Total No. of Questions : 5] **[Total No. of Pages : 2**

P730

[3925] - 203

M.Sc.

MICROBIOLOGY

MB - 603 : Microbial Metabolism

(2008 Pattern) (Sem. - II)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***All questions carry equal marks.***
3) ***Draw neat labelled diagrams wherever necessary.***
4) ***Use of logarithmic tables, graph papers and scientific calculators is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) Attempt any two of the following : **[16]**

a) Derive equation for Hill plot and state its significance in relation to allosteric enzymes.

b) Describe the energy generation pathway in sulphate reducing bacteria.

c) Draw pyrimidine nucleus. Schematically draw the pathway leading to its synthesis.

Q2) Attempt any two of the following : **[16]**

a) How will you calculate free energy change taking place under standard and non standard conditions?

b) Describe the steps recommended by King and Altman to derive kinetic equation for multi-substrate enzyme catalyzed reactions.

c) Illustrate with the help of diagram, structure and function of mitochondrial ATP synthase.

Q3) Attempt any two of the following : **[16]**

a) What are similarities and differences between ionophores and ion channels?

b) Justify : "One round of Calvin cycle for fixation of six moles of CO_2 requires 18 moles ATP and 12 moles NADPH".

c) Describe biosynthesis of glutamate family amino acids.

P.T.O.

Q4) Write short notes on <u>any four</u> of the following : **[16]**

a) Bacteriorhodopsin.

b) Nitrogenase.

c) Entropy.

d) NADH dehydrogenase.

e) Competitive inhibition.

Q5) Solve <u>any two</u> of the following : **[16]**

a) Green sulfur bacteria do not use water as electron donor and do not evolve oxygen upon illumination. Rather they use H_2S and evolve elemental sulfur. Given that these photosynthetic organisms use only photosystem I, explain why do they use H_2S rather than H_2O as an electron donor during the photosynthetic production of NADPH?

b) The oxidation of malate to oxaloacetate in citric acid cycle results in production of 2.5 moles of ATP during oxidative phosphorylation. In contrast, the oxidation of succinate to fumarate in the similar process produces only 1.5 moles of ATP. Since both oxidations require the transfer two electrons, why should succinate oxidation produce one ATP less?

c) At what substrate concentration would an enzyme with maximum substrate transformation velocity of 30.0 S^{-1} and Km of 0.005 M operate at one quarter of its maximum rate?

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Total No. of Questions : 5] **[Total No. of Pages : 2**

P731

[3925] - 301

M.Sc.

MICROBIOLOGY

MB - 701 : Immunology

(2008 Pattern) (Sem. - III) (New)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***All questions carry equal marks.***
3) ***Neat well labelled diagrams must be drawn wherever necessary.***
4) ***Use of log tables and electronic pocket calculators is allowed.***
5) ***Assume suitable data if necessary.***

Q1) Attempt any two of the following : **[16]**

a) Compare the immune response of an arthropod with that of a human.

b) Justify "All self reactive lymphocytes are not eliminated in the thymus or bone marrow, yet they are prevented from harming the host".

c) Explain regulation of immune response by antibody network.

Q2) Attempt any two of the following : **[16]**

a) Explain five basic common themes of signal transduction process in case of T-cell activation.

b) Explain the immunoregulatory role of IL-4, INF-γ and TNF β in T_H subset cells.

c) Justify "Gene rearrangements yield a functional gene encoding the $\alpha\beta$ T-cell receptor".

Q3) Attempt any two of the following : **[16]**

a) Justify, "Intracellular pathogen fail to induce an antibody response".

b) Explain pathophysiology and diagnosis of chronic granulomatous disease.

c) Explain the etiology and clinical features of Plasma Cell Myeloma.

P.T.O.

Q4) Attempt <u>any four</u> of the following : **[16]**

a) Fat body in drosophila.

b) TNF

c) Superantigens.

d) AFP

e) T-cell costimulatory signal (CD 28).

Q5) The antigen activation of T-cell leads to the release or induction of various nuclear factors that stimulate gene transcription. On the basis of given information, answer the following : **[16]**

a) What transcription factors that support proliferation of activated T-cells are present in the cytoplasm of resting T-cells in inactive forms?

b) Once in the nucleus, what might these transcription factors do?

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Total No. of Questions : 5] **[Total No. of Pages : 3**

P736

[3925] - 403

M.Sc. (Sem. - IV)

MICROBIOLOGY

MB - 803 : Microbial Technology

(2008 Pattern) (New)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***All questions carry equal marks.***
3) ***Draw neat labelled diagrams wherever necessary.***
4) ***Use of logarithmic tables, graph papers and scientific calculators is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) Discuss the design of CSTR. Add a note on CSTR with recycle. **[16]**

OR

With the help of suitable examples, describe various types of control mechanisms involved in regulation of growth non - associated metabolites.

Q2) Answer *any two* of the following : **[16]**

a) Justify 'SOP is a vital element associated with operation of any analytical instrument'.

b) Describe the process of protease production using immobilized cell reactor.

c) Comment on 'Influence of sparger location on gas distribution in airlift reactors'.

Q3) Answer *any two* of the following : **[16]**

a) Describe various types of biosensors and their possible use in monitoring process parameters.

b) With the help of suitable example, discuss how exopolysaccharides affect the mass transfer of nutrients and oxygen.

c) Explain the design of intermig impeller and describe the flow pattern generated by its use in chemostat.

P.T.O.

Q4) Write short notes on *any four* of the following : **[16]**

a) Sensors to monitor dissolved oxygen.

b) ISO certification.

c) Fungi as biofertilizers.

d) Oxygen Transfer Rate.

e) Baffles.

