Total No. of Questions : 5]

SEAT No. :

P1446

[Total No. of Pages : 2

[5434]- 11
M.Sc. - I
MICROBIOLOGY
MB - 501 : Microbial Diversity and 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-labeled diagrams wherever necessary.***
4) ***Use of logarithmic tables and scientific calculator is allowed.***
5) ***Assume suitable data if necessary.***

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

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

b) Discuss the significance of extra chromosomal element transfer in bacterial taxonomy.

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

Q2) Answer 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) Discuss the role of sequence alignment in the field of molecular evolution.

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

a) Describe in short the methodological strategies for 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 anyfour 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) A water body has been contaminated with run-off water from an oil refinery. Explain how you would measure the possible difference in bacterial diversity. Draw the flow chart of proposed strategy. **[16]**

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Total No. of Questions : 5]

SEAT No. :

P1447

[Total No. of Pages :3

[5434]-12
M.Sc. - I
MICROBIOLOGY
MB - : 502 : Quantitative Biology
(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 - 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 following: **[16]**

a) Calculate and compare mean and median of following distribution.

X Variable	51-55	56-60	61-65	66-70	71-75	76-80	81-85
Frequency	5	8	9	11	8	6	3

b) Describe the models in population genetics.

c) Water samples were taken from the wells of two localities, one from industrial area(1) and the other from non-industrial area (2). The samples were analyzed for lead content and the following data were obtained.

Locality 1	Locality 2
Sample size$_1$= 25	Sample size$_2$=25
Mean$_1$=390 ppb	Mean$_2$ = 10 ppb
Stand. Dev$_1$.= 277.5 ppb	Stand. Dev$_2$. = 5 ppb

Test the hypothesis that the average lead concentration in the ground water of industrial area exceeds that of the non-industrial area.

P.T.O.

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

a) Draw a histogram, frequency polygon representing following data:

Number of pods	10-20	20-40	40-50	50-70	70-80	80-100	100-130	130-150
Number of plants	13	48	24	20	5	8	6	2

b) Calculate the Probability of following:

i) The life expectancy of light bulbs whose life times are normally distributed with a mean life of 700 hours and standard deviation of 40 hours. What is the probability that the bulb will last 790 hours?

ii) An average of 5 cars arrives at a tollbooth every minute. Assuming this to be a Poisson distribution, what is the probability that exactly 1 car will arrive in a one minute period.

c) Calculate the variance, the standard deviation and coefficient of variation from the data recorded on the respiration rate per minute of 10 persons. Respiration/minute = 22, 22, 20, 24, 16, 17, 18, 19, 21, 21

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

a) A new drug candidate was administered to 250 persons out of total 450 persons in a locality where epidemic was prevalent to test its efficacy against malaria. The results are given below in the table. Find out effectiveness of drug against disease.

	Infection	No infection
Drug	100	150
No Drug	150	50

b) If two parents, both heterozygous carriers of the autosomal recessive gene causing cystic fibrosis, have five children. What is the probability that three children will be normal?
(Given:Mono-hybride cross)

c) Explain the concept of epidemiological model.

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

a) F test

b) Genome database

c) Simulation of bacterial growth

d) Standard error

e) Confidence interval

Q5) Attempt any one of following: **[16]**

a) Calculate the correlation coefficient and regression coefficient between two measurements of water quality of a lake. Test its significance.

Salinity (%)	3	5	7	9	11	13	15
Dissolved Oxygen (mg/1)	4	5	6	8	10	10	12

b) To study the performance of three detergents and three different water temperatures; following whiteness readings were obtained with specially designed equipment.

	Detergents		
Water Temperature	A	B	C
Cold water	57	55	67
Warm Water	49	52	68
Hot water	54	46	58

Apply two way ANOVA and interpret results.

