Total No. of printed pages = 19

63/2 (SEM-4) BIT 402 (Opt-1,2,3,4)

2022

BIOTECHNOLOGY

(Theory Paper)

Paper Code : BIT 402 (Opt-1)

(Computational Biology)

Full Marks – 80

Time – Three hours

The figures in the margin indicate full marks for the questions.

1. Answer the following multiple-choice questions : 1×6=6

   (a) The amino acids in Hemoglobin (or any protein) uniformly have

   (i) D configuration

   (ii) R configuration

   (iii) L configuration

   (iv) S configuration

[Turn over

(b) Which amino acid is achiral and destabilizes the secondary structure of proteins ?

(i) Glycine

(ii) Aspartic acid

(iii) Lysine

(iv) Arginine

(c) Which one of the following methods for predicting the 3D structure of a protein is template free ?

(i) Homology modelling

(ii) Abinitio

(iii) Threading

(iv) None of the above

(d) Identify the correct site of ubiquitination of protein which leads to its degradation via the proteasome.

(i) K48 and K29

(ii) K33 and K36

(iii) K28 and K45

(iv) K62 and K70

(e) Which one of the following proteins is required for mitochondrial protein sorting ?

(i) PTS1 and Importin

(ii) Sec62 and Sec63 complex

(iii) TOM and TIM

(iv) None of the above

(f) Which one of the following online bioinformatics tools is widely used for Homology modelling ?

(i) NCBI

(ii) PUBMED

(iii) FASTA

(iv) SWISS-MODEL.

2. Write short notes on the following topics : 2×5=10

(a) Phosphorylation and Ubiquitination

(b) Importance of Serine / Threonine / Throsine / Lysine in post-translational modification of proteins.

(c) Templete-dependent methods for predicting tertiary structure of the protein.

(d) TIM and TOM.

(e) NLS and Importin.

3. Answer any *six* from the following questions : 5×6=30

(a) Explain the four levels of protein structure.

(b) What is the importance of protein databases ?

(c) Describe the different types of methods used for predicting tertiary structure of protein.

(d) To remove unwanted and damaged proteins from cells, what kind of post-translational modification is carried out ? Explain the molecular mechanism.

(e) What is meant by protein sorting ? Describe mitochondrial and nuclear protein sorting.

(f) What do you mean by genome ? Describe prokaryotic and eukaryotic genome organization.

(g) Elucidate the principle of molecular modelling and molecular docking.

(h) What is functional genomics and its importance ? Explain the different methods for performing functional genomics.

(i) What is comparative genomics and its significance ? Explain the different ways to perform comparative genomics.

4. Answer any *two* from the following descriptive and analytical questions : 10×2=20

(a) You are given two proteins A and B. Protein A is made up of 800 amino acids while protein B is made up of 200 amino acids (Note that the molecular weight of one amino acid is110Da). In these conditions, what methods will you perform to determine the 3D structure of Protein A and B ? Explain the principles and pros and cons of the methods you have chosen.

(b) For example, you are asked to predict the 3D structure of three proteins X, Y and Z. Upon performing bioinformatic analysis, protein X showed homologous structure in PDB (Protein Data Bank), while protein Y showed fold similarity but for protein Z no homologous and fold similarity was found

in PDB. In these scenarios, what kind of methods will you perform to predict the 3D structure of protein X, Y and Z. Explain the principles of the methods you have chosen.

(c) What is a protein database ? Provide a detailed classification of protein databases with examples.

5. Answer any *one* from the following essay type questions : 14×1=14

(a) Write in details on Post-translational modification.

(b) Explain in details on protein sorting.

(Theory Paper)

Paper Code : BIT 402 (Opt-2)

(Stem Cell and Molecular Biology)

Full Marks – 80

Time – Three hours

The figures in the margin indicate full marks for the questions.

