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Use separate answer script for each group

Ph.D. Course Work Examination, 2019
Biotechnology
Course - 1
Research Methodology and Techniques

Time : 4 Hours **Full Marks : 80**

Questions are of value as indicated in the margin
Group – A (Computer Application) Marks : 20
Answer Question No.1 and any two from the rest

1.a) Write the corresponding formula of the following source code:

```
$$\sum_{1=1}^k n_i^2 \leq n^2 - (k-1)(2n-k)$$
```

b) What is Float? Write the names of two floating objects.
c) What is the use of the BibTeX file (.bib)?
d) Write the syntax of the ordered list structure environment.
e) What is the use of the *verbatim* environment? $2 \times 5 = 10$

2.a) Write the source code of the following equation:

$$\sin \frac{\alpha}{2} = \pm\sqrt{\frac{1-\cos\alpha}{2}}$$

b) Write the source code of the following equation:

$$A_{m,n} = \begin{pmatrix} a_{1,1} & a_{1,2} & \cdots & a_{1,n} \\ a_{2,1} & a_{2,2} & \cdots & a_{2,n} \\ \vdots & \vdots & \ddots & \vdots \\ a_{m,1} & a_{m,2} & \cdots & a_{m,n} \end{pmatrix}$$

c) How to add extra horizontal space in math mode? What is the use of \mathrm{} command? $2 + 2 + 1 = 5$

3. a) Write the names of two formats of vector graphics. Why are vector graphics preferred over raster graphics?
b) When to use the "starred" (*) variants of *figure* and *table* environments?
c) Write the names of two environments to arrange multiple figures side-by-side. $2 + 2 + 1 = 5$

P.T.O.

4. a) Write the corresponding table of the following source code:

```
\begin{tabular}{|l|l|}
 \hline
 \multicolumn{2}{|c|}{Course Sheet} \\
 \hline
 CS01 &  P. Ghosh \\ \hline
 \multirow{2}{*}{CS02} & A. Saren \\
 & C. Roy \\
 & D. Sarkar \\ \hline
\end{tabular}
```

b) What is the use of \cline{} command in the *tabular* environment?
c) Briefly explain the purposes of \ref{} and \cite{} commands?

$2 + 2 + 1 = 5$

Group – B (Full Marks : 60)

Answer **any six** questions of the following

1. a) Describe affinity chromatography.
   b) How does reverse phase HPLC differ from normal phase HPLC? Explain with schematic diagrams. 4+6=10
2. a) Describe different types of ionizing radiations and the sources of radionuclei.
   b) Elucidate different applications of radioactivity. 4+6=10
3. a) BLAST represents a family of program. Name and briefly describe four of these.
   b) Describe different steps of BLAST. What is the significance of 'E-value' in BLAST?
   c) What is the difference between BLAST and FASTA? 4+4+2=10
4. a) Name two manufacturing companies that make centrifuge machines. If you want to modify a regular centrifuge machine into an ultracentrifuge machine, what are the different adaptations you have to integrate?
   b) When you are working with your lab centrifuge machine, suddenly you experienced with usual vibration combined with extra sound. What may be the reason and possible solution?
   c) What should be the criteria for selecting fixed angle rotor or swing bucket rotor?
   d) Comment on the principle and application of density gradient centrifugation.
   (1+2)+2+1+4=10
5. Describe the Principle of IEF. Briefly describe the different steps necessary to perform the technology. What kind of information canbe retrieved using this technique? 4+3+3=10

6. a) Explain the working principle of absorption spectrophotometer.
   b) Discuss the basic principle of NMR.
7. What are the three basic structureal parts of a flowcytometer? What are the significance of FSC and SSC? Why is proper compensation necessary when using multiple fluorochromes? 3+2+5=10
8. How is the sample matrix prepared in MALDI? How is protein sequencing done in mass spectrometer? 5+5=10

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Use separate answer script for each group

Ph.D. Course Work Examination, 2022

Paper-1: Research Methodology and Techniques

Questions are of value as indicated in the margin
Notations used are of usual meaning

Time: 4 Hours

Full Marks: 80

Group-A [Common to all Science subjects]: LaTeX [Marks: 20]

Answer any two questions

1.a) Write down the source code of the following equation:

$$\frac{x^2}{a^2} + \frac{y^2}{b^2} = 1$$

b) Write down the syntax of the ordered list structure environment.
c) What is the use of the \bibliographystyle{} command? Name two bibliography styles.
d) What is the use of the \ref{} command? Explain with an example.

