UNIVERSITY OF PUNE
[4362]-233
S. E. (Biotechnology)
Examination - 2013
Microbiology
(2008 Pattern)

Total No. of Questions : 12 **[Total No. of Printed Pages :2]**
[Time : 3 Hours] **[Max. Marks : 100]**

Instructions :

(1) Answer Q1 or Q2, Q3 OR Q4, Q5 OR Q6, Q7 OR Q8, Q9 OR Q10, Q11 OR Q12.
*(2) Answers to the **two sections** should be written in **separate answer-books**.*
(3) Neat diagrams must be drawn wherever necessary.

SECTION-1

Q1. Enumerate the growth requirement of bacteria. Describe in detail the method of anaerobic culture. [18]

OR

Q2. What are the similarities and differences between prokaryotic and eukaryotic cells? [18]

Q3. Answer the following: (8 marks each) [16]

1) What are the three domains of life?
2) Describe the construction and working of a Hot Air Oven.

OR

Q4. Answer the following: (8 marks each) [16]

1) Describe the important contribution of Antony Van leeuwenhoek.
2) Explain the structure of cell membrane.

Q5. Define each of these groups as what kind of carbon and energy source they utilize: Give examples. [16]

1) Phototrophs
2) Lithotrophs

3) Organotrophs
4) Hetetotrophs

OR

Q6. Answer the following: (8 marks each) [16]

1) Differentiate between macronutrients and micronutrients. How are they supplied to media?
2) Explain the typical bacterial growth curve.

Section-II

Q7. What is a bacteriophage? Draw a diagram of the T4 bacteriopahge an explain its life cycle. [18]

OR

Q8. Explain the Egg inoculation technique in virology. [18]

Q9. Answer the following: (8 marks each) [16]

1) What is food spoilage? Explain its causes.
2) Explain the symbiotic association found in soil microorganisms.

OR

Q10. Answer the following: (8 marks each) [16]

1) Write the causative agent of tuberculosis and explain the morphology of the organism.
2) List the characteristics common to all viruses.

Q11. Answer the following: (4 marks each) [16]

1) Drug resistance.
2) Lysogeny
3) Water borne illness
4) Anaerobic sewage treatment.

OR

Q12. Write in brief: (8 marks each) [16]

1) Foods for microorganisms
2) Techniques used for isolation of microorganisms from air.

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S. E. (Biotechnology) Examination

May 2013

Biochemistry-I

(2008 Course)

[Total No. of Questions: 12] **[Total No. of Printed Pages: 3]**

[Time: 3 Hours] **[Max. Marks: 100]**

Instructions:

*(1) Answer **three** questions from each section-I and three questions from section-II.*

*(2) Answers to the **two sections** should be written in **separate answer-books**.*

(3) Neat diagrams must be drawn wherever necessary.

(4) Figures to the right indicate full marks.

SECTION-I

Q. 1. Answer the following (18)

A) Write short notes on carbonate bicarbonate buffering system in blood.

B) Calculate the pKa of lactic acid, given that when the concentration

Of lactic acid is 0.010 M and the concentration of lactate is 0.087 M,

the pH is 4.80.

OR

Q. 2. Answer the following (18)

A) Draw a diagram showing the hierarchy of biomolecules and Organelles in the living cell.

B) Write a short note on storage polysaccharide

Q. 3. Answer the following

A) Draw a neat labeled diagram for a) Cori cycle b) TCA cycle (16)

OR

Q. 4. Describe the synthesis of starch. Explain the role nucleoside diphosphate sugars in the same. (16)

Q. 5. Write in short about (16)

A) Acid base properties of amino acid

B) Affinity and size exclusion chromatography

OR

Q. 6. Answer the following (16)

A) Draw the structures of peptide bone and explain its typical Characteristics

B) Draw a schematic for Urea cycle

SECTION-II

Q. 7. Answer the following (18)

A) Biosynthesis of sphingomyelin

B) Elongation of saturated fatty acids in mitochondria

OR

Q. 8. Answer the following (18)

A) What are ketone bodies? Explain the role of acetyl-CoA in the Formation of ketone bodies.

B) Write in detail about classification of lipids with suitable example

Q. 9. Write short notes on (16)

A) Nucleoside and nucleotide

B) Purines and pyrimidines

OR

Q. 10. Describe in detail about (16)

A) Hydrolysis of nucleic acid by enzymes

B) Nucleic acid and protein supramolecular complex

Q. 11. Write down the sources and functions of vitB_1,B_2,B_6,B_{12}, vit C (16)

OR

Q. 12. Answer the following (16)

A) Describe in detail about the function and deficiencies of fat soluble Vitamins

B) What are fibers? Describe the different types of dietary fibers and Give its application.

Total No. of Questions : 12 **[Total No. of Printed Pages :3]**

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S.E. (Biotechnology)

Examination - 2013

(2008 Pattern)

Biochemistry II(215465)

[Time: 3 Hours] **[Max. Marks: 100]**

Instructions:

1 *Answer 3 question from section I and 3 question from section II*

2 *Answers to the* ***two sections*** *should be written in* ***separate answer-books****.*

3 *Neat diagrams must be drawn wherever necessary.*

4 *Black figures to the right indicate full marks.*

Section I

Q1. Draw the structures and explain in detail about [18]

1. α-helix 2. β-Pleated sheet 3. Turns and loops

OR

Q2. Answer the following (9 marks each) [18]

1. Describe in detail about correlation between protein misfolding and neurological diseases with one example.
2. What is tertiary structure of protein? Explain it with suitable example.

Q3. Enlist the various steps involved in purification of protein. Give the brief account of each step. [16]

OR

Q4. Write a short note on: (8 marks each) [16]

1. Multienzyme complex
2. Naming and classification of enzyme.

Q5. Answer the following:

1. Draw the Linewaever-Burk plot for competitive, uncompetitive and non competitive inhibition of enzyme. Discuss about the kinetic parameters in all these type of inhibition. [12]
2. Significance of inhibition studies. [4]

OR

Q6. Describe in detail about (8 mark each) [16]

1. Pyruvate dehydrogenase complex.
2. Coenzyme A

Section II

Q7. Answer the following (9marks each) [18]

1. Draw a schematic representation of the hierarchical organization of endocrine regulation under the control of hypothalamus.
2. Describe in detail about seven transmembrane receptor.