1. Answer the following multiple-choice questions : 1×6=6

(a) Neo-organs are referred to as

(i) Man made graft

(ii) Man made organ

(iii) Scaffolding materials

(iv) Sympurifier

(b) Apligraph and ATS are the names of artificial

(i) Heart (ii) Bone

(iii) Skin (iv) Kidney

(c) In the treatment of burns, scientists can use stem cells to help them replace

(i) All parts of the patient's skin

(ii) Hair follicles and sweat glands

(iii) The outermost layer of the skin

(iv) All parts of the skin except sweat glands

(d) What does the acronym SCNT stand for?

(i) Stem Cell Nuclear Transplant

(ii) Somatic Cell Nuclear Transfer

(iii) Stem Cell Nuclear Transfer

(iv) Stem Cell Novo Transplant

(e) From what embryonic or extraembryonic tissue is placenta derived?

(i) Ectoderm

(ii) Trophoectoderm

(iii) Inner Cell Mass

(iv) Primary Endoderm

(f) What are cell 'fed' when they are grown in a lab?

(i) Antibodies

(ii) Proteins and sugars

(iii) Salts

(iv) Other cells.

2. Distinuish between (*all* compulsory): 2×5=10

(a) Allograft and Xenograft

(b) TSA and TAA

(c) MHC I and MHC II

(d) Wnt Pathway and Hh Pathway

(e) Exogenous and endogenous antigen processing.

3. Write short notes on any *six*: 5×6=30

(a) Cancer Stem Cells

(b) Therapeutic Cloning

(c) Autoimmune Disease

(d) Spermatogonial Stem Cells

(e) Signalling in the Neural Stem Cell micro-environment.

(f) Labial Retention Cells

(g) Stem Cell Plasticity

(h) Tumour initiating Cells

(i) Scaffolding Material.

4. Answer any *two* of the following questions : $10\times2=20$

(a) Write any essay for cryopreservation of embryos.

(b) Write a process of cell harvesting after lymphocyte culture.

(c) Describe the process of hand-made cloning.

5. Answer any *one* of the following questions : $14\times1=14$

(a) What is tissue engineering ? Explain Skin gene therapy. Describe the role of biomaterial scaffold for constructing tissue and cell delivery. $2+3+9=14$

(b) What is MSC ? Elaborate the role of MSC in clinical application and therapy. $2+12=14$

(c) What is cell culture ? How it is different from cell line ? What are the different types of Cell Culture ? Differentiate between primary and secondary cell culture. What are the different methods to initiate tissue culture ? Delimit cell culture from Organ culture. Mention the various applications of cell culture. $1+1+2+2+2+2+4=14$

(Theory Paper)

Paper Code : BIT 402 (Opt-3)

(Industrial Food Biotechnology)

Full Marks – 80

Time – Three hours

The figures in the margin indicate full marks for the questions.

1. Choose the correct option for the following : 1×3=3

(a) Ultrafiltration is used for separation with molecular weight range from

(i) 0.1-10 μm

(ii) 0.005-0.1 μm

(iii) 100-200 μm

(iv) 200-500 μm

(b) Which of the following are the recommended heat temperature and time period for the moist heat sterilization method used in an autoclave ?

(i) 180°C for 5 minutes

(ii) 121°C for 15 minutes

(iii) 126°C for 3 minutes

(iv) 160°C for 45 minutes

(c) Which proteases are widely used in the detergent industry ?

(i) Serirne Proteases

(ii) Metal Proteases

(iii) Threonine Proteases

(iv) None of these.

2. Answer the following questions : 1×3=3

(a) Name one inhibitor used in fermentation media.

(b) What is OUR ?

(c) What is the net growth in a stationary phase of a batch culture ?

3. Answer the following questions in brief: 2×5=10

(a) What is K_La ? What is the relation between K_La and the aeration capacity of a fermenter ?

(b) Define the fundamentals of downstream processing for product recovery.

(c) How is nanotechnology applied in the food industry ?

(d) Mention two methods used in ethanol production ?

(e) How is an industrial scale fermenter aerated ?