$2 + 2 + 3 + 3 = 10$

2.a) Write down the output of the following source code:

```
\sigma = \sqrt{\frac{\sum(x_i-\mu)^2}{N}}
```

b) What is the use of the \cite{} command?
c) How will you arrange multiple figures side-by-side?
d) Distinguish between \clearpage{} and \pagebreak{}.

$2 + 2 + 3 + 3 = 10$

3.a) Write the source code of the following table:

Course	Credit
CS01 CS02	4
CS03 CS04 CS05	6

Table 1: Course vs. Credit

b) Why are vector graphics preferred over raster graphics?
c) What is the purpose of the .aux file?
d) What is the use of the verbatim environment?

$4 + 2 + 2 + 2 = 10$

D0

Ph.D. Course Work Examination, 2022
Biotechnology

Paper No. 1: Research Methodology and Techniques

Time: Four hours | Full Marks: 60

(Group B)

Questions are of value as indicated in the margin

Answer any four questions

1. Describe the technique, IEF. What are ampholytes? What is their role in IEF? How would you stain proteins after IEF? 8+2+2+3=15

2. (a) Write the working principle of a flow-cytometer. (b) State the purpose of data analysis in histogram, X-Y scattered plot and counter plot. (C) What is the functional principle of dichroic mirrors? 5+6+4=15

3. Write down the basic principal of HPLC? Describe the instrument in details. What are the main applications of HPLC? 4+6+5=15

4. Mention the basic principle of Ultracentrifugation. What are the major advantages of ultracentrifugation over tabletop preoperative centrifugation? What is the basic principle of isopycnic centrifugation? Mention the most common troubleshoots experienced by the users during daily usage of laboratory centrifugation with respective control measure. What do you mean by derating of centrifuge for proper maintenance? Mention the different types of rotors used in centrifugation with specific uses? 3+3+2+3+2+2=15

5. (a) Explain similarities and differences between BLAST and FASTA tools for sequence alignment. Explain the significance of E value in BLAST.
(b) Describe Dynamic Programming. Differentiate between local and global alignment in terms of algorithm.
(c) Describe Dot Matrix Analysis. 4+2+2+4+3= 15

6. (a) Write comparative notes on different types of mass analysers.
(b) What is TOF?
(c) Deduce the TOF equation.
(d) Define soft and hard ionization and its use in mass spectroscopy with example.
(e) Differentiate between protein fingerprinting and Tandem mass spectrometry.
(f) Why is trypsin used for cleavage? 3+0.5+2.5+4+4+4=15

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Use separate answer script for each group

Ph.D. Course Work Examination, 2023

Paper-1: Research Methodology and Techniques

Questions are of value as indicated in the margin
Notations used are of usual meaning

Time: 4 Hours

Full Marks: 80

Group-A [Common to all Science subjects]: LaTeX [Marks: 20]

Answer any two questions

1.a) Write down the source code of the following equation:

$$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$$

b) What is the use of the \quad{} command? Can it be used in both the text and math modes?
c) Write down the syntax of the ordered and unordered list structure environments.
d) Distinguish between the use of the \bibliographystyle{} and \bibliography{} commands.

$2 + 2 + 3 + 3 = 10$

2.a) Write down the output of the following source code:

```
$\sum_{i=1}^k n_i^2 \leq n^2 - (k-1)(2n-k)$
```

b) Distinguish between the use of the \hline{} and \cline{} commands.
c) Briefly explain different placement specifiers of floating objects.
d) How will you arrange multiple figures side-by-side?

$2 + 2 + 3 + 3 = 10$

3.a) Write down the source code of the following table:

Company	Colors	
	White	Black
DELL	40000	50000
HP	45000	55000

Table 1: Desktops price list

b) Write down two file types of vector and raster graphics each.
c) What is the use of the BibTeX file (.bib)?
d) Distinguish between the use of the \ref{} and \cite{} commands.

