Total No. of Questions : 5]

SEAT No. :

P2927

[Total No. of Pages : 2

[5534]-11
M.Sc. - I
MICROBIOLOGY
MB-501 : Microbial Diversity & Taxonomy
(2008 Pattern) (Semester - I)

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

Instructions to the candidates:

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

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

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

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

c) Discuss 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 bacteria without the need of cultivation.

c) Discuss the use of scoring matrices and gap penalities in sequence alignment.

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

a) Discuss 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 procedure steps involved in Needleman-Wunsch algorithm.

P.T.O.

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

a) Protein profiles in taxonomy.

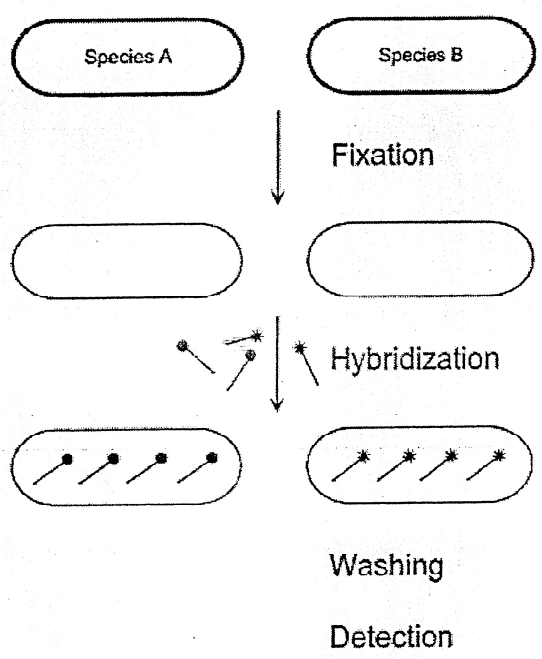
b) Chromosomal transfer a tool in taxonomy.

c) Application of FISH in bacterial diversity.

d) Compare PSI-BLAST and PHI-BLAST.

e) Environmental clone libraries.

Q5)



Detection using fluorescence microscopy.

Observe the diagram given above carefully and answer the following : **[16]**

a) The above given diagram is a protocol, answer for what it is used in taxonomy?

b) Enlist the various molecular techniques which follow the same protocol.

c) Name the biomolecules which may be used in this protocol/technique.

Total No. of Questions : 5]

SEAT No. :

P2928

[Total No. of Pages : 3

[5534]-12
M.Sc. - I
MICROBIOLOGY
MB-502 : Quantitative Biology
(2008 Pattern) (Semester-I) (Credit System)

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) Calculate mean and mode of the following data:

Class Interval	0-5	5-10	10-15	15-20	20-25	25-30
Frequency	2	4	8	5	4	1

b) Calculate the variance, the standard deviation and coefficient of variation of the following data recorded on days to flowering of particular variety of plant.

Days of flowering: 22, 23, 25, 25, 27, 30, 30, 31, 32, 32

c) Calculate the probabilities of following

i) The incidence of occupational disease in industry is such that workers have 24% chance of suffering from it. What is the probability that out of six workmen, 4 or more will contact the disease?

ii) A book contains 50 misprints distributed randomly throughout its 100 pages. What is probability that a page observed at random contains at least two misprints. Assuming Poisson distribution.

P.T.O.

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

a) Draw a pie diagram of the following data related to areas under different crops.

Crops	Area (in 000 acres)
Rice	26
Wheat	34
Maize	20
Jowar	18
Milets	10

b) In an experiment on immunization of goats from anthrax, the following results were obtained. Derive your inferences on the efficacy of the vaccine.

	Affected	Not affected	Total
Inoculated	2	10	12
Not Inoculated	6	6	12
Total	8	16	24

c) What are biological databases? Give their types and explain in short about them.

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

a) The Carbohydrate content of two banana variety are as follow:

Variety A: 36, 36, 39, 39, 39, 41, 48

Variety B: 43, 39, 49, 45, 35, 48, 45

Test whether there is any significant difference in carbohydrate content of two varieties.

b) Find whether or not the following observed distribution of phenotypes in a sample of 384 Drosophila flies have a significant goodness of fit with proposed Mendelian 9:3:3:1 distribution (L.S. 5%).

c) Describe the epidemiological model with example.