Q5) In the experiment, batch mode and membrane mode fermentation process for the continuous chitinase production by *Paenibacillus* sp. Was investigated using 5 L stirred tank reactor containing 2 L culture medium. **[16]**

The experimental set - up used was as per Fig. 1.

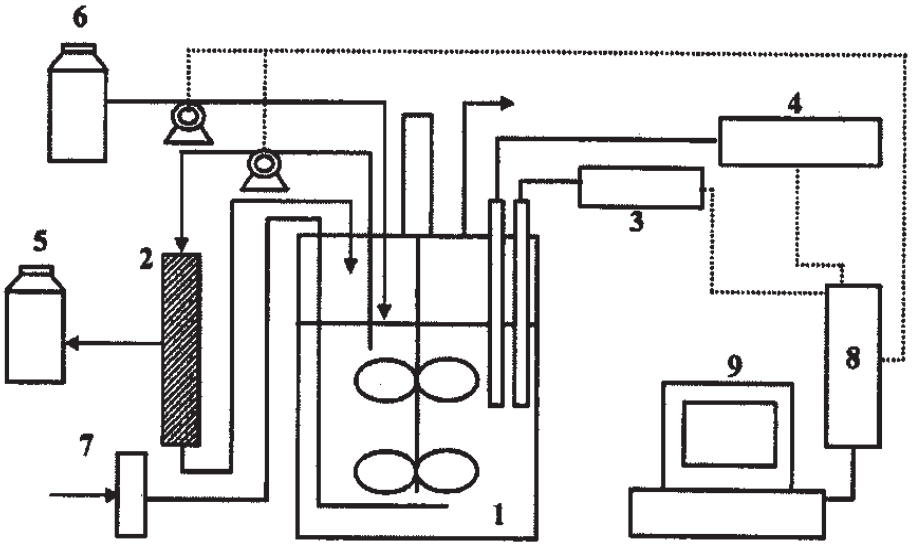

Fig. 1. Experimental set-up. 1, bioreactor; 2, microfiltration module; 3, pH-meter and controller; 4, DO-meter; 5, permeate vessel; 6, fresh medium vessel; 7, air filter; 8, interface box; 9, computer.

Membrane mode operations were carried out at the same conditions as in batch mode except for an outer loop microfiltration module.

Considering the operations, scale of the study and the data table, answer the following questions;

i) Which operational mode is more productive? Give your reasons.

ii) What are the limitations of membrane mode operations at large scale?

Table 1: A comparison on the total chitinase activity obtained during batch and membrane mode operations.

Items	Time											
	72 h		84 h		96 h		108 h		120 h	132 h	144h	168 h
	B	M	B	M	B	M	B	M	M	M	M	M
Retentate volume (ml)	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000	2000
Cell number (x10^8 cell/ml)	5.0	5.3	5.9	5.6	8.0	7.9	8.3	8.2	8.0	5.9	0	0
Spore number (x10^8 spore/ml)	0	0	0	0	0	0	0	0	6.5	6.7	6.8	7.4
Retentate activity (mU/ml)	14.2	14.4	12.9	13.1	12.7	12.7	12.0	12.2	12.1	11.8	10.9	9.0
Permeate volume (ml)				398		796		1133	1469	1752	2036	2475
Permeate activity (mU/ml)				13.3		12.7		12.1	11.6	11.0	10.3	8.6
Chitinase activity (x 1000 mU)	28.4	28.8	25.8	31.4	25.4	35.5	24.0	38.1	41.2	42.8	42.7	39.2
Fermentation efficiency	390	400	300	370	260	360	220	350	340	320	290	230
Activity ratio of M/B			1.21		1.39		1.58		1.71	1.78	1.77	1.63

B - batch mode; M - membrane mode;

As time over 108 h, chitinase activity for batch mode was assumed constant and equals to 24000 mU.

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Total No. of Questions : 5] **[Total No. of Pages : 2**

P736

[3925] - 403

M.Sc. (Sem. - IV)

MICROBIOLOGY

MB - 803 : Molecular Biology - II

(2005 Pattern) (Old)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***All questions carry equal marks.***
3) ***Draw neat labelled diagrams wherever necessary.***
4) ***Use of logarithmic tables, graph papers and scientific calculators is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) Explain any two of the following : **[16]**

a) Enlist different vectors and their role in RDT.

b) Explain role of aminoacetyl t - RNA in translation.

c) Explain promotor recognition in prokariotes.

Q2) Explain *any two* of the following : **[16]**

a) The role of site directed mutagenesis in protein engineering.

b) Organization of tryptophan operon.

c) Active centers of ribosomes.

Q3) Describe the principle, working and applications of *any two* of the following: **[16]**

a) Nothern and Southern hybridization technique.

b) DNA microarray's.

c) PCR.

P.T.O.

Q4) Write short notes on *any four* of the following : **[16]**

a) Plasmid curing.

b) Green Fluorescent Protein (GFP)

c) Rho dependent termination.

d) Chaperons.

e) Hybrid antibodies.

Q5) If the following DNA duplex is transcribed from right to left; **[16]**

a) Which is the sense strand?

b) What is the resulting m RNA sequence?

c) What is the informational relationship between the sequences in the mRNA and the antisense strand of DNA?

5'- A-T-A-C-G-C-A-G-G-C-T-3' Strand 1

3'-T-A-U-G-C-G-T-C-C-G-A-5' Strand 2

d) On mRNA, where translation will start? Name the codon.

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Total No. of Questions : 5] **[Total No. of Pages : 2**

P725

[3925]-101

M.Sc. (Sem. - I)

MICROBIOLOGY

MB-501 : Microbial Diversity and Taxonomy

(2008 Pattern)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***All questions carry equal marks.***
3) ***Draw neat-labeled diagrams wherever necessary.***
4) ***Use of logarithmic tables and scientific calculator is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) Attempt ***any two*** of the following: **[16]**

a) Compare and contrast between phenetic and phylogenetic approaches to classification.

b) Describe the newer approaches for exploring uncultured bacteria.

c) Explain the various measures and indices of microbial diversity.

