

R5962

Sub. Code

501101

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

First Semester

Biotechnology

BIO-CHEMISTRY

(CBCS – 2020 onwards)

Time : Three Hours

Maximum : 75 Marks

Part A

(30 × 1 = 30)

Answer **all** the questions.

1. Blood analysis indicates a relatively low pH, and the patient is breathing rapidly. Applying your knowledge of acid-base balance, which of the following suits well
 - (a) Respiratory acidosis
 - (b) Metabolic acidosis
 - (c) Metabolic alkalosis
 - (d) Respiratory alkalosis
2. Henderson-Hasselbach equation states, when the pH of the solution becomes equal to its pKa, the solution becomes a buffer. This condition is achieved when
 - (a) concentration of proton donor equals proton acceptor
 - (b) concentration of proton donor becomes zero
 - (c) concentration of proton acceptor becomes zero
 - (d) none of the above.

3. pH of gastric juice is _____
- (a) 1 (b) 2
(c) 5 (d) 6
4. The pH of the body fluids is stabilized by buffer systems. Which of the following compound is the most effective buffer system at physiological pH?
- (a) Bicarbonate buffer
(b) Phosphate buffer
(c) HEPES buffer
(d) Citrate buffer
5. The greatest buffering capacity at physiological pH would be provided by a protein rich in which of the following amino acids?
- (a) Lysine (b) Histidine
(c) Aspartic acid (d) Leucine
6. Which among the following is the structure of myoglobin
- (a) Monomer (b) Homodimer
(c) Heterodimer (d) Tetramer
7. Which of the following pairs of amino acids would carry a positive charge on their side chain at pH 5.0
- (a) Glycine and valine
(b) Histidine and lysine
(c) Aspartate and glutamate
(d) Proline and leucine

8. Which of the following is not an example of supersecondary structure of proteins?
- (a) β -meander
 - (b) Greek key
 - (c) $\beta\alpha\beta$ unit
 - (d) α -monomer
9. At what level of protein structure would you expect disulfide bridges
- (a) Primary and secondary
 - (b) Secondary and tertiary
 - (c) Tertiary and quaternary
 - (d) All the levels
10. Which of the following name is given to molecular chaperones?
- (a) Allosteric protein
 - (b) Heat shock protein
 - (c) Thermolabile protein
 - (d) Porins
11. The Michaeli's constant, K_m is
- (a) Numerically equal to $\frac{1}{2} V_{max}$
 - (b) Dependent on the enzyme concentration
 - (c) Independent of pH
 - (d) Equal to the substrate concentration that gives half maximal velocity

12. In competitive inhibition, an inhibitor
- (a) Binds at several different sites on an enzyme
 - (b) Binds only to ES complex
 - (c) Binds covalently to the enzyme
 - (d) Binds reversibly at the active site
13. Non-competitive enzyme inhibition leads to
- (a) Increase in V_{max}
 - (b) Decrease in V_{max}
 - (c) Increase in K_m
 - (d) Decrease in K_m
14. Which of the following is a glycolipid?
- (a) Plasmalogen
 - (b) Cerebroside
 - (c) Lecithin
 - (d) Inulin
15. Mucins are
- (a) High molecular weight glycoproteins
 - (b) High molecular weight glycolipids
 - (c) Low molecular weight lipoproteins
 - (d) High molecular weight lipoproteins
16. Two strands of DNA are held together by
- (a) vander waal bond
 - (b) hydrogen bond
 - (c) covalent bond
 - (d) ionic interaction

17. Carbonic anhydrase is present at all places except
- (a) Gastric parietal cells
 - (b) Red blood cells
 - (c) Renal tubular cells
 - (d) Plasma
18. Enzymes of TCA cycle are located in the matrix of mitochondria except one which is located in the inner mitochondrial enzyme. The enzyme is _____
- (a) Succinate dehydrogenase
 - (b) Citrate synthase
 - (c) α -keto glutarate dehydrogenase
 - (d) Malate dehydrogenase
19. The electron flow in cytochrome c oxidase can be blocked by
- (a) Rotenone
 - (b) Antimycin A
 - (c) Cyanide
 - (d) Actinomycin
20. The main function of the pentose phosphate pathway is
- (a) supply pentoses and NADPH
 - (b) give the cell an alternative pathway when glycolysis fail
 - (c) supply of energy
 - (d) utilization of carbon resources

21. F₀-F₁ complex, ATP synthase inhibitor is
- (a) Valinomycin
 - (b) Antimycin
 - (c) Rotenone
 - (d) Oligomycin
22. The function of the Mevalonate pathway is
- (a) production of cholesterol
 - (b) production of myo-inositol
 - (c) production of thyroxine
 - (d) none of the above
23. Which enzyme catalyzes the reaction of glycogenolysis?
- (a) phosphoglucomutase
 - (b) glycogen phosphorylase
 - (c) glucose-6-phosphatase
 - (d) all of the above
24. Which of the following enzyme is responsible for glycogen breakdown?
- (a) Glycogen phosphorylase
 - (b) Glycogen phosphatase
 - (c) Glycogen hydrolase
 - (d) Glycogen phosphoglycosidase