Q4) Attempt any one of following: **[16]**

a) The three unidentified yeast strains were grown in liquid medium at three different incubation temperatures. The wet biomass yield per liter is given below in table. Test whether wet biomass yield depends on strain type and incubation temperature using two factor analysis.

	Yeast Strain type		
Incubation Temperature (°C)	A	B	C
20	9	9	10
30	8	8	11
40	8	7	9

b) Following is the distribution of two variables in population. Calculate the Correlation and Regression coefficient. Comment on both the coefficient.

X	8	9	10	11	12	13	14	15	16	17
Y	13	14	15	17	16	20	19	18	21	22

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

a) Factorial design.

b) Hypothesis testing.

c) Confidence interval.

d) Skewness.

e) Distribution of sample means.

Total No. of Questions :5]

SEAT No. :

P2929

[Total No. of Pages :2

[5534]-13
M.Sc.
MICROBIOLOGY
MB-503: Cell Organization and Biochemistry
(2008 Pattern) (Semester - I)

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

Instructions to candidates:

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

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

a) Explain the structure and function of endoplasmic reticulum.

b) Explain the structure of β-pleated sheet with the help of diagram.

c) Derive Henderson-Hasselbalch equation and describe its role in buffer preparation.

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

a) Differentiate between reducing and non-reducing sugars.

b) Describe the process of blastulation in *Xenopus*.

c) Explain the molecular mechanism of quorum sensing in bacteria with suitable example.

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

a) Describe with the help of diagram regulation of cell cycle in eukaryotes.

b) What are terpenes? Explain their structure and function with suitable examples.

c) Explain 5'to 3' polarity of nucleic acids and comment on its significance.

P.T.O.

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

a) t-RNA

b) N- terminal labeling

c) Vitamin K

d) Steroids

e) Sugar epimers

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

a) What would be the net charge on following hexapeptide at pH1,7,and 12? H_2N-Gly-Arg-Cys-Glu-lle-Asp-COOH.

b) Explain why absorption of UV light by double standed DNA increases (the hyperchromic effect) when the DNA is denatured? What is its application?

c) Match the following.

Column A	Column B
1) FDNB	i) Disulfide bridge reduction
2) CNBr	ii) C-terminal determination
3) Hydrazine	iii) Dinitrophenyl derivative
4) β-mercapto ethanol	iv) Cleaves after Methionine

Total No. of Questions :5]

SEAT No. :

P2930

[Total No. of Pages : 2

[5534]-21
M. Sc. - II
MICROBIOLOGY
MB - 601 : Instrumentation & Molecular Biophysics
(2008 Pattern) (Semester - II)

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

Instructions to the candidates:

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

Q1) Describe any two of following : **[16]**

a) Describe the construction and working of Gas chromatography. Comment on different types of detection devices.

b) Explain the principle of gel electrophoresis. Describe in brief the sodium dodecyl sulphate-polyacrylamide gel electrophoresis.

c) Explain the differential centrifugation. Compare rate zonal and Isopycnic centrifugation.

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

a) Discuss in brief working of mass spectroscopy.

b) Discuss in brief single crystal X-ray crystallography.

c) What is nuclear magnetic resonance spectroscopy (NMR)? Explain the terms chemical shift and spin - spin coupling.

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

a) Explain how neural network help in predicting secondary structure of proteins.

b) Give the schematic diagrammatical representation of single beam and double beam uv-visible spectrophotometer.

c) Explain Detection and Measurement of radioactivity by liquid scintillation counting.

P.T.O.

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

a) Affinity chromatography

b) Infrared spectroscopy.

c) Super secondary structure of proteins

d) Applications of NMR in biology

e) Protein crystallization

Q5) Attempt the following. **[16]**

a) An ultracentrifuge is operating at 55,000 RPM

i) Calculate angular velocity in radians per second.

ii) Calculate the centrifugal force at a point 6 cm from centre of rotation.

b) Explain the partial double bond nature of peptide bond. Comment on phi and psi angles.