$4 + 2 + 2 + 2 = 10$

Group B
Questions are of value as indicated in the margin

Part 1
Attempt any *two* questions

1. Briefly comment on the following statistical statements:
   (i) t test is used to determine the significance of mean difference between two samples.
   (ii) x^2 test is used for validation of Mendelian hybridization experiment.
   (iii) ANOVA is more powerful than Z and t test.
   (iv) Correlation is not opposite to regression.
   (v) In most of the biological experiment 5 % is taken as the level of significance. 2x5=10

2. Write the classification of patents by WIPO. 10

3. (a) What are the considerations one should make to identify a "problem" before commencing a scientific research.
   (b) Distinguish between Raw and Process data with suitable examples. 5+5=10

Part 1I
Attempt any *four* questions

4. (a) Draw and explain the principle of mass spectrophotometer.
   (b) Contrast between Soft and hard ionization. 5+5=10

5. (a) Define Time of Flight with mathematical expression.
   (b) Distinguish between MALDI and EI. 5+5=10

6. (a) Explain the working principle of the dichroic mirror.
   (b) Explain the mode of flow cytometric analysis for double-stained sample with a suitable example. 5+5=10

7. Define BLAST. Explain the different types of BLAST available in NCBI. Define "e-value" with respect to BLAST. 1+8+1=10

8. Describe 2D electrophoresis and identify the applications of this technique. 10

9. Discuss Reverse Phase Chromatography with a diagram. What is the advantage of reverse phase chromatography over normal phase chromatography? 8+2=10

Give an account of good laboratory practices (10)

12/5/25

What are compensation ~~and~~ and Gating in flow cytometry? Illustrate and explain histogram and X-Y-scattered plots to analyse flow cytometric data (5+5=10)

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Use separate answer script for each group

Ph.D. Course Work Examination, 2023
Paper-I: Research Methodology and Techniques

Questions are of value as indicated in the margin
Notations used are of usual meaning

Time: 4 Hours

Full Marks: 80

Group-A [Common to all Science subjects]: LaTeX [Marks: 20]

Answer any two questions

1.a) Write the source code of the following equation:

$$\sigma = \sqrt{\frac{\sum(x_i - \mu)^2}{N}}$$

b) When do we use the "starred" (*) variants of *figure* and *table* environments?
c) Write the syntax of the ordered and unordered list structure environments.
d) Write the source code of a sample side-by-side of two figures using the *subfigure* environment.

$2+2+3+3=10$

2.a) Write down the source code of the following table:

Company	Type	Colors	
		White	Black
Mahindra	Hatchback	6	7
	Sedan	8	9
Tata	Hatchback	5	6
	Sedan	7	8

Table 1: The average price of different car models in Indian currency (Lac)

b) What is the use of the percentage (%) and tilde (~) characters?
c) Why are the vector graphics preferred over the raster graphics?
d) Write a command to add extra horizontal space in math mode. What is the usage of the `\ldots{}` command?

$4+2+2+2=10$

3.a) What is the use of the verbatim environment?
b) Differentiate between `.bib` and `.bbl` files.
c) Briefly explain the purposes of the \ref{} and \cite{} commands.
d) Write the source code of a sample frame with the beamer documentclass.

$2+2+3+3=10$

Group-B

Questions are of value as indicated in the margin

Part I

Attempt *any two* questions

1a. Discuss the critical role of quality assurance and quality control in ensuring the reliability and validity of experimental data within the framework of Good Laboratory Practice (GLP). Provide specific examples of how these elements contribute to the overall integrity of scientific research.
b. What do you mean by peer reviewed journal?
c. What are the different styles of references used for citation in a manuscript?

(3+2+5)

2a. What is Biocthics? Write down the role of biocthics in biosafety of plants and animals.
b. Illustrate briefly about the legal procedures for registering a patent in India.

(2+3+5)

3. Mention the purpose of following statistical phenomenon with one example
a. F-test
b. Chi square test
c. ANOVA
d. Central tendency
(2.5 x 4)

Part II

Attempt *any four* questions

4a. What are the differences between native- and SDS-PAGE?
b. What kind of information can be obtained from each technique?
c. In your opinion, are either techniques necessary or one is redundant?

(3+3+4)

5. What is peptide fingerprinting? How does it differ from tandem mass spectrometry?

(3+7)

6a. Name two enzymes used in protein cleavage and clarify why they are used for that purpose?
b. Write down the application of Real-time PCR in the field of genomics.