Total No. of Questions : 5]

SEAT No. :

P1448

[Total No. of Pages : 2

[5434]-13
M.Sc. - I
MICROBIOLOGY
MB - 503 : Cell Organization and Biochemistry
(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 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 classification of lipids with suitable examples.

b) Explain the phenomenon of mutarotation in glucose molecule.

c) Compare and contrast between A and B form of DNA.

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

a) What is hydrogen bonding? Explain its role in biomolecules.

b) Explain with suitable example the tertiary structure of globular proteins.

c) Explain the role of morphogen gradients in *Drosophila*.

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

a) Draw structure of vitamin A and explain its biological role.

b) Explain with the help of diagram, working of confocal microscope and comment on its applications.

c) Describe the mechanism of biofilm formation and comment on its significance.

P.T.O.

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

a) Teratogens

b) Tm value

c) Ninhydrin reaction

d) Inductive effect

e) Sugar acids

Q5) Solve the following:

a) A mixture of following amino acids is subjected t electrophoresis at pH 4.0: Gly, Ile, Lys, Glu. His. Which one will go towards anonde (-)? Towards cathode(+)? Why? Is it possible to separate amino acids by the above mentioned method? **[8]**

b) Describe the preparation of 100 ml of 0.5 M buffer, pH 7.0 using solid KH_2PO_4 and K_2HPO_4.

(Given- pKa = 6.86, M.W. KH_2PO_4= 136, $K_2HPO_4$174). **[8]**

Total No. of Questions :5]

SEAT No. : ____

P1449

[Total No. of Pages : 2

[5434]-21
M.Sc.
MICROBIOLOGY
MB-601: Instrumentation and Molecular Biophysics
(2008 Pattern) (Semester-II)

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

Instructions to the candidates :

1) ***All questions are compulsary.***
2) ***Figures to the right indicate full marks.***
3) ***All questions carry equal marks.***
4) ***Use of logarithmic tables and scientific calculators is allowed.***
5) ***Assume suitable data if necessary.***
6) ***Neat diagrams must be drawn wherever necessary.***

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

a) Explain the working of affinity chromatography.

b) Describe SDS-PAGE.

c) With a suitable example explain the pulse chase experiment.

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

a) Explain the theory involved and instrumentation of CD.

b) Describe super secondary structures of protein.

c) With suitable example explain quarternary structure of protien.

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

a) How is phase determination done in X-ray crystallography.

b) With respect to NMR explain

   i) Relaxation parameter

   ii) Spin-spin coupling

c) Explain the working of MALDI-TOF.

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

a) Homology based Method for protein structure prediction.

b) Chemical properties of Aliphatic amino acid.

c) Hanging drop method of crystallization.

d) Cerenkov radiation.

e) Electron capture detector.

P.T.O.

Q5) a) i) predict the order of eluction when a mixture containing the following compounds is passed through a column containing a gel that excludes all protein's of MW 2,00,000 and higher. Cytochrome C (MW-13,000) tryptophan synthetase (MW-1,17,000) hexokinase (MW-96,000) ATP sulfurylase (MW-4,40,000) glucose oxidase (MW-1,54,000) and xanthine oxidase (MW-3,00,000) **[8]**

ii) What factors other than molecular weight will influence the elution volume, Ve of a protein from a sephadex column.

b) At 20ºC a protein (X) has diffussion coefficent of 6.1×10^{-7} cm^2/sec and a sedimentation coefficient of 4.6S. The density of water at 20ºC is 0.998. Calculate the MW of protein (X) assuming a specific volume of 0.74 at 20ºC **[8]**

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Total No. of Questions : 5]

SEAT No. :

P1450

[Total No. of Pages : 2

[5434]-22

M.Sc.

MICROBIOLOGY

MB - 602 : Evolution, Ecology and Environmental Microbiology

(2008 Pattern) (Part-I) (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, scientific calculators is allowed.***
6) ***Assume suitable data, if necessary.***

Q1) Enlist different anaerobic treatment processes. Describe in detail fluidized bed reactor treatment process, its microbiology and process analysis. **[16]**

OR

Explain different types and levels of selection. Describe kin selection in detail.