25. Liver glycogen contributes to the maintenance of glucose but not muscle glycogen. Which of the following enzyme is absent in muscle?
- (a) Glycogen phosphorylase
 - (b) Hexokinase
 - (c) Glucose-6-phosphatase
 - (d) Debranching enzyme
26. Enzymes for beta oxidation of fatty acids are located in
- (a) Mitochondria
 - (b) Mitochondria and cytoplasm
 - (c) Mitochondria and peroxisome
 - (d) Mitochondria and golgi
27. The following is not a phospholipid
- (a) Lecithin
 - (b) sphingomyelin
 - (c) cerebroside
 - (d) oleate
28. In the α helix the hydrogen bonds:
- (a) are roughly parallel to the axis of the helix
 - (b) are roughly perpendicular to the axis of the helix
 - (c) occur mainly between electronegative atoms of the R groups
 - (d) occur only between some of the amino acids of the helix

29. Polypeptide formation in peptide is due to
- (a) Primary structure
 - (b) Secondary structure
 - (c) Tertiary structure
 - (d) Both secondary and tertiary structure
30. In glycoproteins, the carbohydrate moiety always gets attached through which of the following amino acids?
- (a) Glycine or alanine
 - (b) Glutamine or arginine
 - (c) Tryptophan or phenylalanine
 - (d) Asparagine, serine, or threonine

Part B

(10 × 2 = 20)

Answer any **ten** questions.

31. Give the structure of hemoglobin. Compare its characteristics with myoglobin.
32. What are micelles and how are they formed?
33. What are isoenzymes? Give examples.
34. Why is rate of an enzyme-catalysed reaction proportional to the amount of E-S complex?

35. Give the structure of cellulose. How does it differ from amylose structurally?
36. Briefly describe mTOR? How is mTOR connected to autophagy?
37. Describe experimental evidence to prove that DNA is the genetic material.
38. Mention few calcium signaling proteins. Write a note on intracellular calcium.
39. Write a short note on molten globule state in proteins, and its implications?
40. Role of citric acid cycle in cellular metabolism. Mention the total energy yield of the TCA-cycle.
41. Discuss the neurodegenerative disorders associated with protein folding.
42. What are isozymes? Outline its clinical significance

Part C

(5 × 5 = 25)

Answer any **five** questions.

43. Water is an ideal biological solvent — Justify.
44. (a) Show the features of Ramachandran plot?
(b) Discuss the Ramachandran plot of proline.
45. Outline the classification of membrane lipids.
46. Schematically present the Inositol/diacylglycerol/protein kinase c pathway and the mechanism through which calcium is regulated.

47. Describe the steps involved in oxidative phosphorylation
Also describe ATP synthase unit.
 48. What are the different steps involved in the Calvin cycle?
What is its significance?
 49. What are the different types of lipoproteins Mention their
function in human body.
 50. Give detailed account of Gibbs free energy, entropy and
enthalpy.
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R5963

Sub. Code

501102

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

First Semester

Biotechnology

CELL AND MOLECULAR BIOLOGY

(CBCS – 2020 onwards)

Time : 3 Hours

Maximum : 75 Marks

Part A

(30 × 1 = 30)

Answer **all** the questions.

1. Who discovered the cell?
(a) Robert Hooke (b) Schwann
(c) Tatum (d) De Bary
2. The study of the structure and composition of cells is called
(a) Cytology (b) Anthology
(c) Ecology (d) Phenology
3. Which of the following cell organelles is absent in animal cells but present in a plant cell?
(a) Mitochondria (b) Cytoplasm
(c) Vacuoles (d) Cell wall
4. Which of the following cell organelles is called digestive bags?
(a) Nucleus (b) Lysosomes
(c) Chloroplast (d) Mitochondria

5. What is the site of ribosome in a living cell?
- (a) Endoplasmic reticulum
 - (b) Golgi bodies
 - (c) Plasma membrane
 - (d) Nucleolus
6. Which of the following is considered as a cell within a cell?
- (a) Chloroplast (b) Ribosome
 - (c) Mitochondria (d) Golgi complex
7. Which of the following is a single membrane-bound cell organelle?
- (a) Vacuole
 - (b) Golgi Apparatus
 - (c) Endoplasmic Reticulum
 - (d) All of these
8. A chromosome consists of DNA and
- (a) Gene (b) Lipids
 - (c) Proteins (d) Carbohydrates
9. The oxygen and carbon dioxide cross the plasma membrane by the process of
- (a) Active diffusion
 - (b) Facilitated diffusion
 - (c) Passive diffusion
 - (d) Random diffusion

10. Distribution of intrinsic proteins in the plasma membrane is
- (a) Random (b) Symmetrical
(c) Asymmetrical (d) None
11. Which cell organelle is involved in apoptosis?
- (a) Lysosome (b) ER
(c) Golgi (d) Mitochondria
12. Meiosis II is similar to mitosis in that
- (a) Sister chromatids separate during anaphase
(b) The daughter cells are diploid
(c) Homologous chromosomes synapse
(d) DNA replicates before the division
13. Homologous chromosomes move toward opposite poles of a dividing cell during
- (a) Mitosis (b) Meiosis I
(c) Meiosis II (d) Fertilization
14. Which of the following are similar between transcription in prokaryotes and eukaryotes?
- (a) RNA polymerase produces mRNAs which grow in the 5'-3' direction
(b) RNA polymerase binds to ribosomes to allow transcription
(c) Poly-A tail is added to the 3' end of messenger RNAs
(d) Introns are present in genes which are spliced out after transcription