(1+4+5)

7a. Describe affinity chromatography.
b. How reverse phase HPLC differs from normal phase HPLC. Explain along with schematic diagrams.

(4+6)

8a. BLAST represents a family of programs. Name and briefly describe four of these.

b. Describe the different steps of BLAST. What is the significance of 'E-value' in BLAST?
c. What is the difference between BLAST and FASTA?

(4+4+2)

9a. Explain the working principle of fluidics in flowcytometry?
b. Elucidate the analytical methods with histogram plot and XY scatter plot.
c. What is Gating?

(3+5+2)

eir

en

Query cover
Threshold value
Input of data file
Biologically relevant

Query search

Seed extension
Alignment
Data compilation

Use separate answer script for each group

Ph.D. Course Work Examination, 2024

Paper-1: Research Methodology and Techniques

Questions are of value as indicated in the margin
Notations used are of usual meaning

Time: 4 Hours

Full Marks: 80

Group-A [Common to all Science subjects]: LaTeX [Marks: 20]

*Answer **any two** questions*

1.a) Write the source code of the following equation:

$$\sin\left(\frac{\theta}{2}\right) = \pm\sqrt{\frac{1-\cos\theta}{2}}$$

b) Differentiate between \hline{} and \cline{} commands?
c) Briefly explain the purpose of the BibTeX file (.bib).
d) Briefly explain the use of \label{} and \ref{} commands with an example.

$2+2+3+3=10$

2.a) Write down the source code of the following table:

Company	Model	Processor	
		i5	i7
DELL	Vostro	50,000	65,000
	Inspiron	60,000	75,000
HP	Pavilion	55,000	65,000
	EliteBook	75,000	95,000

Table 1: Hypothetical price of different laptop models

b) How do you add extra horizontal space in math mode? What is the use of \mathrm{} command?
c) Write the names of two image formats for each vector and raster graphics.
d) Differentiate between *tabular* and *table* environments.

$4+2+2+2=10$

3.a) Write down the output of the following source code:

```
$\sigma = \sqrt{\frac{\sum(x_i-\mu)^2}{N}}$
```

b) What are the uses of '\' and '\@' for spacing?
c) Write the syntax of the ordered list structure environment. What is the use of \includegraphics{} command?
d) Write the source code of a sample frame with the beamer documentclass.

$2+2+3+3=10$

Group-B

Questions are of value as indicated in the margin

Part I
Attempt any two questions

1. Give an account of different good laboratory practices in a biotechnology laboratory. 10

2. Explain the essential components of a patent application, including the role of claims, specifications, and prior art in drafting a legally robust patent. Discuss the legal procedures involved in filing and securing a patent in the context of biotechnological inventions, emphasizing the importance of novelty and non-obviousness. Provide an example of a biotechnological invention that could be patented.

6+3+1=10

3. (a) Discuss the ethical considerations involved in conducting biomedical research on human subjects and experimental animals.
(b) What is the purpose of following statistical tests: (i) ANOVA, (ii) Multiple regression, (iii) Chi square test.

4+(2+2+2)=10

Part II
Attempt any four questions

4. Describe the basic principles of Western blotting. Describe the applications of this technique and one limitation

5+(4+1)=10

5. (a) Explain the principle of mass spectrophotometer with proper drawing
(b) Compare the process of soft and hard ionization

5+5=10

6. (a) Define and discuss Time of Flight with proper mathematical calculation
(b) compare MALDI with EI with proper explanation

5+5=10

7. What are compensation and Gating in flowcytometry? Illustrate and explain histogram and X-Y-scattered plot to analyze flow cytometric data

5+5=10

8 (a). Write short notes on affinity chromatography and ion exchange chromatography
(b). What is HPLC? Explain the two types of HPLC with schematic diagrams. Which one is preferred in biological studies and why?

(2+2)+ (1+4+1)=10

9 (a). Define BLAST. Name and briefly describe four of these.
(b). Describe the different steps of BLAST. What is the significance of 'E-value' in BLAST?
©. What is the difference between BLAST and FASTA?