Q2) Attempt ***any two*** of the following: **[16]**

a) Describe the role of chromosomal material transfer in bacterial taxonomy.

b) What are universal primers? Explain how these are applied in microbial taxonomy and diversity.

c) Describe the role of clustering algorithm in the filed of molecular evolution.

Q3) Attempt ***any two*** of the following: **[16]**

a) Enlist chronologically the methodological strategies for the identification of pure culture.

b) What is the significance of culture independent molecular methods? Describe the whole-genome shotgun technique.

c) Describe the role of sequence alignment in the study of molecular evolution and experimental biology.

P.T.O.

Q4) Write short notes on ***any four*** of the following: **[16]**

a) Significance of T-RFLP in bacterial diversity.

b) Extra chromosomal elements transfer as a tool in taxonomy.

c) Role of flow-cytometery in bacterial taxonomy.

d) Compare FASTA and BLAST.

e) Metagenomic environmental libraries.

Q5) The general limitations in studying microbial diversity in soil are: **[16]**

a) Spatial heterogeneity.

b) Inability to culture soil microorganisms.

c) Limitations of molecular-based methods.

d) Taxonomic ambiguity of microorganisms.

Prepare a protocol, outlining the methodology of estimating the microbial diversity in a patch of soil 3 m x 3 m. The methodology proposed should overcome the limitations (as much as possible) mentioned above.

The estimation of diversity should be to at least the conventional species level. Your answer should also highlight the reasons for the methodology proposed.

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Total No. of Questions : 5] **[Total No. of Pages : 3**

P726 **[3925]-102**

M.Sc.

MICROBIOLOGY

MB-502 : Quantitative Biology

(2008 Pattern) (Sem. - I)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***All questions carry equal marks.***
3) ***Draw neat labeled diagrams wherever necessary.***
4) ***Use of logarithmic and statistical tables, and scientific calculators is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) Attempt **any two** of the following: **[16]**

a) What is skewness? What are the types of skewness? Graphically represent Mean, Mode and Median in each type of skewness?

b) Draw less than and more than 'ogive' curves for following data and determine median from it.

Marks obtained	Number of students
0-5	04
5-10	06
10-15	10
15-20	10
20-25	25
25-30	22
30-35	18
35-40	05

c) A calibration factor for an occular micrometer using oil immersion lens was 1.5 micrometers. The length of 10 yeast cells was found to be as follows.
Length of yeast cells in number of divisions of occular micrometer: 3, 4, 2, 3, 5, 6, 3, 2, 4, 3.
Determine the average length and coefficient of variance.

P.T.O.

Q2) Attempt **any two** of the following: **[16]**

a) When persons X, Y and Z are solving a problem, the probability of X to solve the problem is 1/2, probability of Y to solve the problem is 1/3 and probability of Z to solve the problem is 1/4.
Find the probability that.
   i) No one can solve a problem.
   ii) At least one of them can solve the problem.

b) Explain in brief Logistic growth model.

c) A manufacturer, who produces sterile syringes, finds that 0.1% of the syringes are defective. The syringes are packed in a boxes containing 500 syringe each. A city hospital buys 100 boxes. Using Poisson distribution, find how many boxes will contain:
   i) No defectives.
   ii) At least two defectives.
   (e-0.5 = 0.6065)

Q3) Attempt **any two** of the following: **[16]**

a) The following are data that describe the 6-week weights of mice and their offspring of the same sex:

Parent (g)	Offspring(g)
24	26
21	24
24	22
27	25
23	21
25	26
22	24
25	24
22	24
27	24

Calculate the correlation coefficient and interpret the results.

b) A locus has three possible alleles A, B and C. The genotypes of 200 people chosen at random are determined for the different allele combinations, with the following results.

Genotype	Number of Individuals
AA	6
AB	34
AC	46
BB	12
BC	60
CC	42

i) What are the genotype frequencies?
ii) What are the allele frequencies for the A, B and C alleles?

c) With suitable examples explain the following:
i) Standard error.
ii) Type I and type II error.

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

a) Four different rice varieties were sown in five plots each and the following yield in quintals per acre were obtained. Analyse the data and find out whether there is a significant difference between the mean yields of the four varieties.

A	B	C	D
8	12	18	13
10	11	12	9
12	9	16	12
8	14	6	16
7	4	8	15

b) Explain the concept and application of databases in biology.

c) There is a general belief that high income families send their children to government schools. To verify this, 1600 families were selected at random in a city and following results were obtained.

Income	Public school	Government school
Low	506	494
High	438	162

Test whether income and type of schooling are independent.

Q5) Write short notes on **any four** of the following: **[16]**

a) 't' Test.
b) Non parametric test.
c) Null hypothesis and confidence interval.
d) Multiple regression.
e) Computer simulation in biological system.

Total No. of Questions : 5] **[Total No. of Pages : 2**

P727 **[3925]-103**

M.Sc.

MICROBIOLOGY

MB 503 : Cell Organization and Biochemistry

(2008 Pattern) (Sem. - I)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***All questions carry equal marks.***
3) ***Draw neat labeled diagrams wherever necessary.***
4) ***Use of logarithmic tables, and scientific calculators is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) Attempt ***any two*** of the following: **[16]**

a) Describe structure and function of microtubules.

b) What are non-covalent interactions? Explain the role of non-covalent interactions in biology.

c) What is quorum sensing? State its significance.

Q2) Attempt ***any two*** of the following: **[16]**

a) Diagrammatically illustrate the D-series of ketoses.

b) Explain in brief the tertiary structure of globular proteins.

c) Describe the process of gastrulation in *Xenopus* embryo.

