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

P1000

[3725] - 31
M.Sc.
MICROBIOLOGY
MB - 701 : Immunology
(2005 Pattern)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***All questions carry equal marks.***
3) ***Neat well labeled 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 one of the following: **[16]**

a) Describe polymorphism in Class I & Class II MHC molecules.

b) Enlist the key cells that may kill tumor cells. How do they destroy tumor cells? Describe the central role of interferon in regulating tumor cell killing.

c) Explain the kinetics of antigen antibody reactions.

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

a) Explain why individuals with phagocytic disorders frequently suffer from bacterial infections.

b) Describe the occurrence of various immune system components in Invertebrates.

c) Explain the regulation of classical complement pathway.

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

a) Describe the major immune-regulatory cells of our body. Explain their role in immunoregulation.

b) Explain the signal transduction by TCR : CD 3 complex.

c) Describe the role of BRMs.

P.T.O.

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

a) SLE.

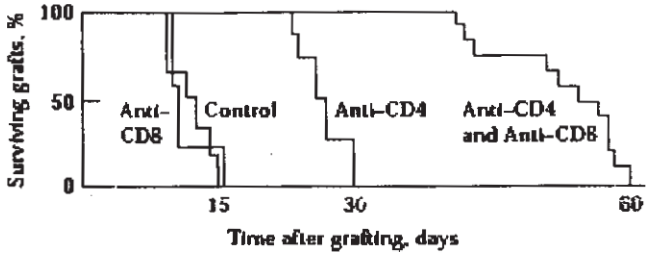
b) Alfa fetoprotein.

c) Mechanism of tolerance induction.

d) Western blotting.

e) Animal models for autoimmunity.

Q5) Given below is the actuarial curve showing survival times of skin grafts between mice mismatched at the MHC and treated with anti-CD8 antibody or anti-CD4 antibody or a combination of both antibodies. **[16]**



a) Give the mechanism of allograft rejection.

b) Explain the role of CD4 and or CD8 cells in rejection of allograft.

c) How allograft rejection is prevented?

❖ ❖ ❖ ❖

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

P1001

[3725] - 32
M.Sc.
MICROBIOLOGY
MB - 702 : Molecular Biology - I
(2005 Pattern)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***All questions carry equal marks.***
3) ***Neat well labeled 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) How is higher order structure of chromatin formed?

b) Explain ATP dependent and ATP independent events in DNA replication.

c) How mismatch repair of heteroduplex leads to gene conversion?

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

a) How DNA replication is connected to cell cycle in *E.coli*?

b) What are the characteristics of genetic code?

c) How Ras genes finely balanced at the edge of oncogenes?

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

a) Error proof DNA repair mechanism.

b) Tn 10 transposons.

c) C-value paradox.

P.T.O.

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

a) Sangers Di-deoxynucleotide method.

b) Holliday Model of recombination.

c) Base excision repair.

d) Zinc motifs.

e) P53 Proteins.

Q5) Dr. Franklin Stein, a classical anatomist by training, has developed an interest in genetic engineering and directed evolution. In a preliminary investigation of specific amino acid conversions, he has been studying a protein of unknown function from the bacteriophage λ. Using hydroxylamine, he isolates a mutant *a*, which makes only a fragment of the wild type protein. Upon treatment of mutant *a*, with 2-aminopurine, he is able to isolate two additional mutants, *b* and *c*, which also make only fragments of the wild type protein. Mutants *a*, *b* and *c* are nonviable on most of the bacterial strains, but can be propagated and distinguished by their growth on suitable nonsense-suppressing strains of bacteria as indicated in the following table. When mutant *a* is mated to either mutant *b* or *c*, no recombinants that will grow on an Su^- host are produced. However, viable recombinants are produced in a mating of mutants *b* and *c*.

What one amino acid difference exists between the protein from the wild type bacteriophage and that from a variable recombinant from the mating of mutants *b* and *c*?

Table : Growth of Three Bacteriophage Mutants on Non suppressing and Suppressing Bacterial Strains. **[16]**

	Su^-	Su2	Su4	Su9
Mutant *a*	-	-	+	-
Mutant *b*	-	+	+	-
Mutant *c*	-	-	-	+

Note : - : No growth; + : Growth

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

P1002

[3725] - 33

M.Sc.

MICROBIOLOGY

MB - 703 : Biophysics, Instrumentation and Bioinformatics

(2005 Pattern)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***All questions carry equal marks.***
3) ***Neat well labeled 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) Explain the principle behind protein gel electrophoresis. Differentiate between native and SDS gel electrophoresis.

b) Explain the principle behind gel filtration chromatography. What will be effect of column size on the separation of proteins? How can we determine the molecular weight of the protein using gel filtration chromatography?

c) Explain the working and applications of gas liquid chromatography.

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

a) Explain isomerism with respect to the structures of amino acids. Which amino acid is an exception? Draw Fisher projection for an L-amino acid.

b) Describe the construction and working of MALDI TOF. Explain the concept of time of flight.

c) What is nuclear resonance spectroscopy (NMR)? Explain the terms Chemical Shift and Spin-spin coupling in NMR.

P.T.O.

Q3) Attempt <u>any two</u> of the following : **[16]**

a) Explain neural networks method for protein secondary structure determination.

b) Explain the dynamic programming method for pair wise sequence alignment. How will you align two sequences ATTGC and AGGC if the identical match is assigned a score of 1, mismatch a score 0 and gap penalty is - 1?

c) What are scoring matrices? How do they help in finding similarity between proteins?

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

a) Anomalous scattering in X-ray diffraction.

b) Homology based protein structure determination.

c) Dynamic programming for sequence alignment.

d) Relative Centrifugal Force.

e) Pulse chase experiment.

