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

P846

[3625]- 1
M.Sc.
MICROBIOLOGY
MB - 501 : Microbial Diversity and Taxonomy
(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 logarithmic tables and scientific calculators is allowed.***
5) ***Assume suitable data, if necessary.***

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

a) Describe the morphological features used in identification and classification of bacteria.

b) Explain the importance and utility of DNA homology analysis in bacterial taxonomy.

c) Explain the newer cultural approaches for exporing uncultured bacteria.

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

a) Describe the application of BLAST in sequence analysis.

b) Describe the methods for extracting total bacterial DNA from a habitat.

c) Enlist the different salient taxonomic features of Archaebacteria.

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

a) Describe the species concept in prokaryotes.

b) Describe the role of optical-tweezers in bacterial diversity.

c) Describe the various features of Mycoplasma used for their taxonomy.

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

a) Significance of DNA-RNA homology analysis.

b) Limitations of chromosomal transfer as tool in bacterial taxonomy.

c) Role of DGGE in bacterial diversity.

P.T.O.

d) What is PSI-BLAST?

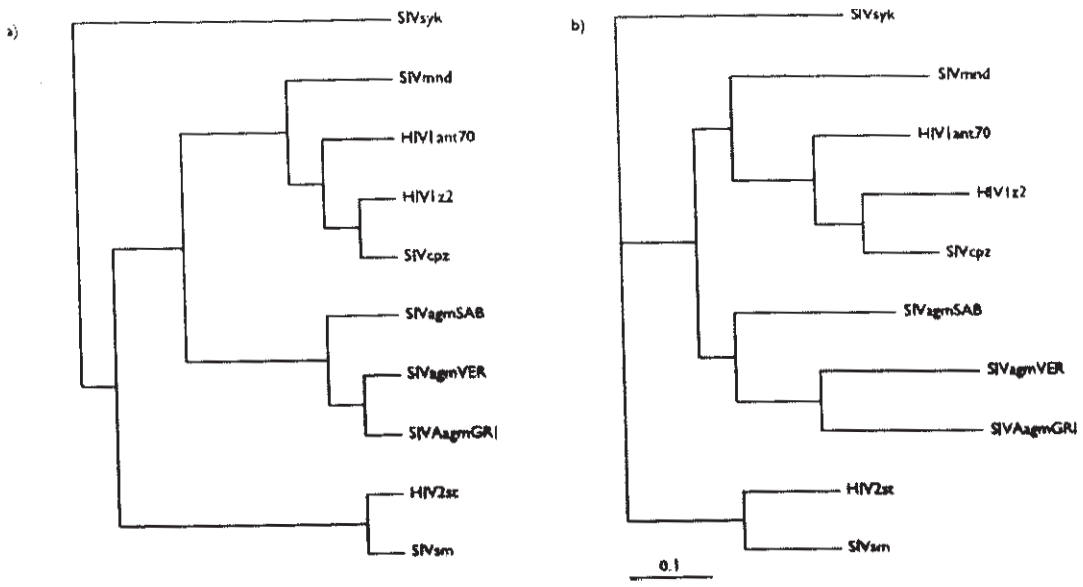
e) Taxonomic position of Rickettsia.

Q5) Two types of dendrograms are shown below : **[16]**

The OTUs are for human and simian immunodeficiency virus (HIV and SIV) polymerase sequences.

In the dendrograms, the vertical separation is for clarity only, and is not significant.

Identify the two types of dendrograms and explain how they are constructed and highlight the difference between them.



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

P847

[3625]- 2
M.Sc.
MICROBIOLOGY
MB - 502 : Quantitative Biology
(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 statistical tables and scientific calculators is allowed.***
5) ***Assume suitable data if necessary.***

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

a) What do you mean by dispersion? Discuss absolute and relative measures of dispersion.

b) Monthly consumption of electricity units of a certain family, in a year, is given below :

210, 207, 315, 250, 240, 232, 216, 208, 209, 215, 300, 290

Find mean, median, mode, and variance for the above data.

c) The following data give live weight of a pig (X) and weight of a side of bacon (Y).

X :	125	155	190	202	218
Y :	31	46	51	65	72

Obtain correlation coefficient and line of regression of Y on X.

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

a) Define the following terms :

i) Parameter.
ii) Significance level.
iii) Variable.
iv) Type I error.

b) If the total cholesterol values for a certain population are approximately normally distributed with a mean of 200mg/100ml and a standard deviation of 20mg/100ml, find the probability that an individual picked at random from this population will have a cholesterol value :

P.T.O.

i) Between 180 and 200mg/100ml.
ii) Greater than 225mg/100ml.
iii) Less than 150mg/100ml.

c) The hair colour and the eye colour are given in the following table. Determine the association between the hair colour and the eye colour. Use 5% level of significance.

Hair Colour

		Fair	Brown	Black	Total
Eye Colour	Blue	15	20	5	40
	Grey	20	20	10	50
	Brown	25	20	15	60
	Total	60	60	30	150

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

a) Write short notes on the following :

i) Factorial design.
ii) Binomial distribution.

b) Three fertilizers (A,B & C) each applied to 7 plots resulted in the following biomass growth (kg/plot).