Q3) Attempt ***any two*** of the following: **[16]**

a) Justify "The cell cycle control system is based on cyclically activated protein kinases".

b) Explain 5' $\longrightarrow$ 3' polarity of nucleic acids.

c) Diagrammatically illustrate the protein import in chloroplast.

P.T.O.

Q4) Write short notes on ***any four*** of the following: **[16]**

a) Denaturation of DNA and G+C%.

b) Partial double bond nature of peptide bond.

c) Waxes.

d) Cell communication among myxobacteria.

e) Morphogen gradient.

Q5) a) The amino acid analysis of an oligopeptide, 7 residues long, gave- Asp+Leu+Lys+2Met+Phe+Tyr. The following facts were observed:

i) Trypsin treatment had no apparent effect.

ii) The phenylisothiocynate reaction gave PTH-Phe.

iii) Chymotrypsin treatment yielded several products including dipeptide and a tetrapeptide. The amino acid composition of the tetrapeptide was Leu+Lys+2Met.

iv) Cynogen bromide treatment yielded a dipeptide, a tetrapeptide, and free Lys.

What is the amino acid sequence of this heptapeptide? **[10]**

b) Predict the direction of migration of peptide His-Gly-Ala-Glu during electrophoresis at pH 2, 4, 6, and 11, using the information provided in the table. **[6]**

Amino acid	**pka α-COOH**	**pka α-NH_3^+**	**pka R**
Histidine	1.8	9.2	6.0
Glycine	2.3	9.6	-
Alanine	2.4	9.7	-
Glutamic acid	2.2	9.7	4.3

Total No. of Questions : 5] **[Total No. of Pages : 2**

P728

[3925]-201

M.Sc. (Sem. - II)

MICROBIOLOGY

MB 601 : Instrumentation & Molecular Biophysics

(2008 Pattern)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***All questions carry equal marks.***
3) ***Draw neat labeled diagrams wherever necessary.***
4) ***Use of logarithmic tables, graph papers and scientific calculator is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) Attempt ***any two*** of the following: **[16]**

a) Discuss the advantages of FTIR over IR. Which of the following bonds would show the strongest absorption in the IR: carbon-hydrogen, oxygen-hydrogen, nitrogen-hydrogen, sulfur-hydrogen? Give reasons.

b) Explain the following detectors used in gas chromatography and state their advantages:
   i) Flame ionization
   ii) Thermal conductivity
   iii) Electron capture
   iv) Flame photometric

c) Compare and contrast the principles and procedures of SDS-PAGE vs Isoelectric focusing to separate proteins. Explain what information about the protein you can get by running it on each type of system.

Q2) Attempt ***any two*** of the following: **[16]**

a) Explain the principle of X-ray diffraction. How is the phase problem tackled after obtaining phases from Fourier transformation?

b) Describe the principle of NMR. Explain spin coupling between $-CH_2$ and $-CH_3$ groups in ethanol.

c) Compare various ionization methods used in Mass spectroscopy.

P.T.O.

Q3) Attempt ***any two*** of the following: **[16]**

a) Explain the principle of Ion-exchange chromatography. Justify the order of retention for Li(I), Na(I), and K(I) on a cation exchange column based on their attraction toward the resin.

b) Justify "Ramachandran Plot is useful in predicting secondary structure of protein".

c) Describe molar extinction co-efficient. Explain giving reasons, which of the following transitions is the highest energy transitions - n to σ^*, n to π^*, σ to σ^*, π to π^*.

Q4) Write short notes on ***any four*** of the following: **[16]**

a) FRET.

b) Circular dichroism.

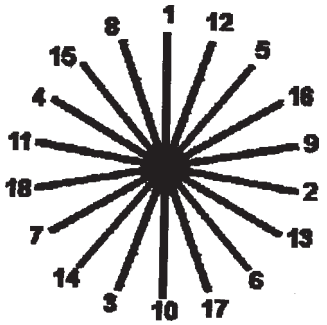
c) Liquid scintillation counter.

d) ESI-QTOF-MS.

e) Super secondary structures of protein.

Q5) Solve **[16]**

a) A useful method for visualizing the properties of a protein helix is to display the sequence on a helical wheel diagram. Construct helical wheel diagram based on a five-turn helix (18 residues). Adjacent residues in the sequence are 100º apart on the wheel and a residue occurs every 20º. The sequence is written onto the wheel in the order shown. Display the following sequence on a helical wheel and explain what information this representation provides. Ala-Phe-Asp-Lys-Met-Ile-Glu-Asn-Leu-Gln-Arg-Leu-Trp-Ser-Glu-Phe-Leu-Gln.



b) An equilibrium mixture of α and β-D-glucose has an $[\alpha]^{25}_{D}$ of +52.7º. Pure α-D- glucose has an $[\alpha]^{25}_{D}$ of +112º. Pure β-D-glucose has an $[\alpha]^{25}_{D}$ of +18.7º. Calculate the proportions of α- and β-D-glucose in the equilibrium mixture.

Total No. of Questions : 5] **[Total No. of Pages : 2**

P729 **[3925]-202**

M.Sc.

MICROBIOLOGY

MB-602 : Evolution, Ecology & Environmental Microbiology

(2008 Pattern) (Sem. - II)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***All questions carry equal marks.***
3) ***Draw neat labeled diagrams wherever necessary.***
4) ***Figures to the right indicate full marks.***
5) ***Use of logarithmic tables, electronic pocket calculator is allowed.***
6) ***Assume suitable data, if necessary.***

Q1) Attempt ***any one*** of the following: **[16]**

a) Enlist the different aerobic processes used in wastewater treatment. Describe the working of activated sludge treatment system. Explain its mass balance.

b) Discuss the concept of evolutionary r and k selection. Elaborate on the various regulatory factors.