OR

Q8. Answer the following:

1. Draw and Discuss the amplification cascade which triggers due to the binding of epinephrine molecule in the liver cell. [12]
2. Functions of parathyroid hormone. [6]

Q9. Answer the following:

1. Describe how the troponin and tropomyosine mediate the regulation of muscle contraction by calcium ion. [10]

2. Describe the ATPase activity of myosin. [6]

OR

Q10. Describe in detail about (8 marks each) [16]

1. Active and passive transport
2. Action potential

Q11. Answer the following: (8M each) [16]

1. Describe any two inborn errors of carbohydrate metabolism
2. Define the trems Dementia , Rickets, Osteomalacia, and Dermatits

OR

Q12. Write a short note on (8M each) [16]

1. Hyper and hypoglycemia
2. Water and electrolyte balance.

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S.E Engineering Examinations 2013

MATHAEMATICS – III

(2008 COURSE)

[Total No. of Question=12] **[Total no. of printed pages= 7]**

[Time : 3 Hours] **[Max. Marks : 100]**

Instructions :

(i) Attempt q. No. 1 or q. no2, Q. No. 2, Q. No. 3 or Q. No. 4, Q. No. 5 or Q. No. 6 from Section I and Q No. 7 or Q. No. 8, Q. No. 9 or Q. No. 10. Q. No. 11 or Q No. 12 from section II.

ii) Answer to the two Sections should be written in separate answer-books.

iii) Figures to the right indicates full marks.

iv) Use of electronic pocket calculator is allowed.

v) Assume suitable data, if necessary.

Q.1 a) Solve any three [12]

1) $(D^2+3D+2)y = sine^x$

2) $(D^2+2D+1)y = 2cosx+3x+2+3e^x$

3) $(D^4 - 1)y = coshx$ Sinhx

4) $(1+x)^2 \frac{d^2y}{dx^2} + (1+x)\frac{dy}{dx} + y = 4\cos[\log(1+x)]$

5) $(D^2 - 4D + 4)y = e^{2x}sec^2x$ (by method of variation of parameter.)

b) Solve

$$\frac{dx}{x^2-y^2-z^2} = \frac{dy}{2xy} = \frac{dz}{2xZ}$$ [5]

Q. 2 a) Solve any three [12]

1) $\frac{d^2y}{dx^2} - \frac{dy}{dx} - 2y = 2logx + \frac{1}{x} + \frac{1}{x^2}$

2) $\frac{d^2y}{dx^2} - y = \frac{2}{1+e^x}$

3) $\frac{d^2y}{dx^2} + 4y = x \sin x$

4) $(D^2 - 4D + 4)y = e^x cos^2 x$

5) $x^2 \frac{d^2y}{dx^2} - 2x\frac{dy}{dx} - 4y = x^2 + 2\log x$

Q.2 b) Solve [5]

$\frac{dx}{dt} + y = e^t$

$-\frac{dy}{dt} + x = \bar{e}^t$

Q. 3 a) A body weighing 4.9 is hung from a spring. A pull of 10 N will stretch the spring to 5 cm. The body is pulled down 6 cm below the static equilibrium position and then released. Find the displacement of the body from its equilibrium position in time 't' seconds, the maximum velocity and period of oscillation [8]

b) A string is stretched and fastened to two points 'λ' apart. Motion is started by displacing the string in the from u= a sin $\frac{\pi x}{\lambda}$ from which it is released at time t=0^{λ}. Find the displacement u(x, t) from one end. [8]

OR

Q.4 a) In a heat exchange the temperatures x and y of two liquids satisfy the equations

$$\frac{dx}{dt} + 5x - 2y = t$$

$$\frac{dy}{dt} + 2x + y = 0$$

Find the temperatures x & y as a function of time, given that x=0 and y=0 at time t = 0

b) Solve the equation $\frac{\partial u}{\partial t} = a^2 \frac{\partial^2 u}{\partial x^2}$ [8]

Where u(x, t) satisfies the following conditions

i) u (0,t) = 0
ii) u (λ, t) = 0 $\forall\, t$
iii) u (x, 0) = x in $0 < x < \lambda$
iv) u(x, ∞) is finite

Q.5 a) Find the Fourier transform of [7]

$$f(x) = \begin{cases} 1 - x^2, & 1x1 \leq 1 \\ 0, & 1x1 > 1 \end{cases}$$

and hence evaluate

$$\int_0^\infty \left(\frac{xcosx - sinx}{x^3}\right) \frac{cos3x}{2}\, dx$$

b) Show that the Fourier transform of f(x) = $e^{-x^2/2}$ is $\bar{e}^{\lambda 2/2}$ [5]

c) Solve the integral equation [5]

$$\int_0^\infty f(x) sin\ \lambda\, x\, dx = \begin{cases} 1, & 0 \leq \lambda < 1 \\ 2, & 1 \leq \lambda < 2 \\ 0, & \lambda \geq 2 \end{cases}$$

OR

Q.6 a) Using Fourier integral equation show that [7]

$$\int_0^{\infty} \frac{cos\lambda x + \lambda sin\lambda x}{1+\lambda^2} d\lambda = \begin{cases} 0, & x < 0 \\ \pi/2\ , & x = 0 \\ \pi\bar{e}^{x}, & x > 0 \end{cases}$$

b) Find the Fourier sine transform of [5]

$$\frac{e^{-ax}}{x}$$

C) Find Fourier integral representation of [5]

$$f(x) = \begin{cases} \frac{\pi}{2} cosx\ , & |x| \leq \pi \\ 0, & |x| > \pi \end{cases}$$

Section-II

Q.7 a) Obtain Laplace transform of (any three): [12]

i) $\frac{\bar{e}^{at} - \bar{e}^{bt}}{t}$

ii) $e^{-4t} \int_0^t t \sin 3t \, dt$

iii) $(1+ 2t - 3t^2 + 4t^3)$ U (t-2)

iv) $\int_0^t erf\sqrt{u} \, du$

b) Using Laplace transform, evaluate: [4]

$$\int_0^\infty t^2 \, \bar{e}^t sint \, dt$$

OR

Q.8 a) Obtain inverse Laplace transform of (any three): [12]

i) $\frac{s}{(s^2+a^2)^2}$

ii) $\frac{1}{s}\log(\frac{s^2+a^2}{s^2+b^2})$

ii) $\frac{2s^2-6s+5}{s^3-6s^2+11s-6}$

iv) $\frac{\bar{e}^{3s}}{s^2+8s+25}$

Q.8 b) Find the Laplace transform of the periodic function: [4]

$$f(t) = \begin{cases} t, & 0 < t < \pi \\ \pi - t, & \pi < t < 2\pi \end{cases}$$

and $f(t+2\pi) = f(t)$

Q.9 a) Find the directional derivative of [5]

$\emptyset = 4 \text{ x } z^3 - 3x^2y^2z \; at \; (2,-1,2)$ along tangent to the curve $x=e^t \cos t$,

$y = e^t \sin t$, $z = e^t$ at $t = 0$

b) If the vector field [6]

$\bar{F} = (x + 2y + z)\,\bar{\imath} + (bx - 3y - z)\,\bar{\jmath} + (4x + cy + 2z)\,\bar{k}$ is irrotational, find a, b, c and determine $\emptyset$ such that $\bar{F} = \nabla\emptyset$.

c) Evaluate $\iint_S (\nabla \text{ X } \bar{F}).\overline{ds}$, where $\bar{F} = (x^3 - y^3)\,\bar{\imath} - xyz\,\bar{\jmath} + y^3\,\bar{k}$ and S is the [6] surface $x^2 + 4y^2 + z^2 - 2x = 4$ above the Y0z - plane.