15. Which combination of the statements below is correct for a cancer cell?
- (A) Binding of p53 with MDM2, a ubiquitin E3 ligase, is a cause for cancer progression
 - (B) Phosphorylation of a tyrosine residue in the C-terminus of human c-Src is essential for cell invasion and motility
 - (C) Loss of function of both alleles of a tumor suppressor gene prevents metastasis
 - (D) Dimerization of c-Myc-Max leads to enhanced cell proliferation
- (a) (A) and B (b) (C) and D
(c) (A) and (D) (d) (B) and (C)
16. In eukaryotic replication, helicase loading occurs at all replicators during
- (a) G0 phase (b) G1 phase
 - (c) S phase (d) G2 phase
17. Which one of the following chemicals is a DNA intercalator?
- (a) 5-Bromouracil
 - (b) Ethyl methane sulfonate
 - (c) Acridine orange
 - (d) UV
18. Given below are events in the cell cycle.
- (A) Phosphorylation of lamin A, B, C
 - (B) Phosphorylation of Retinoblastoma protein
 - (C) Polyubiquitination of securin
 - (D) Association of inner nuclear membrane proteins and nuclear pore complex with chromosomes.

Which of the following reflects the correct sequence of events in the mammalian cell cycle?

- (a) $A \rightarrow B \rightarrow C \rightarrow D$ (b) $B \rightarrow C \rightarrow D \rightarrow A$
- (c) $C \rightarrow A \rightarrow B \rightarrow D$ (d) $B \rightarrow A \rightarrow C \rightarrow D$

19. The coding sequences found in split genes are called
- (a) operons
 - (b) introns
 - (c) exons
 - (d) cistrons
20. Wobble position means
- (a) base pairing
 - (b) altered base on code
 - (c) third altered base on codon
 - (d) none of the above
21. Genes which are active all the time synthesizing substances needed by the cell are called
- (a) cellular luxury genes
 - (b) metabolic genes
 - (c) housekeeping genes
 - (d) control genes
22. Which one is an example for chromosomal mutation
- (a) Sickle cell anemia
 - (b) Muscular dystrophy
 - (c) Phenylketoneuria
 - (d) Klinefelter's syndrome
23. The plant in which Hugo de Vries introduces the concept of mutation is
- (a) *Oenothera lamarckiana*
 - (b) *Pisum sativum*
 - (c) *Allium cepa*
 - (d) *Mirabilis jalapa*

24. Pigments containing bodies that are bounded by the membrane are called
- (a) Chlorophyll (b) Plastids
(c) Chloroplast (d) Haemoglobin
25. The culturing of cells in liquid agitated medium is called
- (a) liquid culture
(b) micro propagation
(c) Agar culture
(d) suspension culture
26. The variation in *in vitro* culture is called as
- (a) in vitro variation
(b) mutation
(c) somaclonal variation
(d) all of these
27. A technique called southern blotting is used in
- (a) Monoclonal antibody production
(b) In vitro culture
(c) Genetic finger printing
(d) Polyrnerase chain reaction
28. Nuclear membrane is in continuous connection with
- (a) SER (b) RER
(c) Golgi apparatus (d) Lysosomes

29. Mitochondria in the living cell can readily be identified from other organelles of the cell through light microscope by using
- (a) Cotton blue (b) Osmic acid
(c) Janus green (d) Lead citrate
30. Which of the following is NOT the part of growth medium for animal culture?
- (a) Starch (b) Serum
(c) Carbon source (d) Inorganic salts

Part B

(10 × 2 = 20)

Answer any **ten** questions.

31. Name a non-membranous organelle with the indication of the function.
32. Write the name of enzymes present in Microbodies.
33. Define: (a) Cell cycle (b) M phase (c) G2 phase.
34. Define active and passive transport.
35. Comment on receptor mediated Endocytosis.
36. Comment on Decarboxylation process.
37. Explain the role of non-Histone proteins.
38. Discuss nucleosomes as fundamental unit of DNA organization.
39. Compare, Natural and Artificial mutations.

40. Compare Polycistronic and Monocistronic mRNA.
41. Tabulate the components of plant tissue culture media.
42. What is the difference between light microscopy and electron microscopy?

Part C (5 × 5 = 25)

Answer any **five** questions.

43. Distinguish between DNA polymerase I & DNA polymerase — II.
 44. Describe the models of membrane.
 45. What is cell division? Discuss the biological significance of each type of cell division.
 46. Explain the functions of endoplasmic reticulum and Golgi bodies with suitable diagram.
 47. Give an account on laboratory needs for plant tissue culture.
 48. Why fluorescence is important for some forms of microscopy?
 49. What is RNA? Explain types of RNA with significance.
 50. Explain about the tumor suppressor gene p53 and activation of oncogenes.
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R5964

Sub. Code

501103

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

First Semester

BioTechnology

PLANT AND ANIMAL BIOTECHNOLOGY

(CBCS – 2020 onwards)

Time : Three Hours

Maximum : 75 Marks

Part A

(30 × 1 = 30)

Answer **all** questions.