Q2) Attempt ***any two*** of the following: **[16]**

a) Explain the term reuse, recycling and disposal. Describe microbial recycling of different solid wastes.

b) Discuss the various strategies used in the flotation unit processes.

c) Describe the growth and distribution patterns of marine microplankton, and its regulation by environmental conditions.

Q3) Attempt ***any two*** of the following: **[16]**

a) Describe the various agencies involved in speciation of sexual and asexual organisms.

b) Describe the various mycorrhizal associations with respect to host-fungus specificity.

c) Illustrate the different benevolent interactions within the microbial communities of rhizosphere.

P.T.O.

Q4) Write ***short notes*** on ***any four*** of the following: **[16]**

a) Working principle of an UASB digester.

b) Flotation unit process.

c) Industrial ETP layout for paper and pulp unit.

d) Direct and indirect reuses of treated effluent.

e) Octapines.

Q5) A wastewater has a BOD_5 of 220 mg/L. It is to be treated using a trickling filter. The MPCB limit for discharge is 15 mg/L BOD_5. The depth of the filter is 6ft and the recirculation ratio is 2:1. The influent flow rate is 25,000 liters/h. Calculate the following: **[16]**

a) The efficiency of the filter, and

b) The volume and diameter of the filter, and

c) BOD_5 loading to the filter.

Total No. of Questions : 5] **[Total No. of Pages : 2**

P732 **[3925]-302**

M.Sc.

MICROBIOLOGY

MB-702 : Molecular Biology - I

(New) (2008 Pattern) (Sem. - III)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***All questions carry equal marks.***
3) ***Draw neat-labeled diagrams wherever necessary.***
4) ***Use of logarithmic tables and electronic pocket calculators is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) Attempt ***any two*** of the following: **[16]**

a) How is the problem of linear replicons solved?

b) How does the circular DNA replicate?

c) How is a super family of a gene developed? Explain with examples.

Q2) Attempt ***any two*** of the following: **[16]**

a) Explain the control of tumor suppressor gene with reference to p53.

b) Describe the role of retrotransposons in development of cancer.

c) Describe any three types of DNA damage.

Q3) Attempt ***any two*** of the following: **[16]**

a) How is RecA protein involved in recombination?

b) How does the double strand break repair system work?

c) Why is DNA methylation important in gene imprinting?

P.T.O.

Q4) Write short notes on ***any four*** **of the following:** **[16]**

a) C-value paradox.

b) Y- family DNA polymerases

c) Pseudogenes.

d) Cot ½ value.

e) Apoptosis.

Q5) a) A diploid organism has 4.5×10^8 base pairs in its DNA. This DNA is replicated in 3 minutes. Assume all replication forks move at a rate of 10^4 base pairs per minute. How many replicons (replication units) are present in this organism's genome? **[4]**

b) Human DNA contains 20% C on a molar basis. What are the mole percents of A, G and T? **[4]**

c) A space probe returns from Jupiter and brings with it a new micro organism for study. It has double stranded DNA as its genetic material. However studies of replication of the alien DNA revel that, while the process is semi-conservative, DNA synthesis is continuous on both the leading and lagging strand templates. What conclusion(s) can you draw from the result? **[8]**

Total No. of Questions : 5] **[Total No. of Pages : 2**

P733 **[3925]-303**

M.Sc.

MICROBIOLOGY

MB-703 : Virology

(2008 Pattern) (New) (Sem. - III)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***All questions carry equal marks.***
3) ***Draw neat, labeled diagrams wherever necessary.***
4) ***Use of log tables and electronic pocket calculator is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) **Attempt *any two* of the following:** **[16]**

a) Describe the genome organization and multiplication of Cauliflower mosaic virus.

b) Explain pathophysiological changes caused by Herpes virus.

c) How are cell lines prepared in laboratory? How are they used for cultivation of viruses?

Q2) **Justify *any two* of the following:** **[16]**

a) Live attenuated Polio virus vaccine is better than killed Polio virus vaccine.

b) Retroviruses are oncogenic.

c) Nematods act as vectors for transmission of plant viruses.

Q3) **Diagrammatically illustrate *any two* of the following:** **[16]**

a) Capsid symmetries in viruses.

b) Morphogenesis during life cycle of bacteriophage T_4 in *E.coli.*

c) Nucleic acid hybridization technique for detection and identification of viruses.

P.T.O.

Q4) **Write short notes on *any four* of the following:** **[16]**

a) Viriods and prions.

b) Interferons.

c) Symptoms of viral diseases in plants.

d) Specimen preparation for electron microscopy.

e) Rules for ICTV nomenclature.

Q5) **Answer the following:**

a) When 10^9 cells of *Salmonella* sp.were exposed to its potent virus, at the end of the adsorption period there were 10^7 infected cells. Calculate the multiplicity of infection. **[6]**

b) A viral sample was sent to the laboratory to determine its infectivity. A 96 well tissue culture plate was used to check its infectivity.

The following table shows the results obtained in the laboratory.

Dilution of virus used	Row	Control well	Control well	Tissue culture wells with added viral dilutions (0.005 ml of each dilution)									
		1	2	3	4	5	6	7	8	9	10	11	12
10^{-1}	A	-	-	+	+	+	+	+	+	+	+	+	+
10^{-2}	B	-	-	+	+	+	+	+	+	+	+	+	+
10^{-3}	C	-	-	+	+	+	+	+	+	+	+	+	+
10^{-4}	D	-	-	+	+	+	+	+	+	+	+	+	+
10^{-5}	E	-	-	+	+	+	+	+	+	+	+	+	+
10^{-6}	F	-	-	+	+	+	+	+	+	+	+	-	-
10^{-7}	G	-	-	-	-	-	-	-	-	-	-	-	-
10^{-8}	H	-	-	-	-	-	-	-	-	-	-	-	-

Key- + sign indicates cytopathic effects on cells of tissue culture.
- sign indicates no cytopathic effects the cells of tissue culture.