Q5) Solve : **[16]**

a) A solution containing 10^{-5} M ATP has a transmission 70.2% at 260nm in a 1 cm cuvette. Calculate the

i) Transmission of the solution in a 3cm cuvette.

ii) Absorbance of the solution in the 1cm and 3cm cuvettes and

iii) Absorbance and transmission of a 5×10^{-5}M ATP solution in a 1cm cuvette.

b) You have a mixture of proteins with the following properties :

Protein 1 : MW 12,000, pI = 10

Protein 2 : MW 62,000, pI = 4

Protein 3 : MW 28,000, pI = 8

Protein 4 : MW 9,000, pI = 5

Predict the order of elution of these proteins when a mixture of four is chromatographed in the following system :

i) DEAE cellulose at pH 7, with a linear salt gradient elution.

ii) CM cellulose at pH 7, with a linear salt gradient elution.

iii) A gel exclusion column with a fraction range of 1,000 - 30,000 MW at pH 7.

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

P1003

[3725] - 41

M.Sc.

MICROBIOLOGY

MB - 801 : Applied Microbial Biotechnology

(2005 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) ***Figures to the right indicate full marks.***
5) ***Use of logarithmic tables, electronic pocket calculator is allowed.***
6) ***Assume suitable data, if necessary.***

Q1) Draw a flow chart and describe the commercial production of Tetracycline. **[16]**

OR

Delineate 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) Describe the design of and flow characteristics produced by a Marine propellor.

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

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

P.T.O.

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

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

b) Explain the structure of the parasporal body of *Bacillus thuringiensis* and the action of the endotoxin.

c) Draw and explain the construction of the DO probe.

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

a) Siderophores.

b) Use of Trichoderma in biocontrol.

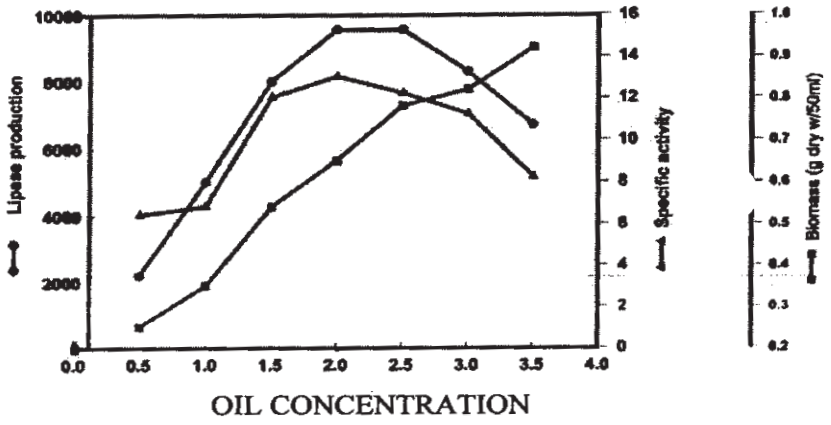
c) Role of PGPPs in metal sequestration.

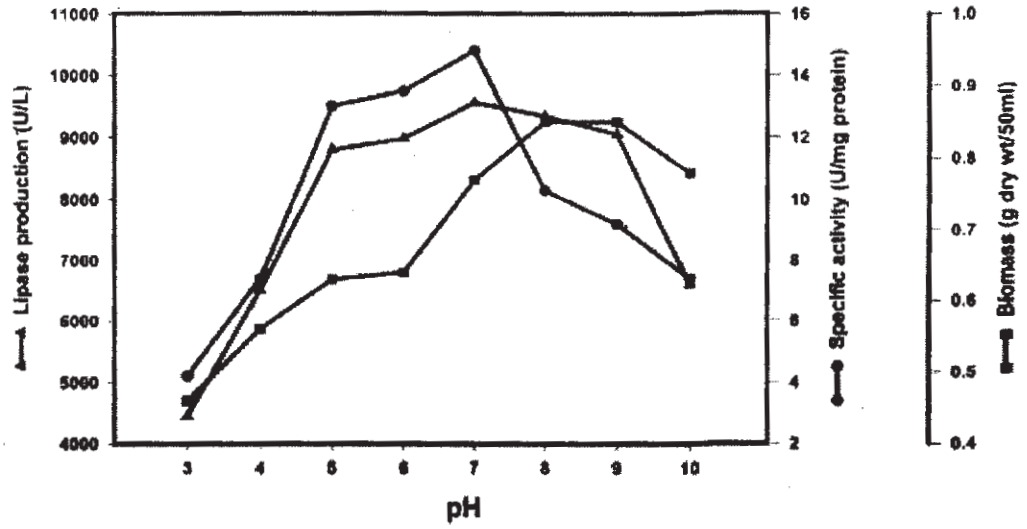
d) Power Number.

e) Advantages of synthetic vaccines.

Q5) The Table and graphs shown below gives the production of Lipase in shake flasks, using different oils as substrates. **[16]**

Oil	Lipase production (U/L)	Specific activity (U/mg protein)	Biomass (g dry wt/50 ml)
Olive	2080 ± 45	7.09 ± 1.01	0.37
Corn	3330 ± 54	5.43 ± 0.30	0.53
Sunflower	948 ± 65	2.97 ± 0.56	0.19
Groundnut	2650 ± 19	4.56 ± 0.33	0.30
Coconut	1080 ± 10	2.96 ± 0.90	0.20
Mustard	2765 ± 101	3.99 ± 0.49	0.33
Walnut	1840 ± 75	2.97 ± 0.66	0.20
Vegetable	2695 ± 45	1.01 ± 0.36	0.55
Tallow	1341 ± 26	4.57 ± 0.98	0.22
Amla	1690 ± 85	3.01 ± 0.11	0.43
Jasmine	2450 ± 45	4.56 ± 0.25	0.36
Neem	8976 ± 60	12.56 ± 0.31	0.52
Castor	3501 ± 10	5.99 ± 0.66	0.47
Rose	830 ± 75	1.97 ± 0.71	0.15
Almond	1050 ± 84	2.95 ± 0.36	0.20
Watermelon seeds	868 ± 95	2.11 ± 0.37	0.10





Interprete the results and answer the following question :

1. Which would be the best substrate and medium composition (including initial pH) for maximum production of Lipase? Give your reasons.