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

a) Describe marine environment and regulation of bacterial community in marine ecosystem.

b) Explain evolutionary origin of biochemical disorders in context to insulin resistance.

c) Explain the term rhizoplane. Describe role of siderophore and indole acetic acid in community ecology.

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

a) Explain cooperation and its significance in evolution of sociality and multicellularity in microorganisms.

b) Explain disinfection with chlorine and dechlorination.

c) Elaborate on the process of adsorption using granular and powdered activated carbon.

P.T.O.

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

a) Dairy industry wastewater treatment process.

b) Neo Darwinism.

c) Rhizosphere community structure.

d) UASB process.

e) Interaction of mychorrhizal fungi with non host plants.

Q5) The following data were obtained in the analysis of an industrial waste:**[16]**

After 5 days of incubation at 20°C , the residual dissolved oxygen in blanks was 7.80 mg/L, and in a 0.1 percent dilution of the waste was 2.80 mg/L.

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

b) How many pounds of 5-day BOD are contained in 10,000 gallons of the waste?

Total No. of Questions : 5]

SEAT No. :

P1451

[Total No. of Pages : 2

[5434]-23
M.Sc.
MICROBIOLOGY
MB - 603 : Microbial Metabolism
(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) ***Figures to the right indicate full marks.***
4) ***Use of log tables, graph papers, scientific calculator is allowed.***
5) ***Assume suitable data, if necessary.***
6) ***Draw neat labeled diagrams wherever necessary.***

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

a) What is purification chart? Explain with the help of a suitable example.

b) Describe the roles of various enzymes in ammonia assimilation.

c) Justify the term 'High energy compounds'.

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

a) Describe the principle and operation of ion exchange chromatography in purification of enzymes.

b) Describe the mechanisms of oxygen exclusion for protection of nitrogenase operated in diazotrophs.

c) Describe the electron transport chain as present in mitochondria.

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

a) Compare plant and bacterial photosynthesis.

b) Explain in brief the process of nitrate respiration.

c) Diagrammatically illustrate structure and organization of biological membranes.

P.T.O.

Q4) Write short note on (Any 4): **[16]**

a) Laws of thermodynamics

b) Glutamine synthetase

c) Passive diffusion

d) Methanogens

e) CO_2 as a terminal electron acceptor

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

a) Use the King and Altman procedure to obtain a rate equation for the reaction $E + S \underset{K_2}{\overset{K_1}{\rightleftharpoons}} E\,S \underset{K_4}{\overset{K_3}{\rightleftharpoons}} E\,P \xrightarrow{K_5} E + P$.

b) Suppose you were to add uncoupler dinitrophenol to a preparation of chloroplast carrying out photosynthesis.

Which of the following activities would you expect to be affected? Give reasons.

i) Absorption of light.

ii) Cyclic photophosphorylation

iii) Electron transport between PS-I & PS-II.

iv) Non cyclic photophosphorylation.

v) Synthesis of PGA.

vi) NADP reduction.

vii) Reduction of O_2.

viii) Transport of H^+ ions back into the matrix.

Total No. of Questions : 5]

SEAT No. :

P1452

[Total No. of Pages : 2

[5434]- 31
M.Sc. - II
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 logarithmic tables and scientific calculators is allowed.***
5) ***Assume suitable data if necessary.***
6) ***Figures to right indicate full marks.***

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

a) Explain the general properties of cytokines giving examples.

b) Explain the T cell accessory membrane molecules and its role in immune activation.

c) Explain the role of Antigen and Antigen - Antibody complexes in the regulation of immune response.

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

a) Justify, "There exists T cells which have role in immune regulation".

b) Explain the functional evolution of immunoglobulins.

c) Explain the host immune responses to tumour.

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

a) Explain tumour markers and its use in diagnosis of tumours.

b) Explain phagocytic deficiencies and its diagnosis.

c) Explain the pathophysiology and diagnosis of Myasthenia gravis.