❄❄❄❄

Total No. of Questions : 5]

SEAT No. :

P2931

[Total No. of Pages : 2

[5534]-22
M.Sc. - I
MICROBIOLOGY
MB-602 : Evolution, Ecology and Environmental Microbiology
(2008 Pattern) (Semester - II)

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

Instructions to the candidates:

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

Q1) Enlist various anaerobic suspended growth treatment processes. Explain in detail design and working of UASB reactors. **[16]**

OR

Describe various mechanisms of speciation in sexual and asexual organisms.

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

a) Enlist and explain mechanisms of disinfection and factors affecting efficiency of disinfection.

b) Describe the process flow equalization. Give limitations of flow equalization in waste water treatment.

c) Explain the structure of rhizosphere. Describe various interactions which are important in shaping rhizosphere community structure.

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

a) Describe solid waste management with relevance to direct and indirect reuse of waste.

b) Describe mechanisms of organic matter production and utilization in marine ecosystems.

c) Define and discuss bioremediation and phytoremediation.

P.T.O.

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

a) Selfish gene theory.

b) Interaction of mychorrhizal fungi with non host plants.

c) Parasite theory of sex and sexual selection.

d) Octapine.

e) Sequencing batch reactor process.

Q5) 200 mL of river water was collected from just downstream of a brewery. 2 mL of river water diluted to 1 L, aerated and seeded. The dissolved oxygen content was 7.8 mg/L initially. After 5 days, the dissolved oxygen content had dropped to 5.9 mg/L. After 20 days, the dissolved oxygen content had dropped to 5.3 mg/L. **[16]**

a) What is the 5 day BOD of the waste?

b) What is the 20 day BOD of the waste?

c) Comment about the ultimate BOD?

d) What other information will be required to determine Ultimate BOD?

Total No. of Questions : 5]

SEAT No. :

P2932

[Total No. of Pages : 2

[5534]-23
M.Sc. -II
MICROBIOLOGY
MB - 603 : MICROBIAL METABOLISM
(2008 Course) (Semester - II)

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

Instructions to the candidates:

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

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

a) Describe the process of anoxic ammonia oxidation and give its importance.

b) Explain the regulation of glutamine synthetase in *E. coli.*

c) Give the role of high energy compounds in cell metabolism.

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

a) Explain the term 'gated ion channels' with help of suitable example.

b) Justify, 'during uncompetitive inhibition both Km and Vmax decreases'.

c) Describe biosynthesis of glutamate family of amino acids.

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

a) Explain the models which account for cooperativity in allosteric enzymes.

b) Differentiate between assimilative and dissimilative nitrate reduction.

c) Diagrammatically illustrate noncyclic photophosphorylation in bacteria.

P.T.O.

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

a) Structure of mitochondrial ATPase

b) Relationship between free energy and standard free energy.

c) Biochemistry of methanogenesis.

d) Liposomes

e) Chloroplast

Q5) a) The following results were obtained for an enzyme catalyzed rection. **[16]**

Sub. conc. (mmol/lit)	Initial velocity (μmol/lit/min)
5.0	147
6.67	182
10.0	233
20.0	323
40.0	400

1) Calculate Km and Vmax.

2) What would be V if the enzyme concentration was doubled?

b) When alanine labeled with ^{15}N was administered to a rat; the animal excreted urea containing ^{15}N in both of its nitrogen atoms. By means of known enzymatic reactions, explain how this conversion can take place?

■ ■ ■

Total No. of Questions : 5]

SEAT No. :

P2933

[Total No. of Pages : 2

[5534]-31
M.Sc.
MICROBIOLOGY
MB-701 : Immunology
(2008 Pattern) (Semester - III)

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

Instructions to the candidates:

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

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

a) Justify, "Clonal deletion is one of the mechanisms of establishing tolerance".

b) Explain how the complement system is regulated after the assembly of different convertases has taken place.

c) Explain the network theory for regulation of humoral immune response.