From the above data, calculate :

a) Proportionate distance. **[4]**

b) 50% end point log over dilution. **[2]**

c) Determine TCID 50 of the viral sample **[4]**

Total No. of Questions : 5] **[Total No. of Pages : 2**

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[3925]-401

M.Sc. (Sem. - IV)

MICROBIOLOGY

MB-801 : Pharmaceutical and Medical Microbiology

(2008 Pattern) (New)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Draw neat-labeled diagrams wherever necessary.***
4) ***All questions carry equal marks.***
5) ***Use of the logarithmic tables, electronic pocket calculator is allowed.***
6) ***Assume suitable data, if necessary.***

Q1) Answer *any two* of the following: **[16]**

a) State Paul Ehrlich's postulates for drug discovery.

b) Explain the concepts in rational drug designing.

c) What are different phases of drug discovery?

Q2) Answer *any two* of the following: **[16]**

a) Explain the experimental strategies to study mode of action of drugs inhibiting bacterial cell wall synthesis, giving suitable examples.

b) Describe the factors affecting bioassay procedures for antimicrobial agents, using liquid media.

c) Explain the methods used for testing of antimycobacterial drugs, giving suitable examples.

Q3) Answer *any two* of the following: **[16]**

a) Describe the receptor mediated adhesion to host tissues by bacterial pathogens, giving suitable examples.

b) Explain mode of action and assay of diphtheria toxin.

c) Discuss the role of extracellular bacterial enzymes in pathogenesis.

Q4) Write short notes on *any four* of the following : **[16]**

a) Ames test.

b) ADME studies.

c) CLSI.

d) Role of pharmacopeia in drug development.

e) Virulence genes.

P.T.O.

Q5) Hepatitis C Virus (HCV) replication in cell culture is limited to human hepatocytes and their derivatives. HCV can replicate in Huh-7 cells through detection of viral genes as well as viral copy number by Real Time PCR in both cells and supernatant. Solvent extracts from different plants were tested to determine the antiviral activity against HCV. Real time PCR results showed that *Solanum nigrum* (SN) out of ten medicinal plants showed antiviral effect against HCV. The results demonstrated that methanolic extract of SN showed inhibition at concentration of HCV RNA at non toxic concentration (Figure 1). This extract was further fractionated in different solvents on the basis of polarity. Significant inhibition against HCV was shown by chloroform fraction of *Solanum nigrum* seeds (Figure 2).

Figure 1

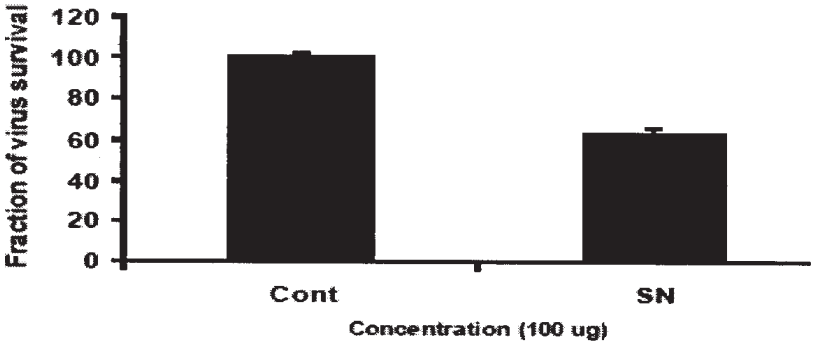
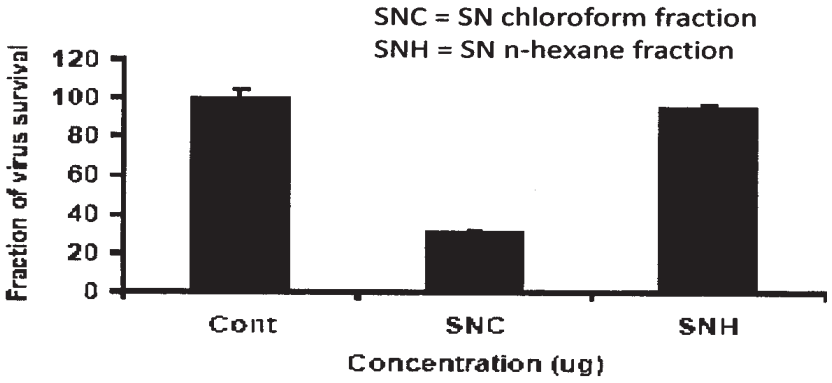


Figure 2



a) i) Interpret the data w.r.t. antiviral activity of *Solanum nigrum*.

ii) Comment on nature of compounds present in methanolic extract and two different fraction of methanolic extract. **[8]**

b) i) What are different methods of extraction of bioactive material from plants?

ii) What are the methods to determine antiviral activity of test material? **[8]**

Total No. of Questions : 5] **[Total No. of Pages : 2**

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[3925]-401

M.Sc. (Sem. - IV)

MICROBIOLOGY

MB-801 : Applied Microbial Biotechnology

(2005 Pattern) (Old)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***All questions carry equal marks.***
3) ***Draw neat-labeled diagrams wherever necessary.***
4) ***Use of logarithmic tables, graph papers and scientific calculators is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) With the help of a flow chart, describe the commercial production of Vitamin C. **[16]**

OR

Describe the advantages using immobilized cells and enzymes for overproduction of microbial metabolites. With suitable examples, explain any two applications where immobilized enzymes are used.