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

P1004

[3725] - 42

M.Sc.

MICROBIOLOGY

MB - 802 : Pharmaceutical Microbiology

(2005 Pattern)

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

Instructions to the candidates:

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

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

a) Explain the *in vitro* and *in vivo* evaluation of a drug.

b) Explain the role of bioinformatics in the study of a drug.

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

a) Write in brief about the phases of clinical trials for a drug.

b) What is the role of cheminformatics in the study of a drug?

c) Enlist FDA guidelines for evaluation of drug.

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

a) How do the drugs interfere in the protein synthesis? Give the probable reasons for the resistance developed in the cells.

b) How will you assay an antimicrobial in agar medium?

c) Explain briefly about the toxicity and allergy testing for new antibiotics.

P.T.O.

Q4) Write short notes on (any four) : **[16]**

a) Action of fusidic acid.

b) Nitrofurans.

c) Anti-viral agents.

d) Tolerability testing.

e) Adhesins.

Q5) Extract of *aloe vera* showed an excellent zone of inhibition against clinical strains of *Staphycoccus aureus*. What will be your steps to assess this extract before you actually try on human beings? Explain in detail. **[16]**

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

P1005

[3725] - 43

M.Sc.

MICROBIOLOGY

MB - 803 : Molecular Biology - II

(2005 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 labelled diagrams wherever necessary.***

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

a) How does foot printing identify DNA binding sites for proteins?

b) Give structural features of prokaryotic ribosome.

c) Comment on : attenuation control in trp operon.

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

a) Bacterial RNA polymerase is multimeric protein.

b) Cosmid is a better vector than a plasmid.

c) Pulse field gel electrophoresis is carried out for the DNA fragments with M.W. > 20kb.

Q3) Schematically/diagrammatically represent any two of the following : **[16]**

a) Dual control of arabinose operon.

b) First two cycles in PCR.

c) Cloning of human insulin gene in *E.coli*.

P.T.O.

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

a) Key features YAC.

b) Fluorochromes in RT-PCR.

c) Initiation factors in prokaryotic transcription.

d) Molecular basis of antibody diversity.

e) Probes used in molecular biology.

Q5) a) A gene encodes a polypeptide 30 amino acids long containing an alternating sequences of phe (UUU) and tyr (UAC)

What are the sequences of nucleotides corresponding to this sequence in the following :

i) The DNA strand that is read to produce the mRNA.

ii) The DNA strand that is not read.

iii) The anticodon on tRNA. **[8]**

b) You have analyzed a cell lysate for its RNA components by various techniques. Following are the observations. Identify the type of molecule that best fits the observation giving reasons.

Observation No. 1) A molecule with a short half life and heterogenous M.W.

Observation No. 2) Molecules that form bands at distinct positions after centrifugation

Observation No. 3) Molecules that form a diffused single band in gel electrophoresis.

Observation No. 4) Molecules that form separate bands in gel electrophoresis. **[8]**

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

P1006

[3725] - 101

M.Sc.

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) Describe the unique salient features of Archaea important in their taxonomy.

b) Explain the importance of lipid analysis in bacterial taxonomy.

c) Explain the various indices used to measure the microbial diversity.

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

a) Describe the advantages of RNA homology analysis over other conventional homology analysis in taxonomy.

b) Explain using block diagram the full-length approach to characterize microorganisms without the need of cultivation.

c) Describe the use of scoring matrices and gap penalties in sequence alignment.

P.T.O.

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

a) Illustrate the major steps involved in rRNA sequencing to be applied for taxonomic studies.

b) Explain the need and techniques of extracting total bacterial DNA from a habitat.

c) Describe the proceedings involved in Needleman-Wunsch algorithm.

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

a) Protein profiles in taxonomy.

b) Chromosomal transfer as a tool in taxonomy.

c) Application of FISH in bacterial diversity.

d) Compare PSI-BLAST and PHI-BLAST.

e) Environmental clone libraries.

Q5) A water sample from a sulfur spring was analyzed for its bacterial content. Microscopic observations indicated a bacterial load in the order of 10^6 cells/ml. On examination by standard plating techniques on conventional nutrient media, the viable counts obtained were in the order of 10^4 CFU/ml.

Explain the reason for the difference in count by these two methods.

Describe the method(s) by which this difference in count could be nullified. **[16]**

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Total No. of Questions : 5] **[Total No. of Pages : 4**

P1007

[3725] - 102
M.Sc.
MICROBIOLOGY
MB - 502 : Quantitative Biology
(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 statistical tables and calculator is permitted.***
5) ***Assume suitable data if needed.***

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

a) Describe the various measures of central tendency. State merits and demerits of arithmetic mean.

b) In a survey of 198 farmers the following data was obtained.

Land Owned	Awareness		
	Low	Medium	High
High (>5h)	40	12	10
Medium (1h - 5h)	22	10	14
Low (<1h)	22	26	42

Test of the association of the extent of land owned with the awareness. Use 5% level of significance.

c) Following are the figures recorded for supply and price for nine years of a commodity. Obtain the regression equation of price on supply.

Years	1981	1982	1983	1984	1985	1986	1987	1988	1989
Supply	80	82	86	91	83	85	89	86	92
Price	145	140	130	124	133	127	120	110	114

Also estimate the most likely price when supply is 90.

P.T.O.