A : 24, 18, 18, 29, 22, 17, 15

B : 46, 39, 37, 50, 44, 45, 30

C : 32, 30, 26, 41, 36, 28, 27

Examine whether the three fertilizers differ in their effects.

c) Data recorded on number of pods per plant in a variety of mothbean are given below :

Number of Pods	0-10	10-20	20-30	30-40	40-50	50-60
Number of plants	3	9	15	30	18	5

Draw less than and more than cumulative frequency curves. Also obtain median graphically.

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

a) Characteristics of the DBMS (Data base management systems).

b) Simulation.

c) Use of computers in biology.

d) Compiler and Interpreter.

e) Logic gates.

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

a) Derive two basic equations of growth in a closed environment.

b) How will you indicate the rate of change of biomass in a culture vessel? What is the significance of growth rate of determination?

c) What is model? Describe the concept of stochastic model.

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

P848

[3625]- 3
M.Sc.
MICROBIOLOGY
MB - 503 : Organization of Living Systems
(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 logarithmic tables and scientific calculators is allowed.***
5) ***Assume suitable data if necessary.***

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

a) Explain different types of biofilms and their applications.

b) Explain genetic organization of mitochondria.

c) Explain localization of macromolecules using electron microscopy.

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

a) What are sugar derivatives? Explain deoxy and acid derivatives with examples.

b) Enlist methods used for N-terminal and C-terminal determination of polypeptide and explain any one method in detail.

c) Explain structure and function of riboflavin.

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

a) Explain communication and coordination in life cycle of *Dictyeostelium sp*..

b) Explain dorso-ventral polarity in development of *Drosophila melanogaster*. H

c) Write classification of lipids? Differentiate between saturated and unsaturated lipids with examples.

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

a) Nicotinic acid.

b) Quorum sensing.

P.T.O.

c) Gastrulation.

d) Homeostasis.

e) Prostaglandins.

Q5) a) What is the concentration of CH_3COOH and CH_3COO^- in a 0.4M buffer, of pH 5.00? The K_a for CH_3COOH is 1.2×10^{-4} ($pK_a = 4.76$). **[6]**

b) Deduce the sequence of amino acid in a peptide from the following information. **[8]**

i) Treatment with Sanger's reagent yields DNP-Alanine;

ii) Selective hydrolysis yields the peptides below :

Cys-Asp-Tyr-Met-Val

Gly-Met

Met-Phe-Leu-Val

Val-Cys-Thr-Glu

Ala-Ile-Gly

Glu-Trp-Gln-Asn-Cys-Asp

iii) Mercaptoethanol reduces the disulphide bridge.

c) Weak acid HA is 0.4% ionized in a 0.1M solution. **[2]**

i) What is the equilibrium constant for weak acid?

ii) What is the pH of weak acid?

Total No. of Questions : 5] **[Total No. of Pages : 1**

P849

[3625]- 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 lebeled diagrams must be drawn wherever necessary.***
4) ***Use of log tables and electronic pocket calculators is allowed.***
5) ***Assume suitable data if necessary.***

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

a) Immunoregulatory role of cytokines.
b) Structure and function of TCR.
c) Methods of HLA typing.

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

a) Regulation of alternative complement pathway.
b) Evolution of immune system in vertebrates.
c) Mechanism of immunity against parasitic infections.

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

a) Discuss in detail the immune response to tumors.
b) Describe the role of immune system in development of Rheumatoid arthritis.
c) Animal models for autoimmunity.

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

a) Structure of MHC class II molecules.
b) Network theory.
c) Hemolytic plaque assay.
d) Immunosurveillance theory.
e) T cell accessory molecules.

Q5) Write an experimental design to test the hypothesis that a given disorder is due to deficiency of a specific complement component. **[16]**

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

P850

[3625]- 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) Explain in detail Sangers Di-deoxynucleotide method of sequencing and its applications.

b) Explain moderately and highly repetitive DNA.

c) Explain Tn A family transposons.

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

a) Explain role of different proteins in Ras pathway.

b) How does mismatch repair system work and what is the role of Dam methylase?

c) How does histone modification affect on structure and function of chromatin?

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

a) Role of Rec A in single strand assimilation in *E. coli*.

b) Special structure of telomerase and its significance.

c) Deciphering the genetic code.

Q4) Write short notes on : **[16]**

a) Proto-oncogenes.

b) Gene imprinting.

c) Tn 5 transposon.

P.T.O.

d) Role of topoisomerease in DNA replication.

e) M-Phase Kinase.

Q5) a) Telomere erosion in human somatic cells limit the number of cell divisions about 50. It has been suggested that this limitation restricts the maximum size of tumors, thus affording some protection against cancer. Assuming that, 10^8 cells have a mass of 1gram, calculate the mass of tumor that originating from 50 doublings of a single cancerous cells. **[8]**

b) Bacteria have a potent repair system for dealing with pyrimidine dimmers. You and your advisor are trying to isolate mutants in *E. coli* using UV light as the mutagenic agent. To get plenty of mutants, you find it necessary to use a dose of irradiation that kills 99.99% of the bacteria. You have been getting much more consistent results than your advisor, who also requires 10-fold to 100-fold higher doses of irradiations to achieve the same degree of killing. He wonders about the validity of your results since you always do your experiments at night after he left. When he insists that you come in the morning to do the experiments in parallel, you are surprised when you get exactly the same results as he does. You are a bit surprised. When you both repeat the experiments at night, you got exactly same result as your advisor.