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

a) Justify, "Immunoglobulin isotypes evolved from IgM, since it has many structural and functional limitations".

b) Giving suitable examples, comment on - "Therapeutic applications of cytokines has many drawbacks".

c) Explain the role of TCR - CD_3 complex in activation of immune response.

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

a) Describe immunological characteristics of different etiological classes of tumors.

b) Justify "Tumor specific antigens can be targeted for developing immunotherapy of cancer".

c) Explain the host immune mechanisms against intracellular bacterial pathogens.

P.T.O.

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

a) Antigen antibody reaction kinetics.

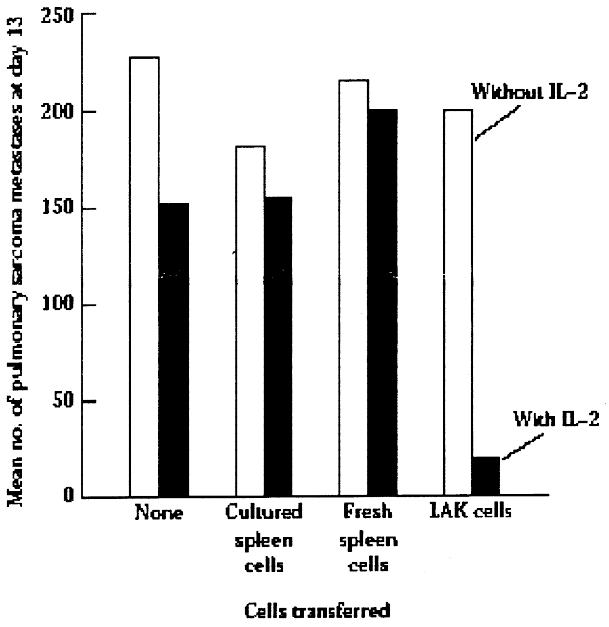
b) Animal models in HIV research.

c) ELISPOT assay.

d) Diagnosis of complement deficiencies.

e) IL - 1 and pyrogenesis.

Q5) Spleen cells or LAK cells, in the presence or absence of recombinant IL-2, were infused into mice with pulmonary sarcoma. The animals were evaluated 13 days later for the number of pulmonary sarcoma metastases. The LAK cells were prepared by isolating lymphocytes from tumor-bearing animals and incubating them in vitro with high concentrations of IL-2. The results are expressed in the graph below :



Based on the data given, answer the following :

a) Explain in brief, LAK cells and Sarcoma. **[4]**

b) Diagrammatically illustrate the role of IL-2 in activation of immune response. **[4]**

c) Discuss the outcome of the experiment. **[4]**

d) Comment on the possible extrapolation of this study for developing immunotherapy for cancer. **[4]**

Total No. of Questions : 5]

SEAT No. :

P2934

[Total No. of Pages : 2

[5534]-32
M.Sc.
MICROBIOLOGY
MB-702 : Molecular Biology - I
(2008 Pattern) (Semester-III) (Credit System)

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

a) Describe the components of DNA polymerase III holoenzyme in *E. coli*.

b) Draw structure of nucleosome. Comment on methylation of histones and its effect on function of the chromosome.

c) Justify, "Composite transposons have IS modules".

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

a) Justify, "Priming is required to start DNA synthesis".

b) Explain the base excision repair mechanism of damaged DNA.

c) Differentiate between genome organization in prokaryotes and eukaryotes.

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

a) Justify, "Centromeres and telomeres are essential parts of the eukaryotic chromosome".

b) Comment on - Transposition of Tn10 has multiple controls.

c) Describe replication features of single stranded phage.

P.T.O.

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

a) Metastasis in cancer.

b) Types of DNA damage.

c) Non-repetitive DNA sequences.

d) Gene imprinting.

e) Gene clusters.