1. The theoretical basis for plant cell culture was first proposed by
 - (a) Murashige and Skoog
 - (b) Skoog and Miller
 - (c) G.Haberlandt
 - (d) White
2. Which one of the following stages not found in Dicot somatic embryogenesis
 - (a) Coleoptile scutellum stage
 - (b) Torpedo stage
 - (c) Heart shaped stage
 - (d) Globular stage
3. Which stain is used for the plant protoplast viability test
 - (a) Bromophenol blue
 - (b) Crystal violet
 - (c) Acridine orange
 - (d) Fluorescein diacetate

4. The most favourable plant culture for secondary metabolite isolation is
- (a) Protoplast culture
 - (b) Shoot meristem culture
 - (c) Cell suspension culture
 - (d) Embryo culture
5. To get more defined tissue which type of animal cell culture is preferable
- (a) Organotypic culture
 - (b) Secondary cell culture
 - (c) Primary cell culture
 - (d) Cell line culture
6. To prevent accumulation of lactate in animal cell culture
- (a) high glutamine concentration is required
 - (b) low glutamine concentration required
 - (c) high glucose concentration is required
 - (d) low glucose concentration is required
7. The advantage of chloroplast transformation is
- (a) nuclear integration and specific expression
 - (b) foreign DNA is settled in protoplasm
 - (c) maternal inheritance
 - (d) stops the expression of nuclear genes
8. The protein which receives the signal from wounded plant is
- (a) vir A
 - (b) vir C
 - (c) vir G
 - (d) vir E

9. Which method of plant transformation method will end up with single or less copy number of foreign gene
- (a) Electroporation
 - (b) Particle bombardment
 - (c) PEG mediated gene transfer
 - (d) *Agrobacterium* mediated transformation
10. Which one of the plant transformation reporter system uses X gluc substrate
- (a) GFP reporter gene
 - (b) GUS gene
 - (c) Luciferin reporter gene
 - (d) Vir reporter gene
11. Cas9 is a
- (a) protein which recognizes the target DNA
 - (b) enzyme which induce the gRNA
 - (c) a palindrome sequence
 - (d) a protein cleaves the target DNA
12. Plantibodies are
- (a) short sequences found in plants
 - (b) antibodies produced by transgenic plants
 - (c) antibodies used to control plant disease
 - (d) proteins used to improve the efficiency of plant genetic engineering
13. Which of the following statement is True about human spermatozoa
- (a) tend to release large number of post abstinence
 - (b) moves because of their tails
 - (c) has an enzyme in their head which facilitates penetration of ovum
 - (d) fertilizes the ovum at a concentration of around 1 million/ml

14. Which one of the cryopreservation is less successful
- (a) Oocyte cryopreservation
 - (b) Spermatozoa cryopreservation
 - (c) Ovarian tissue cryopreservation
 - (d) Embryo cryopreservation
15. Most ideal method of Oocyte collection from ovary is
- (a) Slicing of ovaries
 - (b) Follicle aspiration
 - (c) Follicle puncturing
 - (d) None of the above
16. Which genetic manipulation in animals increase the gene expression
- (a) Knock in
 - (b) Knock out
 - (c) Transgenic
 - (d) All above
17. Which one is the incorrect statement about the inactivated type of virus
- (a) prepared by heat or radiation for the inactivation of toxins of microbes
 - (b) most effective against effective pathogen but less on viral pathogen
 - (c) polio virus and Hepatitis A vaccines are common inactivated vaccines
 - (d) prepared by heat or radiation for the inactivation of microbe
18. The first recombinant antigen vaccine approved for human use
- (a) DPT vaccine
 - (b) Var vaccine
 - (c) Hib vaccine
 - (d) Hepatitis B vaccine

19. Variation between individuals due to single base changes
- (a) ESTs
 - (b) VNTRs
 - (c) SNPs
 - (d) Transversion
20. Which one of the following is not a genome alignment assembly tool
- (a) PB Jelly
 - (b) PHYLIP
 - (c) FALCON
 - (d) HINGE
21. 1000 genome project deals with
- (a) Genomes of 1000 plants
 - (b) Genomes of microbes
 - (c) Genome of virus
 - (d) Genetic variations in human population
22. Studying the RNA population of the cell
- (a) structural genomics
 - (b) comparative genomics
 - (c) transcriptomics
 - (d) translational genomics
23. Tilling microarray is a
- (a) Sequencing based method
 - (b) High throughput sequencing based method
 - (c) Column separation method
 - (d) Hybridization based method

24. Which one of the following gene is amplified in PCR to detect meat adulteration
- (a) Cytochrome b
 - (b) Cytochrome P450
 - (c) Cytochrome c
 - (d) None of the above
25. Which one of the following PCR technique is more sensitive and using isothermal amplification
- (a) Real Time PCR
 - (b) Reverse transcription PCR
 - (c) LAMP
 - (d) PCR
26. Which one of the following statements is incorrect
- (a) Quantitative inheritance results in a range of measurable phenotypes for a polygenic trait.
 - (b) Polygenic traits often demonstrate continuous variation
 - (c) Certain alleles of QTL have an additive effect on the character
 - (d) Alleles governing quantitative traits do not segregate and assort independently
27. Bt cotton expressing cryIII protein will show better resistant against
- (a) Lepidoptera
 - (b) Coleoptera
 - (c) Both (a) and (b)
 - (d) None of the above

28. Transgenic fungal resistance conferred by
- (a) Coat protein
 - (b) Movement protein
 - (c) PR protein
 - (d) Movement protein
29. DNA fingerprinting relies on minisatellites which are
- (a) repetitive coding short DNA sequences
 - (b) repetitive non coding short DNA sequences
 - (c) repetitive coding non coding short DNA sequences
 - (d) non repetitive coding non coding short DNA sequences
30. AFLP technique is based on
- (a) Restriction digestion
 - (b) Restriction digestion and sequencing
 - (c) Sequencing and hybridization
 - (d) Restriction digestion and selective amplification

Part B

(10 × 2 = 20)

Answer any **ten** questions.