Now that you believe one another's observations, you make a rapid progress. You find that you need a higher dose of UV light in the afternoon than in the morning to get the same degree of killing. Your laboratory faces west. What is the variable that has been plaguing in your experiments? **[8]**

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

P851

[3625]- 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 ion exchange chromatography. If the pI of a protein is 4 what will be the preferred pH of the buffer and which exchanger can be used for the separation of the protein?

b) What is density gradient centrifugation? How was it used for understanding the semi-conservative mode of DNA replication?

c) Explain the principle of Pulse Chase experiment. How will you use this experiment to track protein movement in a eukaryotic cell?

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

a) Explain the principle behind protein structure determination using x-ray crystallography. Explain the problems involved in phase determination and their solutions.

b) Explain the construction of mass spectrometer. How can we combine it with chromatographic techniques? Give the uses of such combined instruments.

c) What is nuclear magnetic resonance? Explain the terms chemical shift, spin-spin coupling and nuclear Overhauser effect.

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

a) What is the difference between statistical methods of Chou-Fasman and Garnier-Osguthrope-Robson for determining the secondary structure of proteins?

P.T.O.

b) Explain the concept of dynamic programming for pair wise sequence alignment.

c) What is sequence alignment? Explain the term gap penalty. What are the PAM and BLOSUM matrices?

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

a) Fluorescence spectroscopy.

b) Beer-Lambert law and its limitation.

c) Ramachandran plot.

d) Isoelectric focusing.

e) FASTA.

Q5) Solve : **[16]**

a) Muscle glycogen phosporylase-*a* elutes from a calibrated gel filtration column at a position corresponding to a MW of 360,000. SDS gel electrophoresis suggests a MW of 90,000. A microbiological assay on an enzymatically hydrolyzed sample of phosporylase-*a* disclosed the presence of 1.86µg of pyridoxal (MW = 167.2) per mg of protein. What conclusions can be drawn about the structure of phosporylase-*a*?

b) An ultracentrifuge is operating at 58,000 RPM.

i) Calculate angular velocity in radians per second.

ii) Calculate the centrifugal force at a point 6.2cm from the center of rotation.

iii) How many *g*' is this equivalent to?

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

P852

[3625]- 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) Explain and contrast between phenetic and phylogenetic approaches to classification.

b) Describe the role of extra chromosomal element transfer in bacterial taxonomy.

c) Explain the characteristics of bacteria in VBNC state. How does this state influence taxonomy?

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

a) Describe how the protein profiles are prepared and used in taxonomy.

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

c) Describe the role of sequence alignment in the field of molecular evolution.

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

a) Enlist 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 analysis of 'Dayhoff model of protein evolution' as used in PAM matrices.

P.T.O.

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

a) FAME profiles in taxonomy.

b) rRNA gene as a tool in taxonomy.

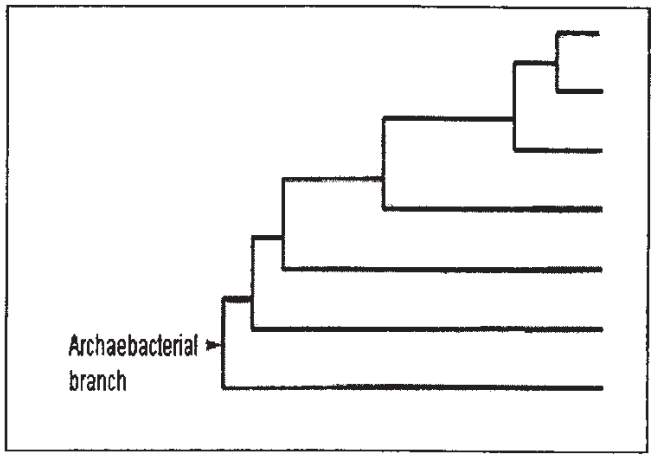
c) Role of flow cytometery in bacterial diversity.

d) Compare FASTA and BLAST.

e) Metagenomic environmental libraries.

Q5) Seven genera are listed below and their phenogram is given. Using known characteristics of the genera, place them in the proper position in the phenogram. Justify your answer. **[16]**

1 ***Klebsiella***
2 ***Thermus***
3 ***Pseudomonas***
4 ***Proteus***
5 ***Bacillus***
6 ***Escherichia***
7 ***Geotoga***



Geotoga is a suspected archaebacterial strain.

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

P853

[3625]- 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 necessary.***

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

a) What is dispersion? Explain absolute and relative measures of dispersion and state utility of relative measures of dispersion.

b) The following data relate to original phosphorus and estimated plant available phosphorus in 10 soils at 20C (ppm). Obtain the correlation coefficient between organic phosphorus and plant available phosphorus.

Organic Phosphorus	52	23	19	34	24	65	44	31	29	58
Plant available Phosphorus	64	60	71	54	77	81	93	93	51	76

c) The following data give the information on education and liking of TV programme.

Education	Liking			
	Very low	Low	High	Very high
Collegiate	18	29	70	115
Secondary	17	28	30	41
Primary	11	10	11	20

Test for the association of education and liking. Use 5% level of significance.

P.T.O.