Q5) a) A mammalian cell line has 1.2 m of duplex DNA per cell. The S phase in these cells is 10 hours long. If the rate of DNA strand growth in these cells is 20 μm/min. How many replication forks are operating during chromosome replication? **[8]**

b) Haploid yeast cells that preferentially repair double stranded breaks by homologous recombination are especially sensitive to agents that cause double stranded breaks in DNA. If the break occurs in G1 phase of the cell cycle, most yeast cells die. However, if the break occurs in G2 phase, a much higher fraction of cells survive. Explain these observations. **[4]**

c) A double stranded DNA molecule having B form has 100,000 base pairs. **[4]**

i) How long is the DNA molecule?

ii) How many complete turns are there in the molecule?

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Total No. of Questions :5]

SEAT No. :

P2935

[Total No. of Pages :2

[5534]-33
M.Sc.
MICROBIOLOGY
MB: 703 - Virology
(2008 Pattern) (Credit System) (Semester - III)

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

Instructions:

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 electron microscopic methods for detection of virus.

b) Explain the protein-nucleic acid interaction and genome packaging in virus.

c) How is virus detected in tissue culture.

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

a) Interferons create an antiviral state

b) Phage M 13 can be used as a cloning vector

c) Killed viral vaccine require booster doses.

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

a) Western blotting as diagnostic technique for detection of viral disease.

b) Life cycle of Cauliflower Mosaic Virus.

c) Infectivity assays of plants viruses.

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

a) Phage therapy

b) Disease forecasting

c) Plant inclusion bodies

d) Newcastle disease

e) Viroids

P.T.O.

Q5) a) What advantage would an RNA virus gain by having it's genome resembling eukaryotic mRNA? **[4]**

b) A virus preparation was tenfold diluted. One ml of each dilution was inoculated in four separate tissue culture flasks. Following data is obtained.

Calculate the $TCID_{50}$ value. **[12]**

Virus dilution	Tissue culture flask			
	1	2	3	4
10^{-1}	+	+	+	+
10^{-2}	+	+	+	+
10^{-3}	+	+	+	–
10^{-4}	+	+	–	–
10^{-5}	+	+	–	–
10^{-6}	–	–	–	–

'+'= Cytopathic effect seen

'–' = Cytopathic effect not seen

Total No. of Questions :5]

SEAT No. :

P2936

[Total No. of Pages : 2

[5534]-41

M. Sc. - II

MICROBIOLOGY

MB - 801 : Pharmaceutical and Medical Microbiology

(2008 Pattern) (Semester - IV)

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 in allowed.***
5) ***Assume suitable data, if necessary.***

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

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

b) What is combinatorial biocatalysis? Explain various mechanisms involved in it.

c) Describe toxicity testing in drug development.

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

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

b) Describe the factors affecting the bioavailabilty of drugs.

c) Explain the mechanisms involved in adhesion and invasion of virulent bacteria.

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

a) How teratogenecity analysis is performed in different phases.

b) Describe the mode of actions of exotoxins with suitable examples.

c) Explain the validation criteria for biologicals.

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

a) Pharmakogenomics

b) RT-PCR

c) Rational drug design approach

d) Drug formulations

e) CLSI

P.T.O.

Q5) Below table shows susceptibility of candida albicans from local hospitals as determined by the CLSI microdilution and E test.

Antifungal agent			MIC (mg/l)					
		Range		MIC_{50}		MIC_{90}	% Resistant	
	CLSI	E test	CLSI	E test	CLSI	E test	CLSI	E test
Amphotericin B	0.25–1	0.063–0.5	0.5	0.25	0.5	0.25	0	0
Flucytosine	≤0.125 – ≥64	≤0.125 – ≥64	≤0.125	0.25	0.5	0.1	3.2	3.6
Fluconazol	≤0.125 -4	≤0.125 -2	≤0.125	0.25	0.5	0.5	0	0

a) Describe the development of resistance mechanisms in fungi. **[8]**

b) Comment on the data above with reference to resistance and sensitivity. **[4]**

c) Define MIC, MIC_{50}, MIC_{90} and MBC. **[4]**

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Total No. of Questions : 5.]

SEAT No. :

P2937

[Total No. of Pages : 2

[5534]-42
M.Sc.
MICROBIOLOGY
MB-802 : Molecular Biology - II
(2008 Pattern) (Semester - IV) (Credit System)

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

Instructions to the candidates:

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

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

a) Transcription process in eukaryotes.

b) Post translational modification of proteins.

c) Ribo switch as regulators.