OR

Q.10 a) Evaluate $\iint_S \frac{x\bar{\imath}+y\bar{\jmath}+z\bar{k}}{r^2} . \overline{ds}$ Where S is the surface of the sphere [6]

$x^2 + y^2 + z^2 = a^2$

b) With usual notations prove that (any two) **[6]**

i) $\nabla^4 (r^2 \log r) = \frac{6}{r^2}$

ii) $\nabla.\left[r \nabla \frac{1}{r^n}\right] = \frac{n(n-2)}{r^{n+1}}$

iii) $\nabla \text{ X } \left[\frac{\bar{a} \text{ X } \bar{r}}{r^3}\right] = \frac{3(\bar{a}.\bar{r})}{r^5}\bar{r} - \frac{\bar{a}}{r^3}$

C) Find the work done by the force

$\bar{F} = (x^2 - yz)\bar{\imath} + (y^2 - zx)\bar{\jmath} + (z^2 - xy)\,\bar{k}$ in taking a particle from

(1,1,1) to (3, -5,7) [5]

Q.11 a) Solve $\frac{dy}{dt} + 2y(t) + \int_0^t y(t)dt = sint$, given y(0) =1 using Laplace [5] transform.

Q.11 b) The transfer function of a second order system is given as [6]

G(s) = $\frac{6}{s^2+1.8s+1}$. Determine its properties such as overshoot, period of oscillation and $y(t)_{max.}$

C) Find the equations of stream line passing through the point (1,1,2) in case of steady motion of fluid defined by : $\bar{q} = -x\bar{\imath} + 2y\bar{\jmath} + (3 - z)\bar{k}$. [6]

OR

Q.12 a) Using the Laplace transform, solve the D.E. [5]

$y''+2y'+y = 6te^t$; y(0) =2, y′(0) =5.

b) Find the surface of equipressure in case of steady motion of a liquid which has velocity potential [6]

Ø = xy + yz + zx and is under the action of force

$\bar{F} = (mz + ny)\bar{\imath} + (nx + lz)\bar{\jmath} + (ly + mx)\bar{k}$

c) Is the motion represented by $(x^2-yz)\bar{\imath} + (y^2 - zx)\bar{\jmath} + (z^2 - xy)\bar{k}$ [6] irrotational? If so, find the corresponding velocity potential.

UNIVERSITY OF PUNE

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S. E. (Biotechnology) Examination-2013

APPLIED CHEMISTRY

(2008 Pattern)

[Time: 3 Hours] **[Max. Marks : 100]**

Total No. of Questions : 12 **[Total No. of Printed Pages :5]**

Instructions :

*(1) Answer **only three** questions from each section.*

*(2) Answers to the **two sections** should be written in **separate answer-books**.*

(3) Black figures to the right indicate full marks.

(4) Neat diagrams must be drawn wherever necessary.

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

(6) Assume suitable data, if necessary.

Q1) a) Define Carbanion ion. Give its two methods of generations and explain its Stability with geometry. [06]

b) Draw the resonance structures of : [06]

i) Benzene ii) Anthracene iii) Phenoxide ion & iv) Benzaldehyde

c) Justify following : (Two marks each) [06]

i) Pyrrole is a weaker base than Pyridine.

ii) Order of Basic strength of aliphatic amines is $2^0 > 1^0 > 3^0$

iii) Phenols are more acidic than alcohol.

OR

Q2) a) Explain Tautomerism and Hyperconjuction with suitable example. [06]

b) Define and explain Inductive effect and mesomeric effect with suitable example. [06]

c) Classify the following compounds as Aromatic, Non-aromatic & Antiaromatic : [06]

i) Pyridine ii) Annulene [14] iii) Anthracene iv) Cycobutadiene

v) Tropylium ion vi) Cyclopentadienyl anion

Q3) a) Discuss the factors affecting rate of SN^1 and SN^2 reaction. [06]

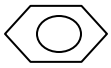
b) Predict the product : (01) Mark each) [06]

i) $CH_3\text{-}\underset{\underset{Br}{|}}{CH}\text{-}CH_2\text{-}CH_3 \xrightarrow[CH_3OH]{KOH}$? (Major comp)

ii) $CH_3 - \overset{\overset{CH_3}{|}}{C} = CH_2 \xrightarrow[H_2SO_4]{Hydration\ by\ conc}$?

iii) $CH_3\text{-}CH{=}CH_2 \xrightarrow{HB_r}$?

iv) $2\ CH_3\text{-}\overset{\overset{O}{\|}}{C}\text{-}O\text{-}C_2H_5 \xrightarrow[EtOH]{NaOH}$?

v)  $+ CH_3 - \overset{\overset{O}{\|}}{C} - Cl \xrightarrow[AlCl_3]{Anhydrous}$?

vi) $2\ CH_3 - \overset{\overset{O}{\|}}{C} - O^-K^+ \xrightarrow{Electrolyis}$? (on anode)

c) Write is the mechanism of conversion of acetophenone into acetanilide. [04]

OR

Q4) a) What is the action of Methyl Magnesium Bromide on Methanal, Ethanal and Propanone followed by hydrolysis ? [06]

b) Explain conversion of : [06]

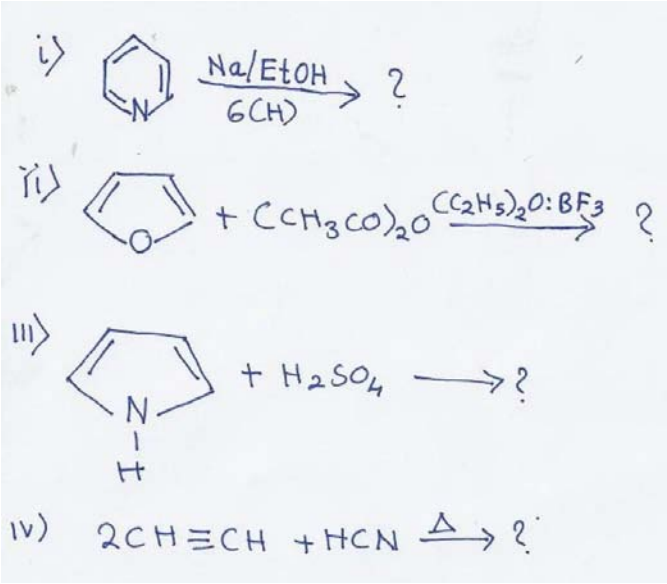
a) Benzene into Tolene & b) Benzene into Acetophenone

c) Write a note on E2 mechanism. [04]