(1+4)+ (2+1)+2=10

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Ph.D. Course Work Examination, 2019
Biotechnology
Course – 2 (Elective)
Plant Microbe Interaction

Time : 4 Hours **Full Marks : 80**

Questions are of value as indicated in the margin

Answer **any four** questions

1. Define bio-control agents with examples. Explain their affectivity and applicability. What are the advantages and/or disadvantages of bio-control agents as compared to chemical treatments? 2+8+10=20
2. Define and give examples of disease management strategies including methods for prevention, eradication, biological and genetic controls. 4+4+4+4+4=20
3. Explain a disease triangle with diagram. Can a disease triangle be four sided? Explain. 16+4=20
4. Explain the zig-zag model of plant pathogen interaction. 20
5. Give an account of PR-proteins along with their classification. 20
6. Write notes on **any two** : 10×2=20
   a) Guard hypothesis
   b) PRR
   c) PAMP

Ph.D. Course Work Examination, 2019
Biotechnology
Course – 2 (Elective)
Recombinant DNA Technology

325

Time : 4 Hours **Full Marks : 80**

Questions are of value as indicated in the margin

Answer **any four** questions

1. What is a restriction endonuclease? Give an example. Discuss briefly how restriction enzymes has facilitated the evolution of genetic engineering methodologies. What is molecular cloning? Briefly describe the general process of cloning a fragment of DNA in to a vector with the helps of schematic diagrams. Briefly discuss, with the help of suitable figures wherever necessary the salient features of two NextGen sequencing methods. State one reason why next Gen methods are superior to traditional methods. 2+1+3+2+5+5+2=20

3

2. Give examples of molecular biology experiments where chemically synthesized oligonucleotide primers are used. Briefly describe the c-ontemporary method of oligonucleotide synthesis. Briefly describe one method of the directed mutagenesis and its applications. What is an expression vector? Write a short essay on antisense and ribozyme biotechnology. Tabulate various applications of PCR technique. 2+5+3+2+2+6=20

3. Briefly discuss the role of genetic engineering in solving some of the environmental issues. What is a renewable energy? Discuss briefly some of the sources of renewable energy. What do you mean by biomass? Briefly discuss some of the products you can obtain from biomass. 5+3+5+3+4=20

4. What are secondary metabolites? Give a brief description of some important secondary metabolites found in plants with examples. State three methods for preliminary identification of their chemical nature. Briefly describe the isolation and purification of bioactive compounds from plants. 2+7+(3×2)+5=20

5. Give five examples in medicinal science where genetic engineering techniques are used for improving human health care. Briefly discuss some of the controversies involving genetically engineered products. 3×5+5=20

7

6. Write short notes on **any four** : 4×5=20

a) Synthetic genes b) Biofuel cells c) Protein expression d) Polymerase chain reaction

e) NMR spectroscopy f) Bioautography

Ph.D. Course Work Examination, 2019
Biotechnology
Course – 2 (Elective)
Biotic and Abiotic Stress Response

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Time : 4 Hours **Full Marks : 80**

Questions are of value as indicated in the margin

Answer **any five** questions

1. What do you mean by Reactive Oxygen Species (ROS)? How do they affect living macromolecules particularly DNA, RNA and protein? 4+12=16
2. What do you mean by oxidative stress? What are the common-mechanisms of antioxidant scavenging system in living cell? Give a list of plants producing good amount of anti-oxidant compounds in nature. 3+8+5=16
3. What are the common effects of anaerobic condition in plants? How these conditions arise in plants? Comments on the activity of common genetic elements functioning under this condition in plants. 2+2+12=16
4. What do you mean by abiotic stress? How does plant system respond to different environmental stress? Describe with diagrams. Describe the role of Ethylene and ABA in abiotic stress responses. 2.5+4.5+4.5+4.5=16
5. Name common osmotically active compounds and their function under abiotic stress responses in plants. Give a list of major transgenic crops developed for the management of abiotic stress responses in plant system. 6+2+8=16
6. Comment on the function of following protecting systems/components in plant systems: 4×4=16
   i) Aquaporin
   i) Proton pump
   iii) ERF
   iv) SNORKEL
7. Write short notes on the following : 4×4=16
   i) Singlet Oxygen
   ii) Carotenoids molecules as antioxidants
   iii) DREB
   iv) LEA

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Ph.D. Course Work Examination, 2022-2023

Biotechnology

Course II (Elective)

Infection and Cancer

Time: Four Hours **Full Marks: 80**

Questions are of value as indicated in the margin.

