacteria and explain any one in brief.

f) What is sterilization? Give mechanism of action of heavy metals as a disinfecting agent.

Q4) Attempt any two. **[2×8 = 16]**

a) Compare and contrast Gram positive and Gram negative bacteria.

b) With neat labelled diagram describe structure of bacterial cell membrane.

c) Justify: Biofilm is novel colony formation pattern.

Q5) Attempt any one. **[1×16 = 16]**

a) Explain in detail nutritional classification of bacteria.

b) Describe bacterial flagella with respect to

    i) Ultrastructure

    ii) Arrangement.

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F.Y.B.Sc.

BIOTECHNOLOGY

Bb-108: Use of Computers

(2008 Pattern)

Time : 3 Hours]   *[Max. Marks : 80*

Instructions to the candidates:

1) *All questions are compulsory.*
2) *Figures to the right indicate full marks.*
3) *Neat diagrams must be drawn wherever necessary.*

Q1) Attempt all of the following.   **[8×2 = 16]**

   a)   What is a super computer? Where it is used?

   b)   Define the following terms:

         i)   RAM

         ii)   PROM

   c)   Define operating system.

   d)   What are wild card characters? Give their use.

   e)   What is a computer worm?

   f)   Give advantages of computer networks.

   g)   What is WWW? Where it is used?

   h)   What are the Database languages?

Q2) Attempt any FOUR of the following: **[4×4 =16]**

   a)   What is a computer? Draw and explain the block diagram of a computer.

   b)   What are input devices? Explain working of mechanical mouse.

   c)   Give advantages of DBMS over file system.

   d)   What is a computer virus? How it propagates?

   e)   Explain different types of operating system.

Q3) Attempt any FOUR of the following: [4×4 = 16]

a) What is a topology? Explain Ring topology and star topology.

b) Explain the Mail-Merge feature in Ms-WORD.

c) Write a short note on:

i) Co-axial cable

ii) Fiber optic cable

d) Draw and state the use of various symbols used for E-R diagram.

e) What is an algorithm? Give its characteristics and give one example.

Q4) Attempt any TWO of the following: [2×8 = 16]

a) Give features of Ms-Excel. How a Pie-chart is drawn in Ms-Excel.

b) Write a short note on PubMed and Medline.

c) Explain various services provided by operating system.

Q5) Attempt the following: [2×8 = 16]

a) Write an algorithm and flow chart for finding a factorial of a given number.

OR

Write an algorithm and draw a flow chart for reversing a number.

b) Draw and state use of various flow chart symbols. Draw flow chart to test whether given character is a vowel or consonent.

OR

Explain booting process of DOS. Also explain any four DOS commands.

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