Q5) a) Define conformational isomerism and explain it with suitable example. [06]

b) Write one reaction each of preparation of pyridine, Thiophene and furan. [06]

c) Predict the product : (One Mark each) [04]

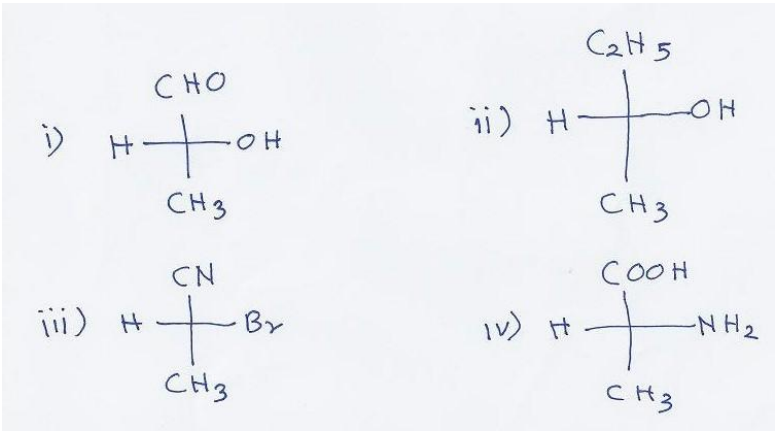


OR

Q6) a) Define Optical isomerism and Explain its causes with suitable examples. [06]

b) Write Fisher's Indole synthesis. [06]

c) Assign R and S configuration of the following: (One Mark each) [04]



Q7) a) What is Bragg's equation? Explain rotating crystal method for measuring Bragg's angle. [07]

b) Define surface tension and explain capillary rise method for the determination of surface tension. [07]

c) The diffraction of a crystal of Barium with X-rays ($\lambda = 2.42\ A^0$) gives second order reflection at $38.\ 5^0$. Calculate inter planar distance. [04]

OR

Q8) a) Derive Poiseuille's equation. [07]

b) Explain any one method of determination of vapour pressures liquids. [07]

c) AT 303^0 K surface tension of ethanol in contact with its vapour is 2.189×10^{-2} N/m and its density is 0.740 g/cc. How far up the liquid will rise in a tube of internal radius 0.5 mm [04]

Q9) a) Give the postulates of kinetic theory of gases. [06]

b) State and explain Van der Waals equation. [06]

c) Calculate the critical temperature (T_c) of a Van der Waals gas for which critical pressure is 80 atm and b is 40 cm^3 mol^{-1}. (R = 0.08206 atm lit k^{-1} mol^{-1}) [04]

OR

Q10) a) Derive kinetic gas equation. [06]

b) Define i) average velocity. ii) root mean square velocity, iii) most probable velocity and explain relation between them. [06]

c) calculate the pressure of 0.40 mole of NH_3 gas in a 2 dm^2 vessel at 25^0C using ideal gas equation. [04]

Q11) a) With the help of a diagram explain Landsberger's method to determine elevation in boiling point. [06]

b) Explain depression in freezing point is a colligative property. [06]

c) Find molal boiling point of elevation constant for water, if heat of vaporization at boiling point is 2000 J/g. (R=8.314 J) [04]

OR

Q12) a) Explain abnormal colligative properties of solution. [06]

b) Define osmotic pressure and explain measurement of osmotic pressure by using Barkley-Hartley apparatus. [06]

c) Calculate vapour pressure of solution containing 2 g of cane sugar ($Cl_2H_{22}O_{11}$) in 60 g of water at 100^0 C. [04]

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UNIVERSITY OF PUNE
[4362-232]
S.E. (Biotechnology) Examination-2013
Fluid Flow and Unit operations
(2008 pattern)

Time-Three hours **Maximum Marks-100**
Total No. of Question=12 **[Total no. of printed pages= 4]**
Instructions:

(1)Answer 3 questions from Section-I. Answer question 3 from Section-II,
(2)Answers to the two sections should be written in separate answer books.
(3)Neat diagrams must be drawn whenever necessary.
(4)Figures to the right indicate full marks.
(5)Assume suitable data wherever necessary.
(6)Use of calculator is allowed.

SECTION-I

Q.1

(a)Define the following terms along with their units. (3)
(i)Density
(ii)Pressure
(iii)Viscosity

(b)Find the kinematic viscosity of an oil having density of $981\,kg/m^3$ .The shear stress at a point in oil is $0.245\,N/m^2$ and the velocity gradient at that point is 0.2 per sec. (4)

(c)A 30 cm diameter pipe conveying water into two pipes of diameters 20 cm and 15 cm respectively. If the average velocity in the 30 cm diameter pipe is 2.5 m/n,find the flow rate in pipe. Also determine the velocity in the 15 cm diameter pipe if the average velocity in 20 cm diameter pipe is 2m/s. (5)

(d)Differentiate between laminar and turbulent flow. (4)

OR

Q.2

(a)Derive the Bernoulli's equation without friction. State the assumptions made. (8)

(b)A horizontal venturimeter with inlet and throat diameters 30 cm and 15 cm respectively is used measure the flow of water.The reading of the differential

manometer connected to the inlet and the throat is 20 cm of mercury
. Determine the rate of flow. Take coefficient of venturimeter as 0.98. (4)

(c)State and explain Newton's law of viscosity. (4)

Q.3

(a)Derive the Hagen Poiseuille equation for laminar flow in circular pipes. (10)
(b)Describe the different types of energy losses taking place during the flow of fluid through a pipe. (6)

OR

Q.4

(a)Define roughness classify the different types of surface based on roughness.(8)
(b)A sudden contraction is introduced in a horizontal pipe line from 50 cm to 25cm.The pressure changes from $103005\,N/m^2$ to $67689\,N/m^2$ .Calculate the rate of flow. Take coefficient of contraction loss is 0.3.If there is a sudden enlargement from 25 cm to 50 cm and if the pressure at the 25 cm section is $67689\,N/m^2$,what will be the pressure at the 50cm enlarged section? (8)

Q.5

(a)What is swirling and how can it be avoided? (6)