Answer any **four** questions.

1. What are the key characteristics of an antiviral drug? Define retroviral drug with an example. 10+10=20

2. Explain Acute and Persistent infection with an example. Explain with diagram the strategies of viral replication in host cells. Describe with diagram the replication of any one of the following viruses - EBV, HCV, HIV. 4+8+8=20

3. Classify with examples Myxoviruses. What is Influenza virus? Describe the basic structure of Influenza virus. Mention the role of Haemagglutinin and Neuraminidase. Define antigenic shift with example. 4+4+6+6=20

4. Compare between the different viruses which causes Hepatitis. What are the unclassified agents in animal virology? Describe viroids with example. 10+4+6=20

5. What are the classical symptoms of plant viruses? Describe life cycle of a typical plant virus. 8+12=20

6. Short Notes **(any four)** 5×4=20

(a) Nuclear Entry of Virus

(b) Latency

(c) Baltimore classification

(d) Viral diagnostics

(e) Zoonosis

(f) Antigenic drift and antigenic shift

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Ph.D. Course Work Examination, 2022
Biotechnology

Course: II (Elective)

(Microbial Technology)

Time: 4 hours

Full Marks: 80

Questions are of value as indicated in the margin

Answer any five questions

1. (a)What is passive immunization? (b) Discuss why the 'Sabin' polio vaccine is considered more appropriate in India than 'Salk' vaccine. (c) 'Suppression of cellular immune effector mechanisms is the key for the survival of the *Leishmania* parasites within mammalian host'- Justify. 3+6+7= 16

2. Give stepwise methods of 16S rRNA sequencing and its use in molecular phylogeny of any group of microorganisms. 16

3. Write an account of antibiotic and antiviral agents. Define pro-drug with example. 10+6 =16

4. Name and briefly explain different types of parasite infection. What is zoonosis and cite examples. Why cannot an antibody mediate immunity in protozoa? 8+4+4= 16

5. Give the quantification protocol for virus. Give an account of stress adaptation mechanism of bacteria. 8+8=16

6. What is downstream processing? Describe its different steps from product isolation to preparation of formulation for marketing. 16

7. Write notes on any four: 4X4=16

i) Latent Phase
ii) Synchronous culture
iii)Culture collections
iv)Phototrophic microorganisms
v) Classification of Virus
vi)Biofuel from algae

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Ph.D. Course Work Examination, 2022

Biotechnology

Course: III (Review Presentation)

Time: 4 hours | Full Marks: 100

1. Submit review and present it. through PowerPoint 50+50

(526)

Ph.D. Coursework Examination 2023

Biotechnology

Paper-II (Elective)

Rice Biotechnology

Time: Four Hours **Full Marks:80**

Questions are of value as indicated in the margin.
(Answer *any four* questions)

1(a) What do you mean by Genomic synteny? What is the molecular-genetic basis of this phenomenon? How is this phenomenon related to rice molecular breeding?

(2+4+4=10)

(b) What do you mean by center of origin and center of diversity for crop plants? How are they related? Briefly describe this phenomenon in rice.

(3.5+1.5+5=10)

2(a) Give a short description of different wild genera and species of the genus rice with special reference to their genome type.

(5)

(b) What are the major abiotic stresses that affect rice growth and yield? Mention some selective mechanisms through which rice plants reduce the effectivity of respective abiotic stresses. Mention the group of genes that have been metabolically engineered in rice plants for the management of drought tolerance.

(3+6+6=15)

3. Why is normal rice deficient in pro-vitamin A? Briefly describe the scientific concept behind the development of golden rice with special reference to metabolic engineering of β carotenoid synthetic pathways. What are the major drawbacks of this technology that prevented this developed crop from being successfully introduced in farmers' fields?

(4+12+4=20)

4(a) What are the principal drawbacks of cultivated rice with regard to photosynthetic machinery in the context of plant yield? Mention at least one such initiation that has been taken to develop metabolically engineered rice to develop photosynthetically efficient rice.

(3+7=10)

(b) What do you understand by biofortification? Mention at least one such biofortified rice where a microelement has been incorporated to improve the rice.