31. Differentiate monocot and dicot somatic embryogenesis stages
32. Give the important applications of micropropagation.
33. What are continuous cell lines?
34. Compare Ti and Ri plasmid structure
35. What are selectable markers?
36. What is genome editing?

37. What is artificial insemination?
38. Write the pronuclear microinjection method of transgenic animal production
39. What is comparative genomics
40. Name any two transcriptome databases and write its service
41. Which DNA markers are used in Forensic science? Why?
42. Multiplexing is advantageous in disease detection – justify.

Part C

(5 × 5 = 25)

Answer any **five** questions.

43. How would you apply different tissue culture technique to improve crop plants?
44. Write the establishment of primary and secondary animal cell culture
45. Explain the molecular mechanism of T-DNA integration
46. Plants are better than animals and microbes for the production of Industrial and pharmaceutical products-justify.
47. Explain the recombinant approaches for Vaccine production
48. Write the applications and proposed benefits of Human genome project
49. Explain the AFLP marker technique
50. Discuss different transgenic approaches used for the production of virus resistant plant

R5965

Sub. Code

501104

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

First Semester

Biotechnology

MICROBIOLOGY

(CBCS – 2020 onwards)

Time : Three Hours

Maximum : 75 Marks

Section A

(30 × 1 = 30)

Answer **all** questions.

1. Which of the following scientist first showed mutually beneficial relationship between bacteria and leguminous plants?
 - (a) H. Hellriegel and H. Wilfarth
 - (b) Nocard and Roux
 - (c) S. Winogradsky and M. W. Beijerinck
 - (d) Welch and Nuttall

2. Culture media for fungi are
 - (a) Potato dextrose agar (PDA)
 - (b) Sabouraud's agar
 - (c) Czapekdox agar
 - (d) All of the above

3. A device used to measure the bacterial growth in continuous culture
- (a) Micromanipulator
 - (b) Chemostat
 - (c) Petroff- Hausser counting chamber
 - (d) Gas pack method
4. Which one of the following produce typical fried egg appearance colonies on solid media?
- (a) Mycobacteria (b) Mycoplasts
 - (c) Mycoplasmas (d) Bacteroides
5. A spontaneous mutation usually originates as an error in
- (a) DNA replication (b) DNA transcription
 - (c) Translation (d) Reverse transcription
6. The fruiting body of a mushroom is called
- (a) Conidiocarps (b) Ascocarps
 - (c) Basidiocarps (d) Sorocarps
7. Five kingdom system of classification is proposed by
- (a) Carl linnaeus (b) Woese
 - (c) Fritsch (d) Whittaker
8. Branch of science that deals with identification, nomenclature and classification of organisms is called
- (a) Systematics (b) Taxonomy
 - (c) Classification (d) Nomenclature

9. In ruminants how many compartments of stomach are there _____
- (a) Two (b) Four
(c) Six (d) Three
10. The best method used to sterilize the air in aerobic fermentation industry is
- (a) Chemicals (b) UV light
(c) Filtration (d) Heat
11. An organism that is osmophilic and has a specific requirements for sodium chloride resembles
- (a) Halophile (b) Basophile
(c) Barophile (d) Xerophile
12. All prokaryotes are surrounded by a cell wall except
- (a) Mycoplasmas (b) Sperochetes
(c) Actinomycetes (d) Methanogena
13. The method in which the cells are frozen dehydrated is called
- (a) Pasteurization (b) Dessication
(c) Disinfection (d) Lypophilization
14. The condition required for autoclave
- (a) 121° C temp. and 15 lbs. pressure for 20 min.
(b) 120° C temp. and 20 lbs. pressure for 30 min.
(c) 150° C temp. for 1 hr.
(d) 130° C' temp for 2 hr.

15. Macconkey agar medium is
- (a) Enrichment medium
 - (b) Enriched medium
 - (c) Selective medium
 - (d) Differential medium
16. β -lactum ring is present in
- (a) Erythromycin
 - (b) Penicillin
 - (c) Tetracyclins
 - (d) Chromphenical
17. Antiseptic methods were first introduced by
- (a) Lord lister
 - (b) Iwanowski
 - (c) Beijernick
 - (d) Edward Jenner
18. _____ are small naked fragments of RNA that infect plant cells.
- (a) Prions
 - (b) Nucleons
 - (c) Prophages
 - (d) Viroids
19. Virus causing Rabies is
- (a) Orthromyxo virus
 - (b) Paramyxo virus
 - (c) Rhbdo virus
 - (d) Toga viruses