(b)What are radial and axial flow impellers?Differentiate between them. (6)

(c)Discuss in brief the construction and working of a Banbury mixer. (6)

OR

Q.6

(a)A disc turbine with six flat blades is installed centrally in a vertical baffled tank 2m in diameter. The turbine is 0.67 m in diameter and is positioned 0.67 m above the bottom of the tank. The tank is filled up to a depth of 2m with solution having a viscosity of 12cp and density of $1500\,kg/m^2$ .The turbine impeller turns at 90 rev/min. What power will be required?
$N_p = 5.8$ For disc turbine. (6)

(b)Write a note on the following: (6)
(i)NPSH
(ii)Standard turbine design

(c)Explain the principle,construction and working of a sigma blade mixer. (6)

SECTION-II

Q.7

(a)Derive the Stoke's law for a spherical object of diameter 'd' falling freely in a liquid density 'p' and viscosity 'μ' .State the assumptions made. (8)

(b)What will be the setting velocity of a spherical particle 10mm diameter in an oil of specific gravity 0.82 and viscotiy 6 Pas?The specific gravity of the sphere is 7.87. (5)

(c)What is the batch sedimentation test?Explain the different zones in this test.(5)

OR

Q.8

(a)State the Kynch's theory of sedimentation along with its assumptions. (6)

(b)What is the free and hindered settling velocity?Which of these two is greater? (6)

(c)Describe in detail the working of a cyclone. (6)

Q.9

(a)What is fluidization?What are its salient characteristic? (6)

(b)Explain the different industrial applications of fluidized bed system. (4)

(c)Enlist the characteristics of good filter medium. (4)

OR

Q.10

(a)Write a notes on the following: (16)

(i)Minimum fluidization velocity
(ii)Spouted beds
(iii)Filter cake
(iv)Rotary drum filter

Q.11

(a)State and explain the Kick's law communication. (6)

(b)A ball mill has a diameter of 400mm and the diameter of the balls used for crushing is 40mm.Calculate the critical speed for this ball mill. Also calculate the operating speed if it is 50% of the critical speed. (6)

(c)Differentiate between: (4)

(i)Open circuit and closed circuit grinding

(ii)Ideal screen and actual screen.

OR

Q.12

(a)What is meant by screen effectiveness?What are the factors which reduce the screen effectiveness? (5)

(b)Calculate the power required to crush $150\times10^{3}kg$ of feed passes through 2.5 inches screen screen and 80% of the product passes through 1/8 inch screen. $(K_b=4.784)$. (5)

(c)Derive the expression for calculating the screen efficiency. (6)

[Total No. of Questions: *12*] **[Total No. of Printed Pages:** *8*]

UNIVERSITY OF PUNE
[4362]-236
S. E. (Biotechnology) Examination - 2013
Material Balances And Stoichiometry
(2008 Pattern)(215466)

[Time: *3* **Hours]** **[Max. Marks: 100]**

Instructions:

1 ***Answer*** *three questions from section I and three questions from section II.*

2 *Answers to the* ***two sections*** *should be written in* ***separate answer-books****.*

3 *Assume suitable data, if necessary.*

4 *Use of electronics pocket calculator is allowed.*

5 *Black figures to the right indicate full marks.*

SECTION -I

Q.1 A Find the molar mass of (i) $CaCO_3$(ii)NH_4NO_3 [2]

B Make the following conversions: [10]

i)200g/L NaOH to Molarity (M)

ii)200g/L NaOH to Normality(N)

iii)2N $H_2SO_4$to g/L

iv)3M $K_2SO_4$to g/L

v)2.4 mg/ ML $CaCl_2$ to normality(N)

C Find the mass% and mole % composition of mixture containing 10 g $NaNO_3$, 21 g glucose, 2g NaCl, 1g NH_4Cl and 2.5 g K_2HPO_4.(Mixture contains no water) [6]

OR

Q.2 A The analysis of magnesite ore obtained from Chalk Hill area, Salem district yields 81% $MgCO_3$, 14% SiO_2 and [4]

5% H_2O (by mass). Convert the analysis into mole%.

B Find the specific gravity of the gas mixture if the gas contains (by volume) methane - 45%, ethane - 10% ethylene - 25% propane - 7%, propylene - 8% and n-butane - 5%. [6]

C Available nitrogen in an urea sample is found to be 45% by weight. Find the actual urea content in the sample. [4]

D A sample of light diesel oil (LDO) from a refinery is found to contain 0.68 mass% sulphur (asS.) Its density is 0.85 kg/ L at 303.15 K (30°C). Convert this impurity into ppm. [4]

Q.3 A Dry neem leaves were subjected to extraction. Dry leaves are analyzed to contain 0.46% $\propto$ - tocopherol and 0.0% β-carotene. Extract is found to contain 15.5% $\propto$-tocopherol and 0.41% β-carotene. All percentages are by mass. If β-carotene content of the leached residue is nil, calculate(i) the mass of extract phase per kg of dry leaves and (ii) % recovery of $\propto$- tocopherol. [6]

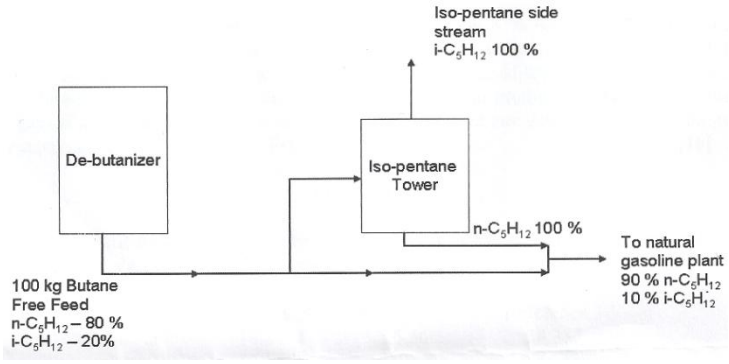
B A quadruple effect evaporator system concentrates thin liquor containing 5% solids to produce thick liquor containing 50% solids (by wt). Calculate the evaporation of water per 100 kg of feed in the evaporator. [6]

C What is degrees of freedom? Explain underdefined and overdefined system. [4]

OR

Q. 4 A In the feedstock preparation section of a pilot plant manufacturing natural gasoline, isopentane is removed 10

from butane-free gasoline. Assume for purposes of simplification that the process and components are as shown in following Figure. What fraction of the butane-free gaoline is passed through the isopentane tower? The process is in steady state and on reaction occurs.