(2+8=10)

5(a) What is the green revolution? What were the major initiations responsible for the Green Revolution, which doubled the global rice yield during the Green Revolution and post-Green Revolution?

(3+7=10)

(b) What is gene revolution? What will be the possible ways for a second green revolution with special reference to the utilization of crop genomics and bioinformatics?

(3+7=10)

6(a) What do you mean by molecular marker? How does a molecular marker differ from a gene? Give an example of a recently developed molecular marker system.

(2+2+5=9)

(b) What is a quantitative trait? How does it differ from normal Mendelian traits? Why are quantitative traits too much influenced by environmental factors? Briefly describe the procedure of QTL mapping.

(2+1+2+6=11)

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Ph.D. Course Work Examination, 2023

Biotechnology

Paper II (Elective)

Biology of Ageing

Questions are of value as indicated in the margin.

Answer *any four* questions

Time: 4 hours Full marks: 80

1. What do you understand by ageing? What kind of biomarkers can be used to define ageing?

   5+15=20

2. What is a free radical? How can they cause oxidative stress?

   4+16=20

3. Describe simple strategies that can be included in our lifestyle for a healthier ageing and lifespan.

   20

4. Briefly describe two pathological diseases which are mediated by oxidative stress in humans.

   10+10=20

5. Describe the repair processes available to modulate the oxidative stress-mediated oxidative modifications of biological macromolecules. Are there any modification(s) which cannot be reversed?

   10+10=20

6. Answer the following:

   (i) Differentiate between ageing and senescence.

   (ii) Describe any assay method to estimate the antioxidant defenses in our body.

   4+16=20

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Ph.D. Course Work Examination 2023
Biotechnology
Paper III: Review Work Report and Seminar Presentation

Time: 10 A.M. onwards **Full Marks: 100**

1. You are required to submit a review on theme of proposed work. 50

2. Presentation of proposed research work covering objectives and research methodologies. 50

Ph.D. Course Work Examination 2024

Biotechnology

Paper II (Elective)

Infection and Cancer

Questions are of value as indicated in the margin.

Time: 4 hours Full marks: 80

Questions are of value as indicated in the margin.

1. Answer any eight of the following: 8×2.5=20

(a) It was observed that the radius of an approximately circular plaque of infected cells grew to 1.45 mm in just 3 days. They measured the distance between adjacent cells to be 0.037 mm to obtain the apparent time for the lytic cycle (from infection to lysis). They compared this time to the actual rate at which new virions are formed: 5 to 6 hours. Predict the radius of infection if the infection process involved a sequence of entry, replication, lysis, and infection of an adjacent cell.

(b) Would a person who has never been in contact with the varicella-zoster virus be at risk of developing chickenpox or shingles if they come in close contact with a person with shingles? Explain your reasoning.

(c) A 44-year-old CMV antibody negative man is given a lung transplant from a CMV antibody positive donor. Comment on it with explanation.

(d) Viruses can be separated into capsid proteins and nucleic acid. When placed back together, these two parts will self-assemble into new infectious virus particles. Purify the NUCLEIC ACID FROM TOMATO mosaic virus and the PROTEIN FROM BEAN mosaic virus. Then combine these two parts, and they self-assemble into infectious viruses. What happens when these newly assembled (hybrid) viruses are rubbed (with an abrasive) onto BEAN LEAVES.

(e) Which step in the replication cycle of viruses do you think is most critical for the virus to infect cells? Explain why.

(f) How do ssDNA and dsDNA viruses replicate?

(g) The promoters for mRNA encoding early proteins in viruses like T4 have a different sequence than the promoters for mRNA encoding late proteins in the same virus. Explain how does this benefit the virus.

(h) How did the development of a porcelain filter, called the Chamberland-Pasteur filter, help scientists discover viruses?

(i) Why do retroviruses convert their RNA genome to DNA (using reverse transcriptase) and then transcribe it back to viral RNA (and translate that into viral proteins)?

(j) Since viral infection leads to more viral particles, explain why the "growth curve" for viruses is stepped rather than smooth (as encountered in bacterial growth).