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

a) Role of IL - 1 in pyrogenesis.

b) Tumour vaccine therapy.

c) Tumour Necrosis factor.

d) ELISPOT assay.

e) Animal models for AIDS.

P.T.O.

Q5) Asthma is a chronic inflammatory airway disease currently afflicting millions of people worldwide. It is characterized by airway hyper responsiveness (AHR), inflammation and remodeling, that are associated with reversible airflow obstructions. Allergic asthma is the major phenotype of asthma.It is characterized by Th2 -type inflammation, allergenspecific IgE induction and mast cell involvement. Interleukin 33 (IL-33) represents one of the potential signals from the epithelial cells that trigger the development of asthma.

This study investigated the potential of IL-33 to exacerbate antigen driven asthma responses. An ovalbumin (OVA) asthma model was used in which sensitized C57BL/6 mice were exposed to IL-33 before each OVA challenge. Total inflammatory cells in BALF (Bronchoalveolar lavage fluid) were counted after injecting the C57BL/6 mice with PBS, IL-33, OVA, and OVA + IL-33.

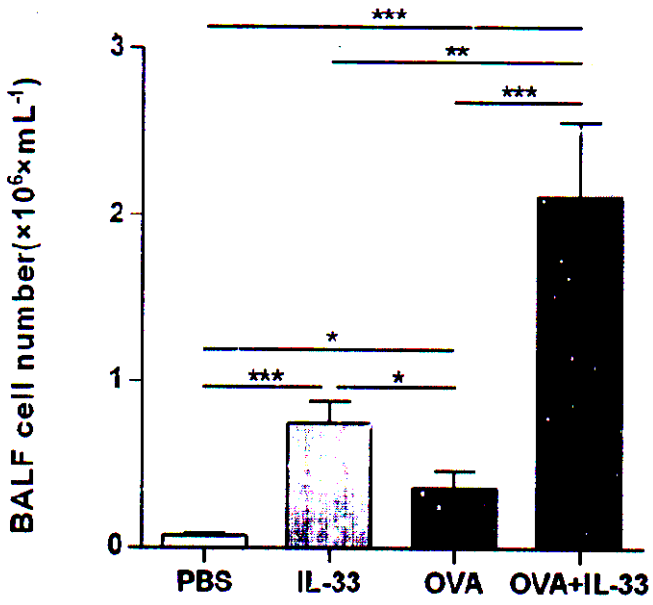

Fig 1 : Total inflammatory cells in BALF (Bronchoalveolar lavage fluid) were counted.*p <0.05,**p < 0.01,***p < 0.001 (ANOVA, Bonferroni) Results are pooled data from four independent experiments (mean +/-SEM of n = 9-10 mice for each group).

a) According to the present study does IL -33 have a role in inducing airway inflammation ? **[8]**

b) Explain the pathophysiology, diagnosis and prognosis of Asthma **[8]**

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Total No. of Questions : 5]

SEAT No. :

P1453

[Total No. of Pages : 2

[5434]-32
M.Sc. - II
MICROBIOLOGY
MB- 702 : Molecular Biology - I
(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-labeled diagrams wherever necessary.***

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

a) How circular DNA replicates? Explain with example.

b) Explain connection between cell cycle and DNA replication in E. coli.

c) List the proteins involved in recombination and explain role of each protein.

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

a) Explain mechanism of controlling elements in Tn10.

b) Explain gene conversion with example.

c) Explain transcription coupled repair system.

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

a) Explain higher order organization of DNA in eukaryotes.

b) Explain double stranded break repair model.

c) Explain role of DNA methylation in cancer with example.

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

a) C-value paradox
b) p^{53}
c) Histone Acetylation
d) SOS operon
e) ARS

P.T.O.