20. Dengue virus is transmitted from man to man by the
- (a) Sand fly
 - (b) Ticks
 - (c) *Aedes aegypti*
 - (d) Culex
21. Japanese encephalitis is caused by
- (a) Toga Viruses
 - (b) Arbo Viruses
 - (c) Para myxo Viruses
 - (d) Ortho myxo Viruses
22. Which point in the replication cycle appears most easily blocked by antivirals?
- (a) Virus absorption
 - (b) Virus penetration
 - (c) Virus RNA and DNA replication
 - (d) Exit of viruses from the cell
23. Which antifungal drug – used only in the treatment of dermatophyte infections works by inhibiting mitosis in fungal cells?
- (a) Griseofulvin
 - (b) Fluconazole
 - (c) Tolnaftate
 - (d) Caspofungin
24. Which of the following species is used for producing tetracycline?
- (a) *S. venezuelae*
 - (b) *S. griseus*
 - (c) *S. aureofaciens*
 - (d) *S. griseoflavus*

25. an organism that has adapted to living in very low temperatures (cold), such as bacteria or algae
- (a) Psychrophile
 - (b) Thermophile
 - (c) Acidophile
 - (d) Xerophile
26. The best example for symbiotic association is
- (a) Ecoli in intestine of man
 - (b) Lichens
 - (c) Normal flora of skin
 - (d) HIV infect human
27. Nitrogen fixation is the conversion of
- (a) N_2 to N
 - (b) N_2 to NH_3
 - (c) N_2 to NO_3
 - (d) N_2 to urea
28. Ruminant can digest fiber because it contain
- (a) Enzyme amylase
 - (b) Enzyme cellulase
 - (c) Enzyme protease
 - (d) None of above
29. Synbiot are called
- (a) Probiotics
 - (b) Prebiotics
 - (c) Postbiotics
 - (d) Combination of Probiotics and Prebiotics

30. The cell-cell communication relies on secreted signal molecules, called
- (a) Autoinducers
 - (b) Pheromones
 - (c) Peptides
 - (d) All the above

Section B

(10 × 2 = 20)

Answer any **ten** questions.

- 31. Compare the autotrophs from heterotrophs
- 32. Define F⁺ and F⁻ conjugation
- 33. Differentiate between archaeobacteria and eubacteria
- 34. List the five kingdom concept
- 35. Which extremophile lives in high areas of pressure?
- 36. Compare the Psychrophiles and halophiles
- 37. Which antifungal drug is used to treat dermatomycosis?
- 38. Which antiviral drug suppress the Hepatitis B Virus?
- 39. Differentiate the Quorum quenching and quorum sensing?
- 40. How Bacteria communicate using autoinducers?
- 41. How does a legume plant benefit from Rhizobia living within the legume root nodules?
- 42. What are postbiotics?

Section C

(5 × 5 = 25)

Answer any **five** questions.

43. Illustrate the generalized and specialized transduction
 44. Explain the types of bacterial culture media
 45. What is taxonomy? Explain the molecular characteristics used in bacterial taxonomy
 46. Describe in detail about the role of methanobacteria in methane gas production
 47. Illustrate the mode of action and clinical uses of antifungal drugs
 48. Define Bacteriophage, Discuss the lytic cycle of T4 Bacteriophage
 49. Discuss the symbiotic N₂ fixation in legume plants
 50. Explain the mechanism of bacterial quorum sensing
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R5966

Sub. Code

501105

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

First Semester

Biotechnology

GENETICS

(CBCS – 2020 onwards)

Time : 3 Hours

Maximum : 75 Marks

Part A

(30 × 1 = 30)

Answer **all** the questions.

1. “A and a” represent the dominant the recessive alleles respectively. If of 1000 offspring, 500 are aa”, which of the following are most probably the genotypes of the parents?
 - (a) Aa and Aa
 - (b) Aa and aa
 - (c) AA and Aa
 - (d) AA and aa
2. A form of vitamin D-resistant rickets, known as hypophosphatemia, is inherited as an X-linked dominant trait. If a male with hypophosphatemia marries a normal female, which of the following predictions concerning their potential progeny would be true?
 - (a) All of their Sons would inherit the disease
 - (b) All of their daughters would inherit the disease
 - (c) About 50% of their Sons would inherit the disease
 - (d) About 50% of their daughters would inherit the disease

3. Which of the following does the best describe the parents in a testcross?
- (a) One individual has the dominant phenotype and the other has the recessive phenotype.
 - (b) Both individuals are heterozygous.
 - (c) Both individuals have the dominant phenotype.
 - (d) Both individuals have the recessive phenotype.

4. DNA replication can be described as

- (a) semiconservative
- (b) conservative
- (c) degenerative
- (d) dispersive

5. A male fruit fly (*Drosophila melanogaster*) with red eyes and long wings was mated with a female with purple eyes and vestigial wings. All of the offspring in the F1 generation had red eyes and long wings. These F1 flies were test crossed with purple-eyed, vestigial-winged flies. Their offspring, the F2 generation, appeared as indicated below.