Q2) Attempt any two of the following: **[16]**

a) Explain the concept of 'Aeration Number' and describe how it is significant in a fermentation process.

b) Illustrate the concept of the 2-film theory of oxygen transfer to the cell from the bubble during aeration of a fermentation broth.

c) With help of a suitable example, explain the batch mode of operation of fermentation process. How is a batch mode more convenient as compared to fed-batch process?

Q3) Attempt any two of the following: **[16]**

a) Explain the use of *Trichoderma viridae* in biocontrol.

b) Draw a flow-chart for microbial leaching of copper.

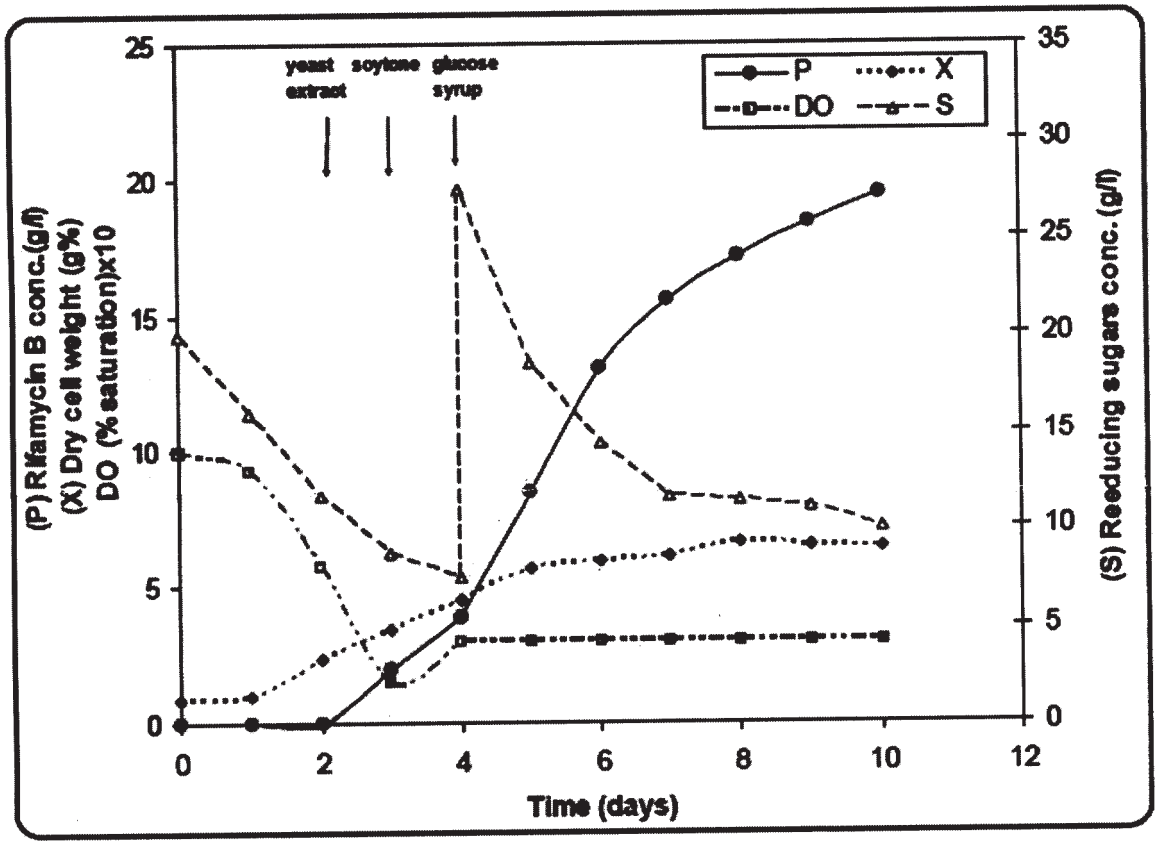
c) Explain bioremediation with the help of a suitable example.

P.T.O.

Q4) Write short notes on *any four* of the following: **[16]**

a) Siderophores.
b) DO sensors.
c) Rheology of fermentation broths.
d) Advantages of synthetic vaccines.
e) PGPRs.

Q5) An integrated fermentation process was carried out combining all of the following optimized conditions: controlled DO (1 vvm for 3 days then 30% of saturation to the end of fermentation), controlled pH (6.5 for 3 days then 7.0 to the end of fermentation) the addition of 0.1% yeast extract at day2, of 3% soytone at day 3 and of 5% glucose syrup at day 4 to F2m3 medium. These conditions afforded a yield of 17.43 and 19.4 g/l in days 8 and 10, respectively as shown in the figure below. **[16]**



a) Identify whether the process is fed-batch or batch process. Explain your answer.
b) What are the process parameters which are critical for the process?

Total No. of Questions : 5] **[Total No. of Pages : 2**

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[3925]-402

M.Sc. (Sem. - IV)

MICROBIOLOGY

MB-802 : Molecular Biology - II

(2008 Pattern) (New)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***All questions carry equal marks.***
3) ***Draw neat labeled diagrams wherever necessary.***
4) ***Use of logarithmic tables, graphs papers and scientific calculators is allowed.***
5) ***Assume suitable data, if necessary.***

Q1) Attempt ***any FOUR*** of the following with reference to RNA processing in eukaryotes. **[16]**

a) What is GU-AG rule? Elaborate with example?
b) Justify: Pre m-RNA splicing proceeds through a lariate.
c) Describe "spliceosome assembly" pathway.
d) What is autosplicing? Elaborate with suitable example.
e) Justify: t-RNA splicing involves cutting and rejoining.
f) Justify: Guide RNA is necessary for RNA editing.