Q5) a) You have a culture of normal cells and a culture of cells dividing uncontrollably (isolated from a tumor). Experimentaly, how might you determine wheather uncontrolled growth was the result of an oncogne or a mutated pair of tumor suppressor alleles? **[8]**

b) A Diploid organism has 5.5×10^8 base pairs in its DNA. This DNA is replicated in 3 minutes. Assuming all replication forks move at a rate of 10^4 base pairs per minute How many replicons (replication units) are present in this organisms genome? **[8]**

Total No. of Questions : 5]

SEAT No. :

P1454

[Total No. of Pages : 2

[5434]-33
M.Sc. - II
MICROBIOLOGY
MB 703 : Virology
(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, labeled diagrams wherever necessary.***
4) ***Use of graph papers, log tables and electronic pocket calculator is allowed.***
5) ***Assume suitable data, if necessary.***

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

a) Explain genome organization and life cycle of Cauliflower mosaic virus.

b) Compare Killed and Attenuated viral vaccines.

c) Justify – Viruses show variations in their structures.

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

a) What is tissue culture? How are Primary cell lines prepared and used in cultivation of viruses?

b) What are the changes associated with virally infected plants?

c) What are the various methods used for enrichment and concentration of viruses?

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

a) TMV

b) Flow chart of Western Blotting technique.

c) PCR for viral genes

P.T.O.

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

a) Retrovirus mediated oncogenesis

b) General characters of Herpes virus

c) Interferons

d) Edible vaccines

e) Transmission of plant viruses through vectors

Q5) a) Diagrammatically illustrate various sites for inoculation of viruses in embryonated chicken egg. **[8]**

b) Luria broth was inoculated with wild type *E. coil* cells. After two hours of incubation at 37ºC One ml T_4 lysate was added to this broth and incubated further. Periodically samples were withdrawn and assayed on host for *pfu*,.

Following table shows the data.

Time of incubation (min)	***Pfu* per ml**
00	01
05	01
10	01
15	01
20	06
25	20
30	50
35	80
40	120
45	150
50	200
55	250
60	250

i) Draw labeled graph of growth of viruses (pfu Vs time) on a graph paper. **[5]**

ii) Calculate latent period from the graph. **[1]**

iii) Calculate burst size. **[2]**

Total No. of Questions : 5]

SEAT No. : ____

P1455

[Total No. of Pages : 2

[5434]-41
M.Sc.-II
MICROBIOLOGY
MB-801 : PHARMACEUTICAL & 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 is allowed***
5) ***Assume suitable data if necessary.***

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

a) Describe the bioprospecting phases involved in discovery of the drug.
b) Explain the rational drug design approach to drug discovery.
c) Describe the methodology to study bioactive molecules from natural sources.

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

a) Explain the safety profile assessment of drugs.
b) Describe the methods used for testing of antimycobacterial drugs.
c) Illustrate the phases of clinical trials for a drug.

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

a) Discuss the mode of action of endotoxin with suitable example.
b) Describe the receptor medated adhesion to host tissues by bacterial pathogens.
c) Explain in brief the extraction and purification of bioactive principles from natural resources.

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

a) CLSI
b) Sustained released drugs
c) Role of pharmacopeia in drug development
d) Micronucleus test
e) LD_{50}

P.T.O.

Q5) a) Following are the stages of product development process for extended release drugs. Rearrange them in apropriate order.
Prototype formulation, Registration/approval, Formulation/Process optimization, Defined formulation, Product, SUPAC, Target (In vivo, in vitro specification), Pilot PK (characterization), IVIVR Defind, Scale up/Pivotal PK studies & clinical studies, IVIVR PK study. **[8]**

b) In the routine pratical done in your laboratory you have observed that a fresh soil isolate of a fungus showed large inhibition zone around an air contaminant of *Bacillus.* After observing this noteworthy result, what would be your strategic steps to study this antifungal bacterium and the bioactive compound? **[8]**

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Total No. of Questions : 5]

SEAT No. :

P1456

[Total No. of Pages : 1

[5434]-42
M.Sc.
MICROBIOLOGY
MB-802 : Molecular Biology - II
(2008 Pattern) (Part - II) (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.***

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

a) Explain Characteristics of Genetic Code.
b) Explain Phage Display System with example.
c) Real Time PCR.