F2 Generation 125 red eyes, long wings 124 purple eyes, vestigial wings 18 purple eyes, long wings 16 red eyes, vestigial wings 283 Total

If in the F1 and F2 generations the same characteristics of eye color and wing length appeared in both male and females, it would be safe to assume that these traits for eye color and wing length _____

- (a) are sex-linked
- (b) vary in dominance according to sex
- (c) are sex-influenced characteristics
- (d) are autosomal characteristics

6. In the F₂ generation, the results are best explained by the fact that _____
- (a) the test cross with the F₁ flies resulted in sterile offspring
 - (b) these genes for eye color and wing shape do not pass through the F₁ generation
 - (c) these genes for eye color and wing shape are found on the same chromosome
 - (d) crossing over decreases variability
7. If a single locus controls wing shape, then the alleles for this gene act as _____
- (a) dominant-recessive alleles
 - (b) incomplete-dominance alleles
 - (c) codominant alleles
 - (d) multiple alleles
8. What would be the sequence of bases of an mRNA molecule that was transcribed from the DNA sequence 5'GTAGTAGGT?
- (a) 5'GTAGTAGGT
 - (b) 5'SCAUCAUCCA
 - (c) 5'UCGUCGUUC
 - (d) 5'AUGAUGAAU

9. Some strains of the bacterium *Streptococcus pyogenes* secrete poisonous substances called exotoxins. The gene, encoding the exotoxins are thought to have originated in bacteriophages, which are viruses that infect bacteria. Which of the following is the most likely mechanism by which the *S. pyogenes* acquired the ability to produce exotoxins?
- (a) Bacteriophages engulfed cellular debris of dead bacteria
 - (b) Bacteriophages in the environment activated bacterial cell division.
 - (c) Bacteriophage DNA became integrated in the bacterial chromosome.
 - (d) bacteriophage proteins were absorbed into bacterial cells by endocytosis.
10. The electrophoretic separation of the pieces of DNA is achieved because of differential migration of the DNA fragments in an electric field. This differential migration was caused by the_____
- (a) relative amounts of radioactivity in the DNA
 - (b) number of cleavage points per fragment
 - (c) size of each fragment
 - (d) overall positive charge of each fragment
11. The DNA is generally labeled with ^{32}P in order to
- (a) stimulate DNA replication
 - (b) inhibit the uptake of unlabeled ATP
 - (c) show which fragments included the 5' end and which fragments included the 3' end
 - (d) visualize the fragments

12. Which one of the following pairings between the subdiscipline of genetics and the phenomenon is incorrect?
- (a) Gene regulation—Molecular genetics
 - (b) Allelic frequency alteration—Population genetics
 - (c) Arrangement of genes on chromosome—Transmission genetics
 - (d) Chemical nature of the gene—Transmission genetics
13. Which one of the following topic of research belongs to the discipline of transmission genetics?
- (a) Inheritance pattern of gene alleles
 - (b) Mechanism of DNA Replication
 - (c) Gene expression patterns
 - (d) Chemical modification of nucleic acids
14. The complete genetic makeup of an organism is referred to as its
- (a) chromosome.
 - (b) alleles.
 - (c) genome.
 - (d) phenotype.
15. Identify a true statement from the descriptions concerning genetics below.
- (a) Bacteria and viruses are not useful in studying genes and inheritance because they are structurally and metabolically different from eukaryotic cells.
 - (b) Charles Darwin accurately described the laws of inheritance in his landmark book, *On the Origin of Species*.
 - (c) Many human traits, such as skin and hair color, are determined by more than a single gene.
 - (d) Evolution can occur without genetic changes in the population.

16. Identify a false statement from the descriptions of genetics below.
- (a) Humans first applied genetics to the domestication of plants and animals between approximately 10,000 and 12,000 years ago.
 - (b) Some viruses use RNA to carry their genetic information.
 - (c) All human traits that display blending inheritance are affected by single gene.
 - (d) The process by which genetic information is copied and decoded is similar for all forms of life.
17. Which of the following species is considered a model genetic organism?
- (a) The plant, *Linaria vulgaris*
 - (b) The deer mouse, *Peromyscus maniculatus*
 - (c) The worm, *Caenorhabditis elegans*
 - (d) The frog, *Hylachryoscelis*
18. Which of the following would serve the *least* well as a model for understanding basic mechanisms of inheritance?
- (a) Fruit flies
 - (b) Humans
 - (c) Yeast
 - (d) Zebrafish
19. Which of the following statements is true?
- (a) Each sub-discipline of genetics is very specific as to what is explored and does not overlap with the other sub-disciplines.
 - (b) All phenotypes or traits are always determined by multiple genes
 - (c) Humans make excellent model organisms, as a variety of traits are well-defined.
 - (d) None of the statements above are true.

20. Which of the following statements is correct?
- (a) All genomes are encoded in DNA only.
 - (b) All genomes are encoded in nucleic acids.
 - (c) All genomes are encoded in proteins only.
 - (d) The genetic instructions are decoded completely differently in each organism.
21. Which of the following theories of inheritance is currently considered true?
- (a) Germ-plasm theory
 - (b) Pangenesis
 - (c) Inheritance of acquired characteristics
 - (d) None of the above is considered true based on new evidence.
22. Which one of the following topics belongs to a different subdiscipline of genetics when compared to the rest?
- (a) Mechanism of gene regulation
 - (b) Allele frequencies of certain gene in different environments
 - (c) Chemical alternation of chromosomes
 - (d) Mechanism of DNA repairs and maintenance
23. Which of the following theories of inheritance is no longer accepted as true?
- (a) Pangenesis
 - (b) Blending inheritance
 - (c) Inheritance of acquired characteristics
 - (d) None of the above is currently considered true.