Q2) Attempt <u>any two</u> of the following : **[16]**

a) i) Define probability and state axioms of probability.

ii) Define Poisson distribution. State its mean and variance. Give three real life situation of Poisson distribution.

b) The oxygen consumption of fishes before and after exposure to dichlorvos were recorded and the following sets of data were obtained. State whether such exposure had any significant effect on the oxygen consumption using paired t-test. Compare your results considering it as a case of independent samples. Use 5% level of significance.

Fish No.	1	2	3	4	5	6	7	8	9	10
O_2 Consumption Before Exposure	5.0	4.8	4.9	4.8	5.2	5.1	5.0	5.2	4.7	4.9
O_2 Consumption After Exposure	4.9	4.7	4.8	4.8	4.9	4.9	4.8	5.0	4.6	4.8

c) Obtain mean, median and mode for the following frequency distribution.

Pockets Money (Rs)	50-100	100-150	150-200	200-250	250-300
No. of Students	08	17	25	18	12

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

a) Define the following terms :

i) Hypothesis.

ii) Type II error.

iii) Kurtosis.

iv) Independence of random variables.

b) Two samples are drawn from two normal population. From the following data, test whether the two samples have the same variance at 10% level of significance.

Sample - 1	60	65	71	74	76	82	85	87		
Sample - 2	61	66	67	85	78	63	85	86	88	91

c) i) From the following frequency distribution of weight of 50 students, draw less than ogive curve.

Weight in (in kg)	35-40	40-45	45-50	50-55	55-60
No. of Students	5	12	15	10	8

ii) A radar system has a probability 0.1 of detecting a certain target during a single scan. Find the probability that the target will be detected at least twice in four scans.

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

a) Database and their uses.

b) Significance of computers in biology.

c) Simulation.

d) Confidence interval.

e) Stratified random sampling.

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

a) What is Hardy - Weinberg principal? Give its significance with example.

b) Explain in brief exponential growth model.

c) If the frequency of heterozygote phenotype (Aa) is 0.15, calculate,

i) Frequency of recessive phenotype (aa).
ii) Frequency of dominant phenotype (AA).
iii) Frequency of dominant allel (A).
iv) Frequency of recessive allel (a).

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

P854

[3625]- 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 structure and function of golgi complex.

b) Justify : "Cell-cell signaling plays important role in lifecycle of myxobacteria".

c) Diagrammatically illustrate the structural features of mitochondrion and chloroplast.

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

a) Describe the classification of amino acids.

b) Explain in brief the secondary and tertiary structure encountered in fibrous proteins with suitable example.

c) What are terpenes? Comment on their biological roles.

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

a) Justify : "In contrast to DNA, RNA shows presence of unusual bases".

b) Derive the Henderson and Hasselbalch equation and explain the meaning of following terms :

i) Buffer-range,
ii) Strength of buffer and
iii) Buffering capacity.

c) What is meant by de-differentiation and re-differentiation? Explain the terms giving suitable example.

P.T.O.

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

a) Ergosterol.

b) Sanger's reaction.

c) Teratogens.

d) Glycosidic bond.

e) Actins.

Q5) Solve :

a) A sample of DNA from *E.coli* contains 50 mole percent G+C. At what temperature would you expect this DNA molecule to melt? The melting curves for most naturally occurring DNA molecules reveal that the Tm is normally greater than $65^{o}C$. Why is this important for most organisms? **[10]**

b) The ε-amino group of Lys has a pKa of 10.5, what fraction of these groups will be protonated in a dilute solution of Lysine at pH = 9.5? Draw structures of ionic species present in solution at this pH. **[6]**

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

P855

[3625]- 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 calculators is allowed.***
5) ***Assume suitable data if necessary.***

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

a) Explain the role of NK cells and macrophages in immune response to tumor.

b) Explain how T cells regulate the immune response.

c) Explain the principles of regulation of complement fixation pathways.

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

a) Describe the immunoregulatory role of IFN α and TNF β.

b) Comment on the evolution of immunoglobulin.

c) Describe the changes that can occur in cell transformation.

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

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

b) Explain the immune mechanism to extracellular infections.

c) What are BMR's? Explain their role in cancer therapy.

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

a) T cell accessory molecules.

b) Septic shock syndrome.

c) SCID mouse.

d) Functional assay for phagocytosis.

e) Immunodiagnosis of tumor.

P.T.O.

Q5) Agents that are commonly used for therapeutic immunosuppression and the mechanisms of action of these agents are given below :

Drug	Mechanism of action
Cyclosporine	Blocks T cell cytokine production by inhibiting activation of the NFAT transcription factor
Rapamycin	Blocks lymphocyte proliferation by inhibiting IL-2 signaling
Corticosteroids	Reduce inflammation by inhibiting macrophage cytokine secretion
Anti IL-2 receptor antibody	Inhibits T cell proliferation by blocking IL-2 binding. May also opsonize and help eliminate activated IL-2R expressing T cells
Anti CD3 monoclonal antibody	Depletes T cells by binding to CD3 and promoting phagocytosis or complement mediated lysis

FK506 is a drug that works like cyclosporine, but FK506 is not used as widely.

a) Give at least two possible applications of each agent in immunopathological conditions. **[5]**

b) Giving the signal transduction pathway, explain role of cyclosporine in suppression of immune response. **[7]**

c) Discuss at least two reasons why FK506 is not used widely. **[4]**

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

P856

[3625]- 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 calculators is allowed.***
5) ***Assume suitable data if necessary.***

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

a) List the proteins that are involved in DNA replication and comment on their known and putative functions.

b) What are proto-oncogenes? How p53 proteins play important role in cancer?

c) How is the controlling of transposition achieved in the case of Tn 10 element?