4. Write short notes on any *three* of the following: 5×3=15

(a) Bioreactors used for submerged fermentation.

(b) Media for inoculum development.

(c) Vessels and fermenters for animal cell culture.

(d) Modes of fermentation.

(e) OTR.

5. State the functions of the following with respect to a fermentation process: 5

Baffle, Sparger, Impeller, Buffer, Antifoam.

6. What are the basic principles exploited for the separation of biomolecules by chromatographic process ? 5

7. Briefly discuss the various types of centrifuges used in fermentation industry. 5

8. Answer any *two* of the following questions: 10×2=20

(a) Describe the build of a bioreactor with a neat and labelled diagram. 10

(b) Describe in brief the operations involved for the isolation and purification of acetic acid with diagrams. 10

(c) Describe the basic and additional components of a production media. 10

9. Answer any *one* of the following questions: 14×1=14

(a) Define a biosensor. Briefly describe the principles, types of biosensors and their applications. 1+3+5+5=14

(Theory Paper)

Paper Code : BIT 402 (Opt-3)

(Industrial Food Biotechnology)

Full Marks – 80

Time – Three hours

The figures in the margin indicate full marks for the questions.

1. Choose the correct option for the following : 1×3=3

(a) Ultrafiltration is used for separation with molecular weight range from

(i) 0.1-10 μm

(ii) 0.005-0.1 μm

(iii) 100-200 μm

(iv) 200-500 μm

(b) Which of the following are the recommended heat temperature and time period for the moist heat sterilization method used in an autoclave ?

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(iv) 160°C for 45 minutes

(c) Which proteases are widely used in the detergent industry ?

(i) Serirne Proteases

(ii) Metal Proteases

(iii) Threonine Proteases

(iv) None of these.

2. Answer the following questions : 1×3=3

(a) Name one inhibitor used in fermentation media.

(b) What is OUR ?

(c) What is the net growth in a stationary phase of a batch culture ?

(b) Derive the equation $X = X_o e^{m}$ net^{t} for cell concentration at any instant in a batch culture. What is doubling time (td) ? Derive the equation of doubling time for a batch culture.

8+1+5=14

(Theory Paper)

Paper Code : BIT 402 (Opt-4)

(Environmental Biotechnology)

Full Marks – 80

Time – Three hours

The figures in the margin indicate full marks for the questions.

1. Answer the following questions in brief : 1×10=10

(a) Define biosurfactants.

(b) Name the enzyme system involved in Phase I reactions of biotransformation of toxicants.

(c) What is Polyhydroxyalkanoates ?

(d) Name an inorganic pesticide.

(e) What is monoculture plantation ?

(f) Name a cryoprotectant.

(g) Name two plants used for phytoremediation.

(h) What are Goegraphical indicators ?

(i) Define xenobiotics.

(j) What does GATT signify ?

2. Answer the following questions in brief : 2×5=10

(a) What is Assisted Natural Regeneration ? What is the advantage of this technique.

(b) Name two drugs derived from plants.

(c) Name a biopolymer and the source from where it is derived.

(d) Classify pesticides based on the mode of entry.

(e) What are the criteria for granting patent ?

3. Write short notes on any *four* : 5×4=20

(a) Cryopreservation.

(b) Biomagnification of pesticides.

(c) Vermiculture.

(d) Biotransformation.

(e) Intellectual Property Rights.

4. What is bioprospecting ? What are the advantages and disadvantages of bioprospecting ? 8

5. Write briefly about transgenic plants used for phytoremediation. Also, briefly explain the significance of phytoremediation. 8

6. Answer any *two* from the following questions : 12×2=24

(a) Write an essay on sources of solid waste and how can they be managed effectively through biotechnology. 12

(b) What are plant secondary metabolites ? Describe in-vitro production of secondary metabolites. 12

(c) (i) What is toxicity testing ? What are the physiological and biochemical methods of toxicity testing ? 6

(ii) What is cytochrome P-450 ? What are its components ? How is it involved in oxidation of xenobiotics ? 6