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

a) Define the following terms :

i) Type 1 error.

ii) Level of significance.

iii) Null hypothesis.

iv) Standard error.

b) The dissolved oxygen of water of a river connected by an effluent channel of a caustic chlorine was measured at 3 different stations. First station was situated at a distance of 250m upstream, second station at the region of confluence of the effluent channel and the third at a distance of 250m downstream. The results are shown as mg of O_2 per liter of water.

Location of stations along the river		
I Upstream	II Middle Zone	III Downstream
5.2	3.8	4.8
4.9	3.3	4.9
5.3	3.5	4.7
4.8	3.7	5
5.1	4	5.1

Perform an analysis of variance to show whether there are significant differences in the dissolved O_2 of the river water at the 3 stations. Use 1% level of significance.

c) If the capacities of the cranial cavities of a certain population are approximately normally distributed with a mean of 1400 cc and a standard deviation of 125, find the probability that a person randomly picked from this population will have a cranial cavity capacity :

i) Greater than 1450 cc.

ii) Less than 1350 cc.

iii) Between 1300 cc and 1500 cc.

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

a) Write short note on the following :

i) Correlation.

ii) Binomial distribution.

b) Grain lengths of two varieties of rice are given below. Calculate the mean and coefficient of variation of grain length of the two varieties. Which variety is more consistent? Why?

Variety A		Variety B	
Grain Length mm	No. of Grains	Grain Length mm	No. of Grains
8-10	4	8-10	1
11-13	6	11-13	3
14-16	5	14-16	2
17-19	3	17-19	4
20-22	2	20-22	3

c) i) Draw a frequency polygon for the following data :

Monthly house rent	500-700	700-900	900-1100	1100-1300	1300-1500	1500-1700
No. of Families	6	16	24	20	10	4

ii) In a certain population an average of 13 new cases of esophageal cancer are diagnosed each year. If the annual incidence of esophageal cancer follows a poisson distribution, find the probability that in a given year the number of newly diagnosed cases of esophageal cancer will be :

1) Exactly 10.

2) Fewer than 2.

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

a) Population interaction.

b) Uses of Internet in Biology.

c) Use of computers in biology.

d) t-test.

e) Variable and Attribute.

Q5) Attempt any two of the following : **[16]**

a) Explain SIR model to study disease epidemiology.

b) What is modeling? State the applications of modeling in biology.

c) Explain in brief logistic growth model.

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

P1008

[3725] - 103
M.Sc.
MICROBIOLOGY
MB - 503 : Cell Organization and Biochemistry
(2008 Pattern)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***All questions carry equal marks.***
3) ***Neat well labeled 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) Describe the protein transport between ER and cell organelles.

b) What is cytoskeleton? Explain its biological significance.

c) What is quorum sensing? Explain its role in virulence of pathogenic bacteria.

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

a) Justify. "Many weak non-covalent interactions stabilize the three dimensional structure of proteins".

b) Justify. "Even if RNA is single stranded it can possess extensive secondary structure".

c) Describe the classification of phospholipids with suitable examples.

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

a) Diagrammatically illustrate the process of gastrulation in *Drosophilla*.

b) Diagrammatically illustrate the D-series of aldoses.

c) Compare and contrast between organization of genomic and organelle DNA.

P.T.O.

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

a) Tocopherol.

b) Mutarotation.

c) Hox code.

d) Keto-enol tautomerism.

e) Edman's degradation.

Q5) Solve :

a) A mixture of following amino acids is subjected to electrophoresis at pH 3.9: Ala (pl = 6.01), Leu(pl = 5.98), Arg (pl = 10.76), Asp (pl = 2.77), His (pl = 7.59). Which ones will go toward anode (-)? Which ones will move towards cathode (+)? Why? **[8]**

b) Is it possible to separate amino acids by the abovementioned method.**[2]**

c) The K_a for formic acid is 1.78×10^{-4}M. What will be the pH of 0.1M solution of formic acid? **[6]**

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

P1009

[3725] - 201
M.Sc.
MICROBIOLOGY
MB - 601 : Instrumentation and 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) ***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 two* of the following : **[16]**

a) Describe the construction and working of Gas Chromatography. How does the peak height get affected with change in split ratio?

b) Give applications of Gel Filtration Chromatography. Does the shape of proteins affect the elution and why?

c) Explain the principle of Fluorescence Spectroscopy. Describe use of Fluorescence Spectroscopy in binding studies and protein folding studies.

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

a) Explain the instrumentation required for X-ray Crystallography. What are planes in a crystal? Explain with diagram the Miller Indices of (100) in a simple cuboid.

b) What is the principle of NMR Spectroscopy? Explain the terms chemical shift coupling constant and NOE.

c) Give the basic principle of Mass spectrometry. Explain how a TOF instrument works.

P.T.O.

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

a) Explain the concept of Ramchandran plot. How do various angles in polypeptide chain decide the structure of proteins?

b) How are the prediction of secondary structures done by the Chou-Fasman method? State how it is different from GOR method.

c) Give the principle of Tracer Technique. Give applications of Tracers in biology.

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

a) Iso-electric focusing.

b) X-ray Diffraction.

c) Isopycnic Centrifugation.

d) Beer Lambert Law and its limitations.

e) Super Secondary structures of protein.

Q5) Solve : **[16]**

a) i) Predict the order of elution when a mixture containing the following compounds is passed through a column containing a gel that excludes all proteins of molecular weight 200,000 and higher : cytochrome *c* (Mr = 13,000), tryptophan synthetase (Mr = 17,000), hexokinase (Mr = 96,000), ATP sulfurylase (Mr = 440,000), glucose oxidase (Mr = 154,000), and xanthine oxidase (Mr = 300,000).

ii) What factors other that molecular weight will influence the elution volume of a protein from a Sephadex column?

b) A solution containing 10^{-5}M ATP has a transmission 0.702 (70.2%) at 260 nm in a 1 cm cuvette.