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

a) How does Ruv system resolve Holiday junction?

b) What are the structural and functional differences between Tn elements and Ty elements?

c) How is a giant DNA molecule packed into eukaryotic chromosome?

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

a) Post replication repair mechanism in *E.coli*.

b) Gene cluster and super families.

c) Gene conversion.

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

a) C-value paradox.

b) LINES.

c) Gene imprinting.

d) SOS operon.

e) Pseudogenes.

P.T.O.

Q5) a) The diplod human genome comprises 6.4×10^9 bp and fits in to a nucleus that is 6 μm in diameter. If base pair occur at intervals of 0.34 nm along the DNA helix, what is the length of DNA in a human cell? **[8]**

b) John Cairns first manage to visualize radioactively labeled replicating chromosomes of *E.coli* by careful isolation and autoradiography. In his original model for chromosome replication, he proposed that there was one replication fork in the colsed circular duplex and only one swivel, near the origin of replication, at which twist could be relived. According to this model, if one round of replication takes 38 min, what would be the rate of rotation of DNA helix at the swivel point, in revolution per minute? **[8]**

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

P857

[3625]- 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 calculators is allowed.***
5) ***Assume suitable data if necessary.***
6) ***Use of graph paper is allowed.***

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

a) Explain the delicate balance between lytic and lysogenic cycles of bacteriophage Lambda.

b) Explain half leaf assay method for quantitation of plant viruses.

c) Elaborate on modern viral vaccines.

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

a) Explain the pathophysiology of infection caused by SV 40.

b) Justify : "Plant viruses can be transmitted without vectors".

c) Comment on the Western blotting as diagnostic technique for detection of viral diseases.

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

a) Explain the use of primary and secondary cell lines in the cultivation of viruses.

b) Elaborate on the positive sense and negative sense RNA as genomes of viruses and explain the replication of these RNAs.

c) Name the criteria used in the classification of viruses by ICTV.

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

a) Oncogenic viruses.

b) Viroids.

c) Interferons.

d) RIPA.

e) Phage therapy.

P.T.O.

Q5) Two strains of bacteriophage T_4 namely T_4 X and T_4 Y were used to infect *E.coli* B separately in phage broth. After adsorption, the cultures were diluted to prevent further superinfection. 0.1 ml broth culture was removed at an interval of 4 minutes and plated for plaque assay. The observation table is given below : **[16]**

Time of plating after infection (in min)	Pfu of T_4 X	Pfu of T_4 Y
0	1	1
4	1	1
8	1	1
16	1	1
20	8	1
24	16	1
28	32	4
32	64	8
36	100	12
40	100	16
44	100	20
48	100	20

a) Draw the labeled growth curves of both the viral strains on the same graph.

b) Comment on the patterns of curves obtained.

c) Give possible reasons for the differences in the curves, if any.

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

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M.Sc.

MICROBIOLOGY

MB - 601 : Virology

(Sem. - 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.***
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) Answer *any one* of the following : **[16]**

a) Describe Structure and explain the life cycle of bacteriophag T4.

b) Describe Structure and explain the life cycle of Adenovirus.

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

a) Describe the structure of influenza virus and comment on its antigenic structure.

b) Justify M13 phage can be used as a vector for cloning.

c) Comment on : Preventive measures for HIV infection.

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

a) Describe various properties of animal viruses used in taxonomy.

b) How will you detect plant viruses using fluorescent antibody technique?

c) Elaborate on Rules for nomenclature of viruses.

Q4) Answer in brief *any four* from the following : **[16]**

a) Cytopathic effects.

b) Monolayer cell culture.

c) Prions.

d) Half leaf assay for plant viruses.

e) Importance of indicator plants.

P.T.O.

Q5) A virus preparation was serially diluted in a buffer. One ml. of each dilution was inoculated into five separate tissue culture flasks containing healthy monolayer tissue culture. The cytopathic effects were detected in mono layers after incubation. The data is given in the following table. Calculate the $TCID_{50}$ value of the original virus preparation. **[16]**

Virus dilution used	No. of Infected monolayers in tissue culture flasks
10^{-5}	5
10^{-6}	3
10^{-7}	1
10^{-8}	0

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

P415 **[3625] - 22**

M.Sc.

MICROBIOLOGY

MB - 602 : Evolution, Ecology & Environmental Microbiology

(Sem. - 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.***
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) Answer 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 evolutionary origin of biochemical disorders with suitable case history.

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

a) Discuss the various strategies used in the floatation unit processes.

b) Explain the different techniques used for disposal of treated effluents in the river, ocean and on land.

c) Describe the strategies of organic matter utilization in marine environment.

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

a) Describe in brief the levels of selection within a community. Give and example of conflict between two levels of selection.

b) Explain rhizosphere community and rhizosphere effect.

c) Explain the significance of recognition phenomena in mycorrhiza formation.

P.T.O.

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

a) BOD : COD ratio.

b) Microbial bleaching of dyes.

c) Continuous granular medium filtration.

d) Phylogeny and molecular distances.

e) Proteinase inhibitors as plant defense agents.