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

a) Discuss the regulation of operon by gene attenuation.

b) Explain various approaches for joining the DNA molecule.

c) How does RNA splicing proceeds by group I introns.

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

a) Modified bases in t-RNA.

b) Oligonulceotide directed mutagenesis.

c) Sigma factors are organized into cascade in sporulation event.

P.T.O.

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

a) Use of kinases in recombinant DNA technology.

b) BAC and YAC vectors.

c) Rho factor.

d) Shuttle vectors.

e) Hybrid antibodies.

Q5) A DNA library is a collection of clones, each containing a different fragment of DNA, inserted into the cloning vector.

a) What is the difference between a cDNA and a genomic library? **[8]**

b) How can you use hybridization or expression to screen a library for a specific gene? **[4]**

c) What oligonucleotide primers could be synthesized as probes to screen a library for the gene encoding the peptide. **[4]**

Met-Pro-Glu-Phe-Tyr.

Total No. of Questions : 5]

SEAT No. :

P2938

[Total No. of Pages : 2

[5534]-43
M.Sc. - IV
MICROBIOLOGY
MB 803 : Microbial Technology
(2008 Pattern) (Semester - IV)

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) Describe the construction and operation of an air-lift bioreactor. Justify that "Air lift bioreactor is more advantageous than conventional CSTR for SCP production". **[16]**

OR

Describe the process of protease production using immobilized cells. How are immobilized cells advantageous over free cells.

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

a) Justify "Rheogram of non-Newtonion fluids deviate from that of Newtonion fluids" with examples.

b) What is 'OTR' in context with a fermentation process? Explain with a suitable example.

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

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

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

b) Describe recombinant vaccine production using animal cell culture technology.

c) Discuss how mass transfer of nutrients and O_2 is affected by mycelia pellet giving appropriate example.

P.T.O.

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

a) Types of impellers

b) Enzymes in biosensors

c) Standard Operating Procedures

d) Limitations of continuous culture

e) OTR.

Q5) The production of pullulan from molasses and synthetic medium by *Aureobasidium pullulans* P56 in batch culture was investigated. Molasses was pretreated with sulfuric acid and activated carbon. Since A. pullulan produces various polysaccharides other than pullulan. Pullulan content of poltsaccharide in molasses and synthetic medium was determined. **[16]**

The kinetics of polysocchride and pullulan production by A. Pullulans in molasses and synthetic medium is given below.

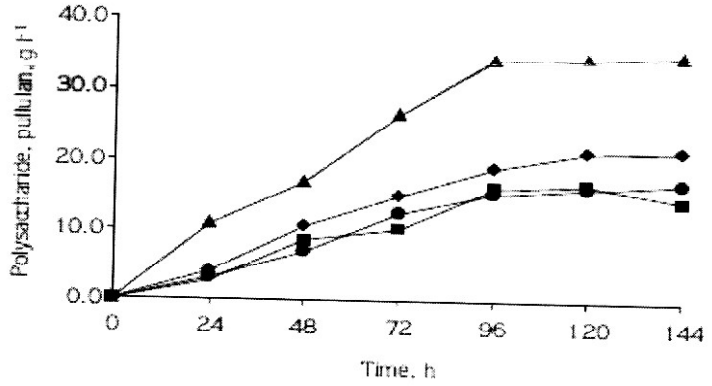

Figure 2. Polysaccharide and pullulan production by *A. pullulans* in molasses medium treated with sulfuric acid + activated carbon and synthetic medium in shake flasks at 28 °C, 200 rpm (polysaccharide in synthetic medium, ◆; pullulan in synthetic medium, ■; polysaccharide in molasses medium, ▲; pullulan in molasses medium, ●)

Interpret and answer the following:

a) In which medium highest pullulan and polysaccharide were produced and why?

b) Which medium will be more beneficial for faster pullulan production?

c) Which medium would you prefer for production of pullulan on production scale? Why?

■ ■ ■