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

a) Describe translation process in Prokaryotes.
b) Explain Sanger's method of sequencing.
c) Explain role of sigma factor in transcription.

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

a) Explain RNA editing with example.
b) Explain "Wobble Hypothesis" for deciphering the genetic code.
c) List the enzymes used in RDT and explain their role in RDT.

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

a) DNA microarry technology
b) Rho dependent transcription
c) Pyrosequencing
d) YAC
e) Gene annotation

Q5) a) The sequence of nucleotides in an mRNA is: **[8]**
5' -AUGACCCAUUGGUCUCGCCCACCCCCUUA-3'
Assuming that ribosomes could translate this mRNA, how many amino acids long would you expect the resulting polypeptide chain to be?

b) What will be the sequence of DNA strand of this mRNA **[8]**
5'-AUGACCCAUUGGUCUCGCCCACCCCCGUGATTUUA-3'

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Total No. of Questions : 5]

SEAT No. :

P1457

[Total No. of Pages : 2

[5434]-43
M.Sc. (Part - II)
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, scientific calculator is allowed.***
6) ***Assume suitable data, if necessary.***

Q1) Describe various designs of airlift reactors using schematics. Comment on 'Influence of sparger location on gas distribution in airlift reactors'. **[16]**

OR

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

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

a) Explain the design of various impellers and describe the flow pattern generated by their use in chemostat.

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

c) Prepare the SOP for temperature controlled ultracentrifuge.

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

a) Explain the unit operations involved in downstream processing of Rifamycin.

b) Comment on 'Versatility of fungi as bioremediating and biocontrol agent'

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

P.T.O.

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

a) Process patent
b) Fungi as biofertilizers
c) Marine propeller
d) CSTR
e) Advantages of batch process

Q5) Refer to the given plot and answer the following: **[16]**

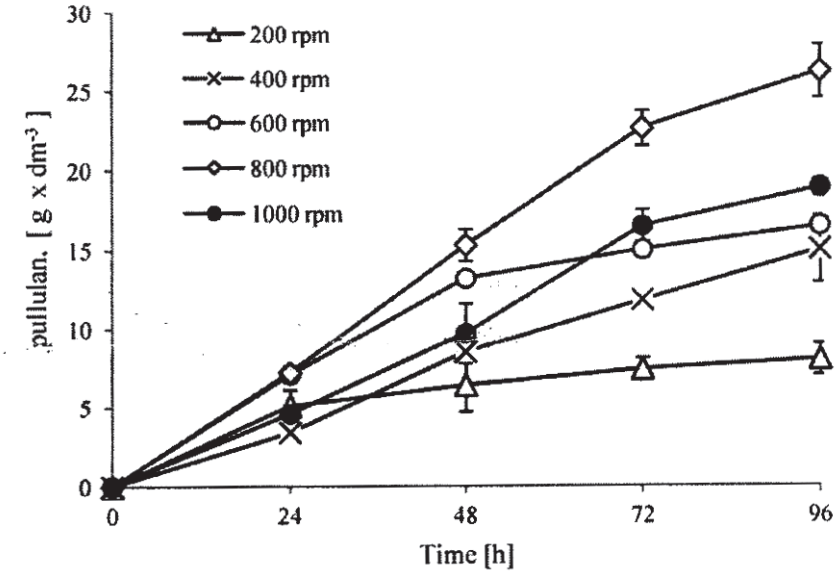

Fig. – The effect of agitation speeds on pH changes during the culture of *A. pullulans* B-1.

a) Interpret the plot for maximum production of Pullulan.
b) Comment about the effect of agitation on Pullulan production.
c) Describe all the parameters that needs to be optimized for Pullulan production.
d) Discuss the process of recovery of Pullulan from fermented medium.