Q5) A single stage trickling filter has 8.0 meter diameter and depth of 6.0 meter. The characteristics of primary effluent wastewater to be treated by this filter are as follows :

Flow rate = 3500 m^3/d, BOD = 130 mg/L, TSS = 70 mg/L, TKN = 25 mg/L.

Determine :

a) BOD loading rate.

b) TKN loading rate.

c) BOD removal efficiency. **[16]**

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

P416 **[3625] - 23**

M.Sc.

MICROBIOLOGY

MB - 603 : Microbial Metabolism

(Sem. - 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.***
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) What are Enthalpy, Entropy, Free energy, and equilibrium constant?

b) Describe general mechanism of oxidative phosphorylation with ATP Synthase.

c) Explain biosynthesis of pyrimidine nucleus.

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

a) Discuss changes occurring in redox potential in electron carriers during photosynthetic electron transfer reaction scheme.

b) What are allosteric enzymes? Explain with example and its significance.

c) Describe nitrogenase enzyme and biochemical nitrogen fixation process.

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

a) Describe lipids and proteins involved in the membranes with its structure and function.

b) Explain energy generation process in Nitrobacter sp.

c) Which are the methods involved in determination of pathways?

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

a) CO_2 as electron acceptor.

b) Purple sulphur bacteria.

P.T.O.

c) High-energy compounds.

d) Signal transduction.

e) Photophosphorylation.

Q5) Solve the following :

a) The following data were recorded for the enzyme-catalyzed reaction $S \rightarrow P$.

[S] (M)	6.25×10^{-6}	7.50×10^{-5}	1×10^{-4}	1×10^{-3}	1×10^{-2}
υ (nmoles/ liter/min)	17	50	62	75	75

i) Estimate V_{max} and K_m.

ii) What would υ be at [S] = 2.5×10^{-5} M and at [S] = 5.0×10^{-5} M?

iii) What would υ be at 5.0×10^{-5} M if the enzyme concentration were doubled?

iv) The υ given in the above table was determined by measuring the concentration of product that had accumulated over a 10-minute period. Verify that υ represents a true initial (or "instantaneous") velocity. **[10]**

b) Calculate the ΔG for the hydrolysis of ATP at pH 7.0 and 25°C under steady state conditions (such as might exist in a living cell) in which the concentrations of ATP, ADP and P_i are maintained at 10^{-3} M, 10^{-4} M and 10^{-2} M respectively. (Given : ΔG^o = -7.3 K cal/mol, R = 1.98 cal/mol). **[6]**

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

P417

[3625] - 201

M.Sc.

MICROBIOLOGY

MB - 601 : Instrumentation and Molecular Biophysics

(Sem. - 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 labelled 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) Explain the principle and working of affinity chromatography. What are the limitations of affinity chromatography?

b) Explain the principle behind protein gel electrophoresis. Differentiate between native and SDS gel electrophoresis.

c) Explain the principle of Pulse Chase experiment. How will you use this experiment to track protein movement in a eukaryotic cell?

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

a) Explain the principle behind mass spectroscopy. What is MALDI-TOF? Give its applications.

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

c) How does x-ray crystallography help in understanding protein structure? Explain the problems involved in phase determination and their solutions.

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

a) Explain the logic behind Chou-Fasman method of secondary structure prediction. What are its limitations?

b) What are the phi (ϕ) and psi (ψ) angles in polypeptides? Explain the concept of Ramachandran plot.

c) Explain how neural networks help in predicting secondary structure of proteins.

P.T.O.

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

a) Distribution coefficient in Gel filtration.

b) Beer-Lambert law and its limitation.

c) Isopycnic centrifugation.

d) Density gradient centrifugation.

e) Protein motifs.

Q5) Solve **[16]**

a) A $KMnO_4$ stock solution was diluted 20-times, and the resulting solution's absorbance was measured to be 1.02 in a 1.00 cm pathlength cuvette at 540 nm. At 540 nm, molar absorption coefficient for $KMnO_4$ is 2310 mol^{-1} dm^{-3} cm^{-1}. Calculate the concentration of the original $KMnO_4$ stock solution.

b) *E. coli* cells are to be pelleted in an SS-34 rotor (maximum radius of 10.7 cm) by centrifugation at 7000 rpm. What is the RCF (g force)?

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

P418 **[3625] - 202**

M.Sc.

MICROBIOLOGY

MB - 602 : Evolution, Ecology & Environmental Microbiology

(Sem. - 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 labelled 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) Answer any one of the following : **[16]**

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

b) Discuss the evolutionary stability of co-operation among the microorganism. Explain the various interactions influencing this stability.

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

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

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

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

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

a) Discuss in brief the molecular evolution with context to the origin of new genes and proteins.

b) Describe the host-fungus specificity and interactions with non-host plants in mycorrhiza.

c) Explain the mechanisms of DOM production in marine ecosystem.

P.T.O.

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

a) Biomethanation.

b) The major pollutants present in dairy waste.

c) Anoxic denitrification.

d) Speciation in sexual and asexual organisms.

e) Flavonoids.

Q5) A single stage trickling filter has a 10.0 meter diameter and depth of 6.1 meter. The characteristics of primary effluent wastewater to be treated by this filter are as follows : **[16]**

Flow rate = 4000 m^3/d, BOD = 120 mg/L, TSS = 80 mg/L, TKN = 25 mg/L

Determine -

a) BOD loading rate.

b) TKN loading rate.

c) BOD removal efficiency.

d) Can nitrification be expected?