B A coal sample is found to contain 67.2% carbon and 22.3% ash (mass basis). The refuse obtained at the end of combustion is analyzed to contain 7.1% carbon and the rest ash. Compute the % of the original carbon remaining unbrunt in the refuse. [6]

Q. 5 A Monochloroacetic acid (MCA) is manufactured in a semibatch reactor by the action of glacial acetic acid with chlorine gas at 373 K(100°C) in the presence of PCI_3 catalyst. MCA thus formed will further react with chlorine to form dichloroacetic acid (DCA). To prevent the formation of DCA, excess acetic acid is used. A small scale unit which produces 5000 kg/d MCA, requires 4536 kg/d of chlorine gas. Also, 263 kg/d of DCA is separated in the crystallizer to get almost pure MCA product. Find the % conversion,% yield of MCA and selectivity. [10]

($CH_3COOH + Cl_2 \longrightarrow CH_2ClCOOH + HCl$

$CH_2ClCOOH + Cl_2 \longrightarrow CHCl_2COOH + HCl$)

B In a fermentation process 13 g of biomass is produced from 29g of substrate (carbon source). During this process 22 g of Oxygen is consumed. Find the biomass yields $Y_{X/S}$ and $Y_{X/O2}$. Comment on the yield coefficients. [6]

OR

Q. 6 A Define yield, selectivity and conversion with suitable example. [6]

B In manufacturing soda ash the wet sodium bicarbonate is dried and calcined in a single stage: [10]

$2NaHCO_3 \longrightarrow Na_2CO_3 + CO_2 + H_2O$

In an experimental investigation wet $NaHCO_3$ containing 8% water is pre-mixed with dry soda ash (Na_2CO_3, 0% water) so as to reduce the water content to 4% before introducing into the calciner. The calciner is fed with 100 kg of wet bicarbonate per hour. Calculate i) kg of soda ash produced per hour as the final product ii) the total quantity of the off gases (containing CO_2 and H_2O only) produced per hour, iii) kg of soda ash recycled per hour iv) the mol ratio CO_2/H_2O in the off gas

SECTION II

Q. 7 A Pure methane is heated from 303 K (30°C) to 523 K (250°C) at atmospheric pressure. Calculate the heat added per kmol methane using following data. [9]

	Reference 1	Reference 2	Reference 3
a	19.2494	25.36	38.387
$bx10^3$	52.1135	16.868	-73.6639
$cx10^6$	11.973	71.312	290.981
$dx10^9$	-11.3173	40.837	-263.849
$ex10^{12}$			80.0679

B Calculate the standard heat of reaction of the following: [4]

$CO+H_2O\ (g) \longrightarrow CO_2 + H_2$

Data:

Standard heat of formation of CO= -110.6kJ

Standard heat of formation of H_2O=-242Kj

Standard heat of formation of CO_2= -394Kj

Standard heat of formation of H_2=0

C Define i) latent heat of fusion ii) latent heat of vaporization [3]

OR

Q. 8 A The heat absorbed when $Na_2CO_3.\ 10H_2O$ is dissolved isothermally at 291.15 K (18°C) in a large quantity of water is 67.91 kJ per mol solute. Calculate the heat of crystallization of 1 kg $Na_2CO_3.10H_2O$. [5]

B The endothermic heat of mixing n-amyl alcohol[pentanol-1, $C_2H_5(CH_2)_2CH_2OH$] and benzene (C_6H_6) to form a solution containing 47.3 mole % benzene is 896 kJ/ mol solution at 293 K (20°C). Calculate the integral heat of solution of n-amyl alcohol and of benzene at this concentration. [5]

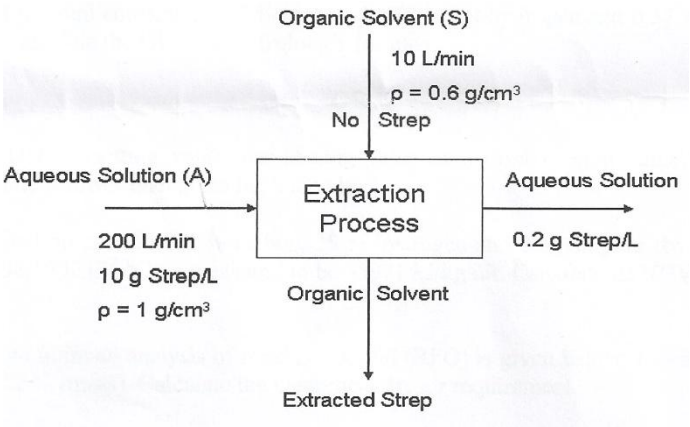
C When 0.5 kg of caustic soda is dissolved to form a 25 per cent solution 100 Joule are evolved. The specific [6]

heat to the 25 per cent solution is 0.84. Calculate the number of kg of solution, heat evolved per kg of solution and the rise in temperature of the solution neglecting radiation loss.

Q. 9 A Streptomycin is used as an antibiotic to fight bacterial diseases, and is produced by the fermentation of a bacterium in a biological reactor with a nutrient of glucose and amino acids. After the fermentation process, streptomycin is recovered by contacting the fermentation broth with an organic solvent in an extraction process. The extraction process is able to recover the streptomycin because Streptomycin has a greater a affinity for dissolving in the organic solution than in the aqueous solution. Following figure shows the overall process. [10]

Determine the mass fraction of Streptomycin in the exit organic solvent assuming that no water exits with the solvent and no solvent exits with the aqueous solution.

Assume that the density of the aqueous solution is 1 g/cm^3 and the density of the organic solvent is 0.6 g/cm^3



B A wet organic pigment contanining 35 wt% CCl_4 is to be dried to 5 wt % the drier is to operate adiabatically with a fresh plus recycle air at 100°C and 1.013 bar pressure having CCl_4 dew point of 15°C and discharging air with a dew point of 25°C. The capacity of the drier should be 200 kg of 'bone-dry' solid per hour. Calculate the kg of fresh air to be supplied/h. [8]

OR

Q. 10 A An absorption tower, packed with Tellerette packings is used to absorb carbon dioxide in an aqueous monoethanol amine (MEA) solution. The volumetric flow rate of the incoming dry gas mixture is 1000m^3/h at 318 K (45°C) and 101.3 kPa a (760 torr). The CO_2 content of the gas is 10.4 mole%, while the outgoing gas mixture contains 4.5 mole % CO_2 A 3.2 M MEA solution is introduced at the top of the tower at the rate of 0.625 L/s. Dissolved CO_2 concentration of the entering solution is 0.166 kmol/kmol of MEA. Find the concentration of dissolved CO_2 in the solution leaving the tower. [10]