2. Write short notes on any four. 2.5×4=10

a) Leishmaniases disease complex

b) Life cycle of *Leishmania* parasite

c) General immune response against viral pathogens

d) Common Lymphoid progenitor

e) Professional Antigen presenting cells

f) MHC haplotype

3. Answer any five of the following:

(a) Describe the unclassified biological agents in animal virology. Define viroid. Describe the replication process of viroid. 5+1+4=10

(b) Compare viroid with plant virus. Compare modes of transmission of viruses in plants and animals. 5+5=10

(c) What should be the key characteristics of antiviral drugs? Classify the antiviral drugs with examples. 4+6=10

(d) Describe HAART. Antivirals target at every phase of viral infection cycle--describe the statement with justification. 4+6=10

(e) What are the classical symptoms of plant viruses? Describe life cycle of a typical plant virus. 10

(f) What is inflammation? Distinguish between Pro-inflammatory and Anti-inflammatory immune responses. 4+6=10

(g) How do PRRs differ in self/nonself recognition than that of BCR and TCR? Elucidate the role of phagocytes in immunity. 4+6=10

Ph.D. Course Work Examination 2024
Biotechnology

Paper II (Elective)

Genomics of plant stress biology

Questions are of value as indicated in the margin.

Answer *any four* questions

Time: 4 hours Full marks: 80

1. Define and explain bio-control agents with examples, their affectivity and applicability. What are the advantages or disadvantages of bio-control agents as compared to chemical treatments?

10+10=20

2. Define and give examples of disease management strategies including methods for prevention, eradication, biological and genetic controls.

5+5+5+5=20

3. Explain a disease triangle with diagram. Can a disease triangle be four sided, explain.

20

4. Explain the zig-zag model of plant pathogen interaction

20

5. Explain plant disease resistance proteins along with their classification

20

6. Write notes on any two 10 x 2 = 20

a) Guard hypothesis
b) PR proteins
c) PAMPs

Ph.D. Course Work Examination 2024

Biotechnology

Paper II (Elective)

Biology of Ageing

Questions are of value as indicated in the margin.

Answer *any four* questions

Time: 4 hours Full marks: 80

1. Describe briefly 4 theories of ageing.

5x4=20

2. What do you understand by oxidative stress? Describe the different ways they are produced in the body under physiological conditions?

8+12=20

3. (a) Oxidative stress is a necessary evil - explain this statement.
   (b) Describe the difference in reactivity of oxygen and superoxide anion.

10+10=20

4. What are the physiological consequences of excessive oxidative stress in the body? How are the biological molecules affected?

20

5. Describe briefly the different mechanisms of managing with oxidative stress in the body.

20

6. Describe briefly different oxidative stress-related diseases. Describe one in detail including its mitigation strategies.

12+8=20

Ph.D. Course Work Examination 2024

Biotechnology

Paper II (Elective)

Microbial Technology

Questions are of value as indicated in the margin.

Answer *any four* questions

Time: 4 hours Full marks: 80

1. Compare and contrast the principles of brightfield, darkfield, and fluorescence microscopy. For each technique, explain the path of light, the appearance of the specimen against the background, and the specific applications in microbiology.
10+10=20
2. Initially grouped with bacteria, Archaea are now recognized as a distinct domain of life. Critically discuss the key structural, biochemical, and genetic differences that distinguish Archaea from Bacteria and Eukarya, highlighting why their separate classification is crucial for understanding the diversity of life.
20
3. Explain the principles behind differential staining techniques in microbiology, using Gram staining as a detailed example. Discuss the chemical basis of the Gram stain reaction and its significance in bacterial identification. Briefly mention two other differential staining methods and their applications.
5+5+10=20
4. Define the term 'pure culture' and discuss two methods commonly used to obtain pure cultures of microorganisms from a mixed population. Explain the importance of pure cultures in microbiological studies.
12+8=20
5. Discuss the key factors that need to be considered when selecting a bioreactor for a specific fermentation process. These factors should include the type of microorganism, the nature of the product, and operational requirements. Provide examples of different types of bioreactors and their suitability for specific applications.
12+8=20
6. Discuss the role of microorganisms in the industrial production of enzymes. Describe the general process for producing extracellular microbial enzymes, including strain selection, fermentation, and recovery. Provide two examples of industrially important microbial enzymes and their applications.
5+10+5=20