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

P419

[3625] - 203

M.Sc.

MICROBIOLOGY

MB - 603 : Microbial Metabolism

(Sem. - 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 labelled 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) Discuss the concept of cooperativity among allosteric enzymes.

b) Describe biosynthetic pathway for aromatic amino acids.

c) What are high energy compounds? What kinds of reasons make them so?

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

a) Explain with example significance of purification chart during enzyme purification.

b) Describe the types of membrane associated proteins involved in transport of solute.

c) Consider an illuminated suspension of green algae fixing CO_2. If the light is suddenly turned off, the concentration of 3-phophoglycerate in chloroplast rises. When light is turned on, the concentration of 3-phosphoglycerate returns to its normal steady state level. Explain.

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

a) Describe the components of mitochondrial electron transport chain. How are they associated with one another?

b) What is adenylate energy charge? What is its significance?

c) How is dinitrogen reduced to ammonia by nitrogenase complex?

P.T.O.

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

a) Models of allosteric enzymes.

b) Passive diffusion.

c) Free energy.

d) Photosynthetic reaction center.

e) Energy generation in methanogens.

Q5) An enzyme has Km 4.7 x 10^{-5} M. If the Vm of the preparation is 22 μ M/l/min, what velocity would be observed in the presence of 2 x 10^{-4} M substrate concentration and 5 x 10^{-4} M concentration of :

a) a competitive inhibitor,

b) an un-competitive inhibitor,

c) a simple non-competitive inhibitor?

Ki in all cases is 3 x 10^{-3}M. What is the degree of inhibition? **[16]**

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

P420

[3625] - 401

M.Sc.

MICROBIOLOGY

MB - 801 : Applied Microbial Biotechnology

(Sem. - IV) (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.***
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 the diagram of a continuous stirred tank bioreactor. Explain the construction and the typical dimensional ratios applied in its construction. **[16]**

OR

With the help of a flow chart, describe the commercial production of Vitamin C.

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

a) Draw a flow chart for recovery of penicillin acylase.

b) Explain the principle of immobilization of microbial cells using the gel entrapment method. Describe any two applications where this process is used.

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

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

a) What are Biosensors? Explain the use of enzyme in biosensors.

b) Explain the use of Trichoderma viridae in biocontrol.

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

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

a) PGPRs.

b) Rheology of fermentation broths.

P.T.O.

c) Types of impellers.

d) Siderophores.

e) DO sensors.

Q5) The addition of phenylacetic acid as a precursor for production of Penicillin G is known. The graph below shows the effect of addition of phenylacetic acid (PAA) for production of penicillin acylase. The PAA was added at different times during the growth phases of the organism (E.coli) in the broth. **[16]**

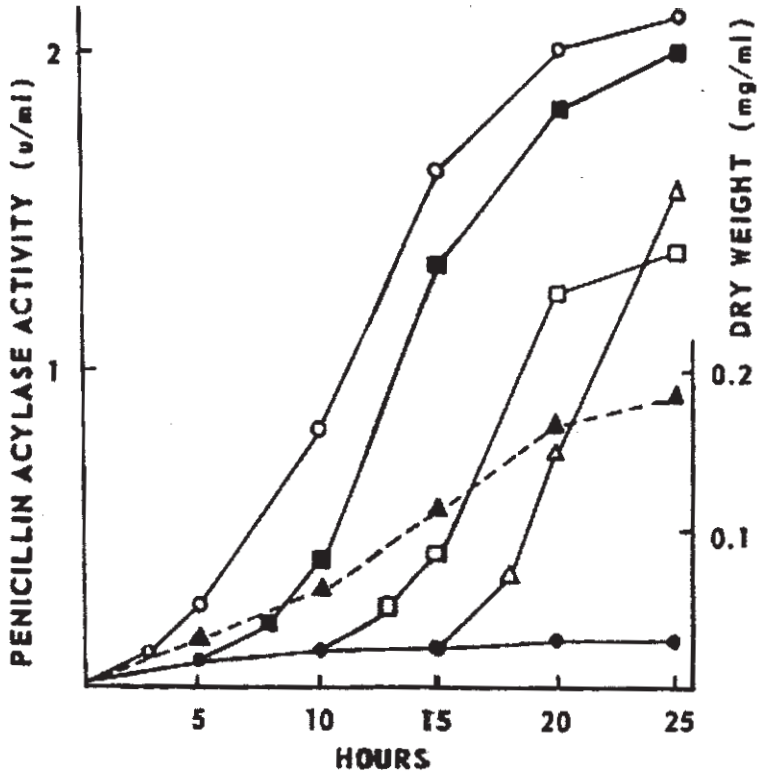


FIG. 2. *Effect of addition of phenylacetic acid to the medium before inoculation with cells in different phases of growth. The activity indicated on the figure concerns 1 ml of medium. Symbols: ●, control without phenylacetic acid; ○, effect of 0.2% phenylacetic acid added at start: ■, effect of phenylacetic acid added in the 5th hour; □, effect of phenylacetic acid added in the 10th hour; △, effect of phenylacetic acid added in the 15th hour; ▲, change in the dry cell content of the culture.*

Interprete the results and answer the following questions :

1) Would it be beneficial (in terms of yield) to operate the fermentation process as a batch, continuous or fed-batch process? Justify your answer.
2) Do you think that penicillin acylase is produced as an inducible or constitutive enzyme?
3) If the experiment was designed by you, what parameters would you test, to further increase the efficacy of penicillin acylase production?