Calculate the :

i) Transmission of the solution in a 3cm cuvette,

ii) Absorbance of the solution in the 1cm and 3cm cuvettes, and

iii) Absorbance and transmission of a 5×10^{-5}M ATP solution in a 1cm cuvette.

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

P1010

[3725] - 202

M.Sc.

MICROBIOLOGY

MB - 602 : Evolution, Ecology and Environmental Microbiology

(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) ***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) Explain how a malfunctioning settler-clarifier can adversely affect the efficiency of an activated sludge process. Give relevant equations for mass balance in explaining the feature.

b) Discuss the evolutionary stability of cooperation among microorganisms. Explain with suitable examples how the cooperative and competitive interactions influence this stability.

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

a) Describe the advantages and disadvantages of various granular medium filters used for wastewater treatment.

b) Discuss the bacterial growth in the marine ecosystem and its regulation by environmental conditions.

c) Discuss mycorrhizal associations with special reference to host-fungus specificity and interactions with non-host plants.

P.T.O.

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

a) Discuss the diversity of secondary metabolites in the evolutionary context.

b) Elaborate on the mode of action of various plant products as antimicrobial agents.

c) Describe the reaction mechanisms of chemical precipitation, as a unit process in the treatment of wastewaters.

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

a) Working principle of an UASB digester.

b) Reuse of treated solid wastes.

c) Industrial ETP layout for dairy waste.

d) Neo-Darwinism.

e) Significance of DOM in marine ecosystem.

Q5) A wastewater has the following characteristics : **[16]**

Flow rate : 10200 m^3/d

BOD_5: 290 mg/L

The process by which it is to be treated is the activated sludge process with recycle. The MPCB has imposed a discharge limit of BOD_5 = 10 mg/L. Assuming MLSS in the aeration basin = 3750 mg/L, MLSS in clarifier sludge = 13500 mg/L, MCRT = 8 days, kinetic coefficients, kd = 0.06 d^{-1} and Y = 0.6,

Determine the following :

a) The hydraulic retention time.

b) The mass of sludge wasted daily.

c) The F/M ratio.

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

P1011

[3725] - 203
M.Sc.
MICROBIOLOGY
MB - 603 : Microbial Metabolism
(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) What is ΔG, ΔG° and $\Delta G^{\circ\prime}$? What is their significance in biochemical reactions?

b) Derive Adair equation for dimeric protein and state its significance.

c) Describe the energy generation pathway in denitrifiers.

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

a) Justify : Aerobic microorganisms have more energy efficient metabolism than anaerobes.

b) Justify : Concentration of reduced metabolites in the cell regulates photosynthetic activity in plants.

c) How is ammonia assimilated into biomolecules?

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

a) Explain with the help of diagram nitrogen fixation in microorganisms.

b) Derive the rate equation for competitive inhibition using King Altman's approach.

c) Describe biosynthesis of aromatic amino acids.

P.T.O.

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

a) Water splitting complex.

b) Oxidation reduction potential.

c) Photosynthetic apparatus of bacteria.

d) Ammonia oxidation.

e) F_1 - F_0 ATPase.

Q5) Solve : **[10]**

a) The following kinetic data were obtained for an enzyme in the absence of inhibitor (1) and in presence of inhibitor (2). Assume that $[E_T]$ is same for both experiments. Determine the V_{max} and K_m for the enzyme in presence and absence of inhibitor and comment on type of inhibition.

[S] mol/L	(1) V(µmol/min)	(2) V(µmol/min)
1×10^{-4}	28	17
1.5×10^{-4}	36	23
2.0×10^{-4}	43	29
5.0×10^{-4}	65	50
7.5×10^{-4}	74	61

b) If for the half reactions the ε_o' values are as follows **[6]**

i) $NAD^+ + 2H^+ + 2e^- \longrightarrow NADH + H^+$ $\varepsilon_o' = -0.32V$.

ii) α-Ketoglutarate + CO_2 + $2H^+$ + $2e^- \longrightarrow$ Isocitrate $\varepsilon_o' = -0.38V$

Calculate the $\Delta G^{\circ\prime}$ for the reaction catalyzed by isocitrate dehydrogenase in TCA cycle.

(F = 96.485 KJ/V.mol, R = 8.314J/mol, Temp = 25°C).

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

P1012

[3725] - 301

M.Sc.

MICROBIOLOGY

MB - 701 : Immunology

(2008 Pattern)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***All questions carry equal marks.***
3) ***Neat well labeled diagrams must be drawn 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) Explain various methods to detect humoral deficiencies.

b) Explain the immune mechanism to intracellular infections.

c) Describe the host immune response to tumors.

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

a) Describe the mechanisms of tolerance induction.

b) Comment on diversity of TCR.

c) Discuss status of immune system components in vertebrates.

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

a) Explain use of inbred animals in immunology research.

b) Describe the regulation of classical pathway of complement activation.

c) Describe in detail the pathophysiology of Asthma.

P.T.O.

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

a) Hemolytic plaque assay.

b) Hodgkin's disease.

c) General properties of cytokines.

d) SLE.

e) Diagnosis of herpes virus infection.