B A distillation column separates a feed mixture containing 30 mol% benzene, 50 mol% toluene and 20mol% xylene into an overhead containing 95mol% bezene,4 mol% toluene and 1 mol% xylene and a bottom product containing 2mol% benzene, The reflux ratio (recycle to final product) is 2.5. On the basis of 1000 mol of feed/h, calculate masses of the top and the bottom products. [8]

Q. 11	A	Explain two different analyses of coal.	[6]
	B	Residual fuel oil is used in a boiler house. The flue gases from the chimney gives CO_2- 11.4%, O_2 – 4.2 % and N_2 – 84.4 % (mole%). Assuming that complete combustion has taken place calculate i) %excess air ii) C/H ratio in the fuel.	[6]
	C	If the coal contains 50.22% carbon, 0.535% net hydrogen and 0.37% Sulphur, (by mass) calculate the GCV using Dulong's formula	[4]

OR

Q. 12	A	Define heating value, net heating value and gross heating value? Why net heating value is lower than gross heating value?	[6]
	B	Fuel oil contains 73% carbon, 25% hydrogen and 2% Sulphur (by mass). Its NCV at 298.15 K(25°C) is measured to be 35071 Kj/kg oil. Calculate its NCV at 298.15 K (25°C).	[6]
	C	The ultimate analysis of residual fuel oil (RFO) is given below: C-88.4% H-9.4%, S-2.2% (mass). Calculate the theoretical dry air requirement.	[4]

University of Pune
S.E. (Biotechnology)
4362-237
Examination - 2013
Cell Biology and Tissue Culture
(2008 Pattern)

Total No. of Questions : 12 **[Total No. of Printed Pages :2]**

[Time : 3 Hours] **[Max. Marks : 100]**

Instructions :

*(1) Answer **03 question from each section.***
*(2) Answers to the **two sections** should be written in **separate answer-books**.*
(3) Figures to the right indicate full marks.
(4) Neat diagrams must be drawn whenever necessary.

Section I

Q1. With the help of neat labeled diagram explain the structure of eukaryotic cell. Discuss the cell organelle involved in bioenergetics and metabolism of eukaryotic cells? [18]

OR

Q2. Describe the structure and functions of different components of cytoskeleton? Add a note on structure and function of Endoplasmic reticulum? [18]

Q3. Explain in details receptor mediated Endocytosis and its role in lysosome formation? [16]

OR

Q4. Describe the different mechanisms involved in transport of molecules across the plasma membrane. How can glucose be transported against its concentration gradient without the energy derived from ATP hydrolysis in intestinal epithelial cells? [16]

Q5. With the help of neat labeled diagram describe the structure of ECM. Add a note on cell –cell interaction and cell-ECM interaction? [16]

OR

Q6. Write short notes on: (8 marks each) [16]

a) Different types of cell signaling molecules.

B) Cell surface receptors.

Section II

Q7. Describe the cell cycle and briefly explain the division of somatic cell. Add a note on how it is different than division of Germ cells? [18]

OR

Q8. Answer the following: (9 marks each) [18]

A) What are the different checkpoint in the cell cycle? Describe the role of cyclin and Cdk'S in cell cycle?

B) Explain the major transformation in the cell when it develops into cancer. Enlist the causes for these transformations?

Q9. With the help of labeled diagram explain the structure of Nerve cells. Add a note on transmission of impulse through synapse? [16]

OR

Q10. Write short notes on: (4 marks each) [16]

a) Fluid connective tissue.

b) Hematopoiesis.

c) Different types of epithelial tissue.

d) Tissue forming the endoskeleton of vertebrate body.

Q11. Answer the following: (8 marks each) [16]

A) Enlist the different parameters which are used to characterized the cell lines. Explain any two in detail.

B) Discuss the different steps involved in somatic hybridization technique. Add a note on its advantages and limitations?

OR

Q12. Write notes on: (4 marks each) [16]

a) Cryopreservation of cell lines.

b) Role of serum in media formulation.

c) Sub culturing of cells

d) Applications of plant tissue culture.

[Total No. of Questions: *12*] **[Total No. of Printed Pages:** *4*]

UNIVERSITY OF PUNE
[4362]-238
S. E. (*Biotechnology*) Examination - 2013
(Thermodynamics)(2008 Course)

[Time: *3* **Hours]** **[Max. Marks: 100]**

Instructions:

1. ***Answer three*** *questions from* ***section I*** *and* ***three*** *questions from* ***section II***.
2. *Answers to the* ***two sections*** *should be written in* ***separate answer-books***.
3. *Neat diagrams must be drawn wherever necessary.*
4. *Assume suitable data, if necessary.*
5. *Use of programmable pocket calculator is allowed*
6. *Black figures to the right indicate* ***full marks***.

SECTION -I

Q.1 A Define the following terms giving suitable examples: 6
- i. State function
- ii. Thermodynamic equilibrium
- iii. Heat engine

B A system undergoes a process 1-2 during which 50 KJ of energy is added as heat while it does 30 KJ of work. Then the system follows the process 2-3 during which 40 KJ is rejected as heat while 50KJ work is done on it. Then the system returns to the initial state by an adiabatic process. Calculate the net work done by the system. 6

C A steam engine operates between 400 K and 300 K at high pressure. What is the minimum amount of heat that must be withdrawn from the hot reservoir to obtain 1000 J of work? 6

OR

Q.2 A It is required to maintain a large cold storage at 10℃ while the ambient temperature is 40℃. The energy losses as heat from the walls of the cold storage are estimated at 10KJ/s per degree Celsius difference between the ambient and the cold space. Determine the minimum power required to maintain the cold 6

storage at 10°C.

B Explain in brief the Carnot's theorems. How is the efficiency of a Carnot's engine calculated? 6

C Explain in brief the Clausius statement of the second law of thermodynamics. 6

Q.3 A Derive an expression to show the temperature dependence of the heat of reaction. 8

B Compute the standard heat of formation of methane using the following data: 8

$CH_4(g) + 2O_2(g) \longrightarrow CO_2(g)+2H_2O(l)$; $\Delta H°_{298K}$=-890.35KJ

$H_2(g)+1/2\ O_2(g) \longrightarrow H_2O(l)$; $\Delta H°_{298K}$ =-285.84KJ

$C(graphite)+O_2(g) \longrightarrow CO_2(g)$ $\Delta H°_{298K}$ =-393.51KJ

OR

Q.4 A Explain in brief the following terms: 8

i. Standard heat of formation
ii. Sensible heat effects
iii. Latent heat effects
iv. Hess's law

B Using Hess's law, calculate the heat of formation of chloroform ($CHCl_3$) with the following given data:- 8