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

P421 **[3625] - 402**

M.Sc.

MICROBIOLOGY

MB - 802 : Pharmaceutical Microbiology

(Sem. - IV) (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.***
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) Define IVIVC. What is significance of IVIVC in pharmaceutical product development?

b) Which are the methods used to study action of inhibitors of cell wall synthesis?

c) What are characteristics of terpenoids?

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

a) Describe the susceptibility testing for antifungal agents.

b) Explain adverse reactions to the drugs due to drug factors.

c) Elucidate the mechanism of bacterial resistance to hosts cellular defences.

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

a) Test for tolerability of the drug.

b) Objectives of animal studies and clinical trial of a new drug.

c) Assay for pyrogenecity of a drug.

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

a) Factors affecting diffusion assay.

b) Steps towards commercialization of a drug.

c) Hot extraction method.

P.T.O.

d) Biological activities of endotoxins of Gram negative bacteria.

e) Prick test for allergy testing.

Q5) Answer the following

a) Following is the list of active components (A) and list of solvents (B) used for their extraction.

Set A - Saponins, Terpenoids, Polypeptides, Flavonoids, Alkaloids, Steroids.

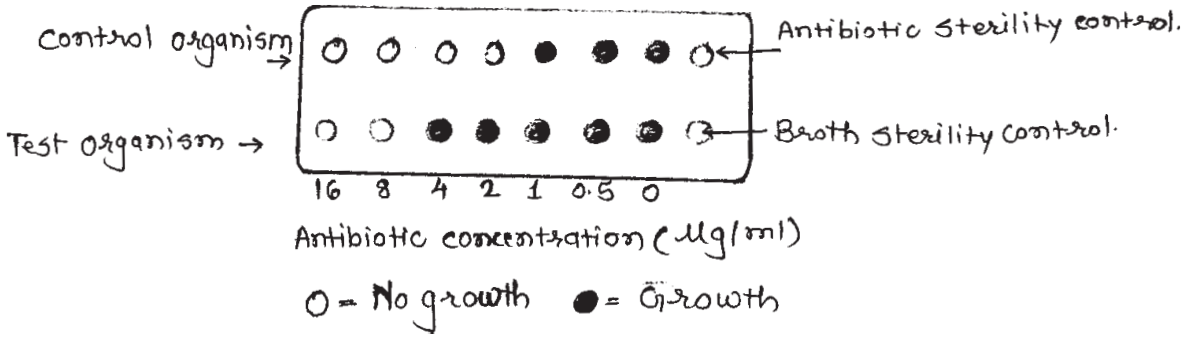
Set B - Ether, Ethanol, Chloroform, Water, Acetone, Methanol, Dichloromethanol.

By using above data -

I - Prepare a table showing solvent/solvents used for each active component extraction. **[6]**

II - From list of set A, which are the active compounds commonly obtained only in one solvent. **[2]**

b) Following is result of broth dilution test using Microtitre tray for antibiotic susceptibility. Two fold dilutions of antibiotic are inoculated with a known number of organisms and incubated at 37°C overnight. The potency of the antibiotic is checked by titrating it against a control organism of known susceptibility.



By observing these results in microtitre tray, answer the following questions.

A) What is MIC for the control organism? **[2]**

B) What is MIC for the Test organism? **[2]**

C) What does the two controls indicate? **[2]**

D) Wha is the commonly used standard inoculum of test strain? **[2]**

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

P422

[3625] - 403

M.Sc.

MICROBIOLOGY

MB - 803 : Molecular Biology - II

(Sem. - IV) (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.***
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) Answer *any two* of the following : **[16]**

a) Explain the structure of Lac repressor protein. How does it regulate expression of lac operon in wild type *E.coli*.

b) Explain the principle of Real time PCR. Give applications of this technique.

c) Explain the structure and action of types I and II aminoacyl tRNA synthetases from *E.coli*.

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

a) Autogenous circuit for lambda repressor in maintaining lysogeny.

b) Initiation and termination of transcription in bacteria.

c) Generation of chimeric plasmid pBR322 form different DNA molecules.

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

a) Justify : TRAP controls trp operon in *B.subtilis*.

b) Explain site directed mutagenesis giving suitable examples.

c) Explain the principle and working of Pulse field electrophoresis technique.

Q4) Answer in brief *any four* from the following : **[16]**

a) Cosmid.

b) Initiation complex in translation.

P.T.O.

c) Type II RE.

d) Role of enhancers in transcription.

e) Importance of cyclic events in PCR.

Q5) The human $\alpha, \beta, \gamma, \delta, \varepsilon$ and ζ globin genes are transcriptionally active at various stages of development. Fill in the following table using graph, indicating whether the globin gene in question is sensitive or resistant to DNase I digestion at the developmental stages mentioned below, giving reasons. **[16]**

Globin gene	Tissue		
	Embryonic stage	Foetal spleen	Adult bone marrow
α			
β			
γ			
δ			
ε			
ζ			

Graph :

Comparison of synthesis of different globin chains at given stages of embryonic, fetal and postnatal development.