Q5) A study was carried out to evaluate the potential of circulating immune complexes (CIC) as marker for disease progress in oral cancer. The study included : **[16]**

a) 60 patients (36 males and 24 females) with primary oral squamous cell carcinoma of the buccal mucosa, ranging in age from 30 to 75 years (median age 52.5 years). Histopathologically the tumors were categorized as : well differentiated squamous cell carcinoma (WDSCC), moderately differentiated squamous cell carcinoma (MDSCC) and poorly differentiated squamous cell carcinoma (PDSCC); with 20 cases in each category.

b) Patients with precancerous lesions : premalignant lesions consisting 20 oral leukoplakias (OL) (12 males and 8 females) and 20 oral submucous fibrosis (OSMF) (13 males and 7 females) ranging in age from 23 to 60 years (median age 41.5 years).

c) Normal subjects : 40 normal subjects (22 males and 18 females) ranging in age from 25 to 60, who were not having any major illness in the past. Circulating immune complexes were separated by PEG-mediated precipitation technique and developed turbidity was quantitated spectrophotometrically. The levels of CIC as turbidity values at 450 nm in different subjects are :

Subjects	Number of samples	Range	Mean	SD	SE	% positive samples
Normal	40	0.010-0.046	0.02315	0.013461	0.00246	-
OL	20	0.013-0.085	0.03817	0.016808	0.00376	15
OSMF	20	0.045-0.253	0.1871	0.054718	0.0173	90
WDSCC	20	0.040-0.153	0.08912	0.032887	0.00735	92
MDSCC	20	0.100-0.162	0.1129	0.016603	0.00371	100
PDSCC	20	0.150-0.435	0.3051	0.090199	0.0202	100

Analyze the data using convenient statistical tools and discuss the pros and cons of CIC as prognostic tool in oral cancer.

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

P1013

[3725] - 302

M.Sc.

MICROBIOLOGY

MB - 702 : Molecular Biology - I

(2008 Pattern)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***All questions carry equal marks.***
3) ***Neat well labeled diagrams must be drawn 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) How is the problem of linear replicons solved?

b) How does phage DNA replicate?

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

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

a) How RecA protein involved in recombination?

b) How Transcription coupled repair system works?

c) How DNA methylation controls gene imprinting?

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

a) Tumor suppressor gene with reference to RB.

b) Retrotransposons and cancer.

c) Different types of DNA damages.

P.T.O.

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

a) T_7 DNA polymerase.

b) Y-family DNA polymerases.

c) NHEJ.

d) Cot ½ value.

e) Src Kinase.

Q5) a) Mouse memory tumor virus (MMTV) is an oncogene retrovirus that cause breast cancer in mice when it integrates in to the genome. You want to know whether it carries its own oncogene or generates an oncogene upon integration. You isolate 26 different breast cancers from mice that were exposed to MMTV and determine the sites at which the retroviruses are integrated. In 18 of 26 tumors the viruses are found at a variety of sites that are all located within a 20 kb segment of the mouse genome. Upon closer examination of these 18 tumors, you find that an RNA is expressed from the region of the mouse genome near the integrated virus, but not from the corresponding region in normal mouse breast cells. Do these observations argue for MMTV carrying an oncogene or for it generating an oncogene upon integration? Explain your reasoning. **[10]**

b) Human DNA contains 20%C on a molar basis. What are the mole percents of A, G and T? **[6]**

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

P1014

[3725] - 303
M.Sc.
MICROBIOLOGY
MB - 703 : Virology
(2008 Pattern)

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

Instructions to the candidates:

1) ***All questions are compulsory.***
2) ***All questions carry equal marks.***
3) ***Neat well labeled diagrams must be drawn 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) Explain *in vivo* technique for cultivation of viruses.

b) Describe the pathophysiology of Herpes virus infection.

c) Comment on-Cellular sites for replication of plant viruses.

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

a) Explain the morphogenesis of T_4 phage.

b) How are nematodes responsible for transmission of plant viruses?

c) What is micro-array DNA chip?

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

a) Comment on the need for development of recombinant DNA vaccine.

b) How are indicator plants used to detect viruses?

c) Name the criteria used for classifying animal viruses as per ICTV classification.

P.T.O.

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

a) Capsid symmetries.

b) Primary cell lines.

c) Epidemiology of Newcastle disease.

d) Disease forecasting.

e) EID_{50}.

Q5) A series of progressive dilutions of a viral stock was made in saline. 0.2ml of each dilution was injected in every mouse of a group of 10 mice. The mice were observed for infection. The observations are given in the following table. Find out the dose at which 50% of the mice shoed infection. **[16]**

Dilution used	Infection ratio
1:2	10/10
1:4	10/10
1:8	6/10
1:16	3/10
1:32	0/10

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

P1015

[3725] - 401
M.Sc.
MICROBIOLOGY
MB - 801 : Pharmaceutical and Medical Microbiology
(2008 Pattern)

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

Instructions to the candidates:

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

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

a) Explain the various phases involved in discovery of a drug.

b) Illustrate the bioassay technique of antibacterial agents as per CLSI guidelines and factors affecting the same.

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

a) Explain the safety profile assessment of drugs.

b) Brief the mechanisms involved in invasion and adhesion of a virulent bacteria.

c) Explain the validation criteria for biologicals.

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

a) Describe the mechanism of bacterial resistance to host cellular defenses.

b) With suitable example discuss the mode of actions of endotoxin.

c) Explain the carcinogenicity testing of drugs.

P.T.O.

Q4) Write short notes on (*any four*) : **[16]**

a) LD_{50}.

b) Mutagenicity testing.

c) FDA guidelines for drugs.

d) Pharmacokinetics.

e) Antimycobacterial testing.

Q5) The table below shows in vitro susceptibility of clinical mold isolates to itraconazole as determined by the microdilution technique

Species (No. of species)	MIC (µg/ml)		
	Range	50%	90%
Fusarium spp. (13)	>8	>8	>8
A.flavus (10)	0.25-1	0.25	1
A.fumigatus (12)	0.5-1	1	1

a) Comment on the scientific data given above with respect to inhibition of Fusarium sp. and Aspergillus sp. by itraconazole. **[8]**

b) How do azoles act in human cells? **[4]**

c) Define MIC, MBC and IC_{50}. **[4]**

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

P1016

[3725] - 402

M.Sc.