Q2) Justify ***any TWO*** of the following: **[16]**

a) The "Wallace rule" is used to determine the appropriate stringency wash temperature of the membrane in Southern blotting technique.
b) Pulse field gel electrophoresis is performed when DNA of > 20 kb is to be resolved.
c) DNA microarray is used for gene expression profiling.

Q3) Comment on ***any TWO*** of the following: **[16]**

a) High capacity vectors.
b) Pyro-sequencing.
c) Non-radioactive labeling.

P.T.O.

Q4) Explain ***any TWO*** of the following with reference to transcription. **[16]**

a) Role of various sigmas in promoter recognition.

b) Rho dependent and independent termination.

c) CpG islands as control elements of transcription.

Q5) a) A space probe lands on a distant planet, takes samples of material, and analyzes their chemical makeup. Results obtained from one planet indicate that nucleic acid molecules are composed of just two kinds of nucleotides and proteins are made up of 12 types of amino acids. **[8]**

i) What is the minimal number of bases required in a code word in order to code for the 12 types of amino acids and a single terminator codon?

ii) Assume that the code is read in the same fashion (i.e., non-overlapping) as occurs in eukaryotes on Earth. What is the maximum number of amino acids that could be incorporated into proteins synthesized from single-stranded nucleic acid molecules that contain 156 nucleotides?

iii) What is the maximum number of amino acids that could be incorporated into the proteins synthesized from double-stranded nucleic acid molecules that contain 272 nucleotides if only one strand is read?

b) You are given a plasmid that contains 8kb of DNA. You wish to create a restriction map of this plasmid by performing a series of restriction digests. After the digests are complete, you perform electrophoresis on an agarose gel and after staining the gel to visualize the DNA you measure the fragment sizes. **[8]**

Restriction enzymes in reaction	Size of DNA fragment(s) in kilobases
Eco R1	8.0
HindIII	6.0, 2.0
Sal I	8.0
Xba1	3.5, 4.5
EcoR 1, HindIII	4.0, 2.0, 2.0
EcoR 1, Sal 1	1.5, 6.5
Eco1, Xba1	2.0, 3.5, 2.5
HindIII, SalI	0.5, 2.0, 5.5
HindIII, Xbal	0.5, 1.5, 2.0, 4.0

Draw a restriction map of this circular plasmid with the EcoR1 site listed as position 0/8.0kb. Indicate the position and distance of the other restriction sites based on the above analysis.

Total No. of Questions : 5] **[Total No. of Pages : 2**

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[3925]-402

M.Sc. (Sem. - IV)

MICROBIOLOGY

MB-802 : Pharmaceutical Microbiology

(2005 Pattern) (Old)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***Figures to the right indicate full marks.***
3) ***Draw neat labeled diagrams wherever necessary.***
4) ***All questions carry equal marks.***
5) ***Use of the logarithmic table electronic pocket calculator is allowed.***
6) ***Assume suitable data, if necessary.***

Q1) Answer ***any one*** of the following: **[16]**

a) Explain the toxicity testing procedures for new antibiotics.

b) Discuss the factors affecting antimicrobial assays by agar diffusion methods.

Q2) Answer ***any two*** of the following: **[16]**

a) Explain the non-specific adhesion mechanisms of bacterial pathogens.

b) Explain mode of action of cholera toxin.

c) How bacterial pathogens overcome non-specific humoral defense mechanisms of host?

Q3) Answer ***any two*** of the following: **[16]**

a) Describe the *in vitro* methods used for assay of diphtheria toxin.

b) Explain susceptibility testing of antiviral drugs.

c) Describe mutagenecity and carcinogenicity testing for drugs intended for human use.

Q4) Write short notes on ***any four*** of the following: **[16]**

a) Solvent extraction technique for bioactive materials from plants.

b) Methods to study drug interactions.

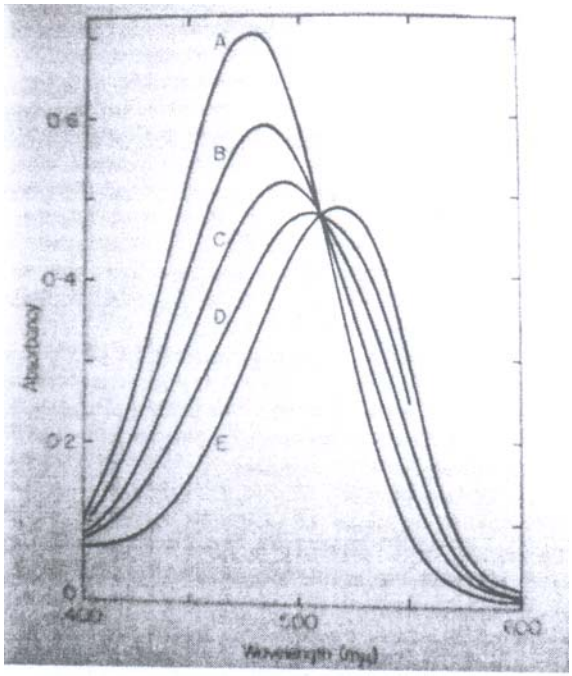
c) Role of pharmacopeia in regulation of drug manufacturing.

d) Methods to study streptomycin resistance mechanism.

e) High Throughput Screening in drug discovery.

P.T.O.

Q5) On binding of certain drugs to DNA, the complex formed is metachromatic and the typical absorption spectrum of the drug is shifted to longer wavelengths and the molar extinction coefficient at the maximum is depressed.
Shift of absorption spectrum of ethidium bromide (EtBr) in presence of DNA is shown in the figure (A = drug alone in buffer, B – E = EtBr with increasing concentrations of DNA added) **[16]**



a) Give the mode of action of EtBr on nucleic acid metabolism.
b) What are other methods to study mode of action of drugs affecting nucleic acid metabolism.

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