$CHCl_3(g) +1/2\ O_2(g) + H_2O \longrightarrow CO_2(g)+3HCl(g)$;	$\Delta H°_{298}$=-509.93KJ
$H_2(g) +1/2\ O2(g) \longrightarrow H_2O(l)$;	$\Delta H°_{298}$ =-296.03KJ
$C(s)+O_2(g) \longrightarrow CO_2(g)$	$\Delta H°_{298}$ =-393.78KJ
$½\ H_2(g)+ ½\ Cl_2(g) \longrightarrow HCl(g)$;	$\Delta H°_{298}$ =-167.57KJ

Q.5 A Distinguish between molar volume and partial molar volume. Does the partial molar volume of a substance vary with the concentration of the substance in the solution? 6

B What is chemical potential and its significance in thermodynamics? 4

C Explain in brief the concept of property change on mixing. 6

OR

Q.6 A What are Maxwell's relations? What is their significance with respect to solution thermodynamics? Derive any two Maxwell's equations. 8

B It is required to prepare 3 m^3 of a 60 mole percent ethanol-water mixture. Determine the volumes of ethanol and water to be mixed in order to prepare the required solution. The partial molar volumes of ethanol and water in 60 mole percent ethanol-water mixture are 57.5 x 10^{-6} m^3/mole and 16 x 10^{-6} m^3/ mole for ethanol and water respectively. The molar volume of the pure components are 57.9 x 10^{-6} m^3/mole and 18 x 10^{-6} m^3/mole for 8

ethanol and water respectively.

SECTION II

Q.7 A With the help of a neat diagram, explain the following terms: 10

i. Bubble point curve
ii. Dew point curve
iii. Tie Line

B Write notes on the following: 6

i. Duhem's theorem for non-reacting system
ii. Lewis Randall's rule

OR

Q.8 A The vapour pressures of acetone (1) and acetonitrile (2) can be evaluated by the Antoine's equation: 10

$$\ln P_1^s = 14.5463 - \frac{2940.41}{T-35.93}$$

$$\ln P_2^s = 14.2724 - \frac{2945.47}{T-49.15}$$

Assuming that the solutions formed by these are ideal, calculate:

i. x_1 and y_1 at 327 K and 65 KPa
ii. T and y_1 at 65 Kpa and x_1=0.4
iii. P and y_1 at 327 K and x_1=0.4

B Show that for equilibrium between liquid and vapour phases of a pure substance, the fugacities in both phases should be same. 6

Q.9 A Explain the criteria of equilibrium for a reacting system 6

B The equilibrium constant for the water-gas shift reaction 6
$CO(g)+H_2(g) \longrightarrow CO(g)+H_2O(g)$; $\Delta H°_{298}$=-509.93KJ at 298.15 K is 8.685 x 10^{-6}. Estimate the value of the equilibrium constant K at 1000 K assuming that ΔH° is constant in the temperature range 298.15 K to 1000 K.

C Consider a vessel which initially contains only n_0 moles of water vapour. If decomposition occurs according to the reaction 6

$$H_2O \longrightarrow H_2+1/2\ O_2$$

Find expressions which relate number of moles and the mole fraction of each chemical species to the reaction co-ordinate

OR

Q.10 A Derive the Van't Hoff equation and explain its significance 9

B A mixture which contained 1 mol CO, 1 mol water vapour and 1 mol CO_2 is undergoing the following reaction at a temperature of 1100 K and a pressure of 1 bar. 9

$CO(g)+H_2O(g) \longrightarrow CO_2(g) + H_2(g)$

The equilibrium constant for the reaction K=1. Assuming the gas mixture to behave as an ideal gas, calculate the fractional dissociation of steam.

$$K=\frac{y_{CO_2} \cdot y_{H_2}}{y_{CO} \cdot y_{H_2O}}$$

Q.11	A	With the help of few examples, explain how biological systems follow the laws of thermodynamics.	8
	B	Explain in brief how thermodynamics govern enzyme catalysed reactions.	8

OR

Q.12		Describe in detail the different types of bio-chemical reactions giving suitable examples for each type.	16

[Total No. of Questions: 12] **[Total No. of Printed Pages: 2]**

UNIVERSITY OF PUNE

[4362]-239
S. E. (Biotechnology) (II Sem.) Examination - 2013
GENETICS AND MOLECULAR BIOLOGY
(2008 Course)

[Time: 3 Hours] **[Max. Marks: 100]**

Instructions:

1 *Answer any three questions from Section I and any three questions from Section II*
2 *Answers to the two sections should be written in separate answer-books.*
3 *Neat diagrams must be drawn wherever necessary.*
4 *Black figures to the right indicate full marks.*

SECTION -I

Q.1	A	Linkage studies provided the first proof that a gene occupies a fixed locus on a specific chromosome. Discuss.	8
	B	In rabbits certain short-haired individuals when crossed with long haired ones produce only short haired progeny. Other short-haired individuals when crossed with long-haired ones produce approximately equal numbers of short haired and long haired off springs. When long-haired individuals are inter-crossed, they always produce progeny like themselves. i) Outline a hypothesis to explain these results and show the genotypes of all individuals? ii) How would you proceed to test this hypothesis? Show the results you would expect in the crosses you describe.	8
		OR	
Q.2	A	Show levels of DNA packaging and with neat diagram explain each level of packaging in detail.	16
Q. 3	A	What is melting temperature? Enlist factors which affect denaturation of DNA. Explain the effect of two factors on denaturation of DNA in detail.	16
		OR	
Q. 4	A	Write short notes on: (Each 8M)	16

		i) Nucleic Acid present in Mitochondria ii) Z form of DNA	
Q. 5	A	Explain the following concepts involved in the process of Replication: (Each 6M) i) Chemistry of DNA Synthesis ii) Processivity of DNA polymerase enzyme iii) Replication Fork	18
		OR	
Q. 6	A	What is **'End Replication problem'**? Describe the process of completion of DNA replication by organisms containing linear DNA molecules.	18
		SECTION II	
Q. 7	A	What is a difference between coding and non-coding RNAs? Describe the structural and functional features of mRNA, rRNA, and tRNA.	16
		OR	
Q. 8	A	**Some RNAs are Enzymes:** Explain the statement with examples.	8
	B	What type of double stranded structure RNA molecule can form? Draw neat labeled diagram of double helical characteristics of RNA and describe each type in detail.	8
Q. 9	A	Describe the process of Transcription with the help of following points: i) Initiation ii) Elongation iii) Termination	18
		OR	
Q. 10	A	What is Operon? Explain trp operon in detail.	18
Q. 11	A	What is protein biosynthesis? Explain in detail the process of translation in prokaryotes.	16
		OR	
Q. 12	A	Write short notes on: (8M each) i) Genetic code ii) Thalassamia	16