MICROBIOLOGY

MB - 802 : Molecular Biology - II

(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 scientific calculator and log table 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 aminoacyl t-RNA in translation.

c) Explain non coding RNAs and their role.

Q2) With reference to transcription and translation in eukaryotes, describe any four from the following : **[16]**

a) Structure of typical eukaryotic promoter.

b) Assembly of basal apparatus and RNA pol. II.

c) Post translational modifications.

d) Protein splicing.

e) Active centers of ribosomes.

P.T.O.

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

a) Northern and Western hybridization technique.

b) RFLP.

c) PCR.

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

a) Site directed mutagenesis for protein engineering.

b) Genome mapping and sequencing.

c) DNA footprinting.

Q5) Your first task as a newly arrived post doc in the laboratory of Dr. Ursh is to analyze the structure of the shellase gene from the Bulgarian spotted grosbeak. Luckily, your professor, Dr. Klassik, has left you a small, but very pure preparation of mRNA of this protein. The mRNA is 9.5 kb in length. As the starting material for your study, you prepare whole genomic DNA from the spotted grosbeak. Using the R.E. BamHI, EcoRI, Hind III, and Sall, in all combinations, you digest the DNA and subject it to electrophoresis on an agarose gel. You than do the southern transfer from the gel to nitrocellulose paper. As a probe you take half of the Dr. Klassiks mRNA preparation and incubate it with γ32P-ATP and polynucleotide kinase to radioactively label 5' end. You then hybridize the probe to the DNA on the nitrocellulose After washing off unhybridized probe, you autoradiograph the filter. Table lists the sizes of bands seen after overnight exposure. You know from Klassiks former work that there are about 20 copies of the shellase gene per haploid genome.

a) Draw the diagram of the restriction map of the gene. **[4]**

b) What, if any, are the unusual features of the gene structure? **[4]**

c) The boss is still not satisfied, and wants a better autoradiogram for publication. You leave another sheet of film on the filter-this time for 3 days. You are aghast at the results! Table shows your data. How would you explain the extra bands? **[4]**

d) Can you say how large this piece of DNA is? Why or Why not? **[4]**

Table : Sizes of fragments identified by southern transfer in digests of Grosbeak genomic DNA[a].

Enzyme	Fragments (kb)	
	Overnight exposure	Three-day exposure
EcoRI	10	10,7*
EcoRI + HindIII	6,4	7*, 6,4
EcoRI + BamHI	9,1	9,6*,1
EcoRI + Sal I	6,4	7*,6,4
HindIII	10	17*, 10
HindIII + BamHI	5(dark)	7*, 5(dark)
HindIII + Sal I	8,2	15*, 8,2
Sal I	10	17*, 10
Sal I + BamHI	7,3	7,3
BamHI	10	10, 7*
EcoRI + HindIII + BamHI	5,4,1	6*,5,4,1
EcoRI + HindIII + Sal I	4(dark),2	7*,4(dark),2
EcoRI + BamHI + Sal I	6,3,1	6,3,1
EcoRI + BamHI + HindIII + Sal I	4,3,2,1	6*,4,3,2,1

i) Restriction digests were probed with purified ^{32}p labeled shellase mRNA.

ii) Astriks indicate faint bands, less than 10% as intense as the main bands.

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

P1017

[3725] - 403

M.Sc.

MICROBIOLOGY

MB - 803 : Microbial Technology

(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) ***Figures to the right indicate full marks.***
5) ***Use of logarithmic tables, electronic pocket calculator is allowed.***
6) ***Assume suitable data, if necessary.***

Q1) With the help of a diagram, describe the construction of an air-lift bioreactor. State the situations in which an air-lift bioreactor is used and explain the advantages of an air-lift bioreactor over a conventional CSTR. **[16]**

OR

Describe the production of Rifamycin. Delineate the critical operating parameters for Rifamycin production.

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

a) 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?

b) What is "Validation" in context with process qualification? Explain with a suitable example.

c) Explain the principle, construction and operation of a DO sensor.

P.T.O.

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

a) What is kLa? Explain its significance in determining aeration rate and how is it measured.

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

c) Explain why the form of mycelial growth during a fermentation process is important in context with product yield.

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

a) N_{Re}.

b) Limitations of continuous culture in fermentation processes.

c) OTR.

d) Non-Newtonian fluids.

e) Forms of IPR.

Q5) The tables given below show the effect of additional carbon and nitrogen sources on chitinase production by Streptomyces sp. The basal medium used was Chitin-Yeast extract-Salts (CYS) medium. **[16]**

Table 1 : Influence of additional carbon sources On chitinase production by *Streptomyces*

Carbon sources	Chitinase activity ($U.mL^{-1}$)	± SD
*Control	6.98	± 0.17
Starch (0.2%)	7.22	± 0.08
Starch (0.4%)	6.14	± 0.30
Glucose (0.2%)	4.16	± 0.21
Glucose (0.4%)	1.45	± 0.07
Cellulose (0.2%)	6.5	± 0.14
Cellulose (0.4%)	6.12	± 0.05
Maltose (0.2%)	6.19	± 0.51
Maltose (0.4%)	6.05	± 0.26
Arabinose (0.2%)	3.06	± 0.19

* CYS medium with 1% chitin; Mean ± SD from three experiments

Table 2 : Influence of additional nitrogen sources On chitinase production by *Streptomyces*

Table 2. Influence of additional nitrogen sources on chitinase production by the strain ANU 6277 cultured in CYS medium

Nitrogen source (%)	Chitinase activity ($U.mL^{-1}$) ± SD	
*Control	6.98	± 0.17
NH_4Cl (0.2%)	3.68	± 0.16
$NH_4(SO_4)_2$ (0.2%)	5.68	± 0.19
$NaNO_3$ (0.2%)	6.84	± 0.09
KNO_3 (0.2%)	6.65	± 0.23
L-glutamine (0.2%)	6.83	± 0.57
L-asparagine (0.2%)	7.12	± 0.39
Soybean meal (0.2%)	7.19	± 0.07
Soybean meal (0.4%)	7.26	± 0.30
Soybean meal (0.6%)	8.05	± 0.24
Soybean meal (0.8%)	7.24	± 0.76
Peptone (0.2%)	6.95	± 0.69
Yeast extract (0.2%)	7.16	± 0.50
Yeast extract (0.4%)	8.89	± 0.34
Yeast extract (0.6%)	7.2	± 0.65

* Control- CYS medium with 1% Chitin; Mean ± SD from three experiments

The salts added in the medium and their amounts (g/L) are as follows : 0.5; K_2HPO_4, 2.0; $MgSO_4$. $7H_2O$, 1.0; and $FeSO_4.7H_2O$, 0.1 and final pH of the medium adjusted to 7.0.

Interprete the results and answer the following question :

1. Give the composition of the ideal medium composition for production of chitinase?

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

P997

[3725] - 21
M.Sc.
MICROBIOLOGY
MB - 601 : Virology
(2005 Pattern)

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

Instructions to the candidates:

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

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

a) What types of cell lines are used for cultivation of viruses? Give reasons for your answer.

b) Discuss the one-step growth curve of bacteriophage.

c) Explain how plant viruses can be detected using serological methods.

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

a) How animal viruses are classified? What are the ICTV recommendations for classification?

b) Describe in detail, the life cycle of Rabies virus.

c) Explain how vectors play an important role in spreading infection in plant viruses.

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

a) Describe the life cycle of TMV virus.

b) Explain which combination of HA and NA is present in Swine flu influenza virus? Explain the role of HA and NA in the spread of influenza virus.

c) Explain chemical assays used to detect the viruses.

P.T.O.

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

a) Indicator plants.

b) Distinctive properties of viruses.

c) LD_{50}.

d) M13 phage.

e) Interferon.

Q5) a) 10^7 cells of *E.coli* were exposed to T4 phage. At the end of the adsorption period there were 10^5 infected cells. What is the multiplicity of infection? **[8]**

b) Determine the LD_{50} value from the following results of an experiment carried out on mice, where each dilution was tested on a set of 6 mice. **[8]**

Virus dilutions	No. of mice which died
10^{-1}	6
10^{-2}	5
10^{-3}	3
10^{-4}	1
10^{-5}	0

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

P998

[3725] - 22
M.Sc.
MICROBIOLOGY
MB - 602 : Evolution, Ecology and Environmental Microbiology
(2005 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) ***Figures to the right indicate full marks.***
5) ***Use of logarithmic tables and electronic pocket calculator is allowed.***
6) ***Assume suitable data, if necessary.***

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

a) Describe the critical operating parameters of an activated sludge treatment system, and explain the resulting malfunctions if these parameters are not maintained optimally.

b) Discuss the molecular evolution with context to the origin of new genes and proteins.

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

a) Explain the various sedimentation phenomena observed during a settling process.

b) Describe how chemical disinfection of wastewater is achieved. What is break-point chlorination?

c) Explain the succession, competition and predation within the microbial communities of rhizosphere.

P.T.O.

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

a) Describe neutral evolution and elaborate on its significance to molecular phylogeny.

b) Describe the various habitats in marine ecosystem based on topography.

c) Describe the various mycorrhizal associations with respect to hostfungus specificity.

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

a) Flotation unit process.

b) Aerated lagoons.

c) Major pollutants present in dairy wastewater.

d) r and k selection.

e) DOM utilization strategies in marine ecosystem.

Q5) A single-stage tricking filter has a diameter of 10.0m and depth of 6.0m. The characteristics of primary effluent wastewater to be treated by this filter are as follows : **[16]**

Flow rate : 3000 m^3/d

BOD : 100 mg/L

TSS : 70 mg/L

TKN : 20 mg/L

Determine the following :

a) BOD loading rate.

b) TKN loading rate.

c) BOD removal efficiency.

d) Can nitrification be expected.

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

P999

[3725] - 23
M.Sc.
MICROBIOLOGY
MB - 603 : Microbial Metabolism
(2005 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 scientific calculator and log table is allowed.***
5) ***Assume suitable data if necessary.***

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

a) Describe the organization of cell membrane.

b) What are the methods employed for the elucidation of a metabolic pathway?

c) How is ammonia assimilated in the cell?

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

a) State the significance of Gibbs free energy equation.

b) Derive Hill equation. Draw Hill plot. State its significance.

c) Compare bacterial and plant photosynthesis.

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

a) Explain King & Altman method using single substrate enzyme catalyzed reaction.

b) Describe the inhibitors of mitochondrial electron transport chain.

c) Discuss the mechanism of energy generation in methanogenic bacteria.

P.T.O.

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

a) Laws of thermodynamics and their significance.

b) Model membranes.

c) Photolysis of water.

d) Glutamate dehydrogenase.

e) Nitrogenase.

Q5) Solve the following : **[16]**

a) Calculate Δ G of hydrolysis of ATP at pH 7.00 and at 25°C under steady state conditions in which concentration of ATP, DP and Pi, is maintained at 10^{-3} M, 10^{-4} M and 10^{-2} M respectively.

(Given : ΔG^0 of ATP = –7.7 Kcal/M; R = 1.98cals/M).

b) Predict what products will be rapidly labeled with ^{18}O when following additions are made to actively photosynthesizing system.

$H_2\ ^{18}O$ is added to green plants. $C^{18}O_2$ is added to green plants. $C^{18}O_2$ is added to green sulfur bacteria.

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