24. Which of the following correctly describes the cell theory?
- (a) Genetic information from different parts of the body travels to the reproductive organs.
 - (b) The cell is the compositional and functional unit of all life.
 - (c) Inside the germ cells, there exists a fully formed miniature adult which enlarges in the course of development
 - (d) The genetic material itself blends, which cannot be separated out in figure generations.
25. Which of the following examples of scientist and their contribution is matched incorrectly?
- (a) Watson and Crick—chemical structure of DNA
 - (b) Mendel—principles of heredity using pea plants
 - (c) Gilbert and Sanger—DNA sequencing methods
 - (d) Morgan—polymerase chain reaction
26. Choose the correct match between the scientist and the field of genetics that they made the contribution to.
- (a) Haldane and Wright—transmission genetics
 - (b) Mendel—molceular genetics
 - (c) Gilbert and Sanger—population genetics
 - (d) Morgan—transmission genetics
27. The first complete DNA sequence of a non-viral, free-living organism was obtained for
- (a) a bacterium in 1900.
 - (b) a bacterium in 1945.
 - (c) a bacterium in 1995
 - (d) humans in 1990.

28. The three-dimensional structure of DNA was first deciphered based on the work of
- (a) James Watson.
 - (b) Francis Crick.
 - (c) Rosalind Franklin.
 - (d) All of the above
29. Which of the following scientists contributed significantly to the foundations of population genetics?
- (a) James Watson
 - (b) Thomas Hunt Morgan
 - (c) Ronald Fisher
 - (d) None of the above
30. Which of the following scientists contributed significantly to the foundations of molecular genetics?
- (a) James Watson
 - (b) Thomas Hunt Morgan
 - (c) John B. S. Haldane
 - (d) Charles Darwin.

Part B

(10 × 2 = 20)

Answer any **ten** questions.

31. A dog has 39 pairs of chromosomes, Considering only independent assortment of chromosomes, how many genetically different puppies are possible when two dogs mate? Is this number an underestimate or overestimate of the actual total? Why?
32. How does meiosis differ from mitosis?
33. How was Mendel able to derive the two laws of inheritance without knowing about chromosomes?

34. Why would Mendel's results for the dihybrid cross have been different if the genes for the traits he followed were located near each other on the same chromosome?
35. Distinguish between
 - (a) autosomal recessive and autosomal dominant inheritance.
 - (b) Mendel's first and second laws,
36. How does inheritance of ABO blood type exhibit both complete dominance and codominance?
37. How does the relationship between dominant and recessive alleles differ from epistasis?
38. How does a pedigree for a maternally inherited trait differ from one for an autosomal dominant trait?
39. Why would it be extremely unlikely to see a woman who is homozygous dominant for an X-linked dominant disease?
40. The function of DNA is to specify and regulate the cell's synthesis of protein. If a cell contains all the genetic material required to carry out protein synthesis, why must its DNA be replicated?
41. Distinguish between a germinal and a somatic mutation. Which is likely to be more severe? Which is more likely to be transmitted to offspring?
42. How do excision and mismatch repair differ?

Part C

(5 × 5 = 25)

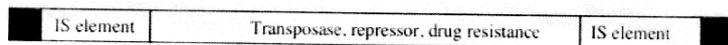
Answer any **five** questions.

43. Aniridia is an autosomal dominant eye condition in which the iris is absent. In one family, an 11-base insertion in the PAX6 gene causes a very short protein to form. What kind of mutation must the insertion cause? Why?
44. Distinguish among Down syndrome caused by aneuploidy, mosaicism, and translocation.

45. A couple has a son diagnosed with Klinefelter syndrome. Explain how the son's chromosome constitution could have arisen from either parent.
46. Factor IX deficiency is a clotting disorder affecting 1 in 190 Ashkenazim living in Israel. It affects 1 in 1,000,000 Japanese, Korean, Chinese, German, Italian, African American, English, Indian, and Arab people.
- What is the frequency of the mutant allele in the Israeli population?
 - What is the frequency of the normal allele in this population?
 - Calculate the proportion of carriers in the Israeli population.
 - Why might the disease incidence be very high in the Israeli population but very low in others?
47. There are 100 students in a class. Ninety-six did well in the course whereas four blew it totally and received a grade of F, Sony. In the highly unlikely event that these traits are genetic rather than environmental, if these traits involve dominant and recessive alleles, and if the four (4%) represent the frequency of the homozygous recessive condition, please calculate the following:
- The frequency of the recessive allele.
 - The frequency of the dominant allele.
 - The frequency of heterozygous individuals
48. A rather large population of Biology instructors have 396 red-sided individuals and 557 tan-sided individuals, Assume that red is totally recessive, Please calculate the following:
- The allele frequencies of each allele,
 - The expected genotype frequencies.

- (c) The number of heterozygous individuals that you would predict to be in this population.
- (d) The expected phenotype frequencies.
- (e) Conditions happen to be really good this year for breeding and next year there are 1,245 young 'potential' Biology instructors. Assuming that all of the Hardy-Weinberg conditions are met, how many of these would you expect to be red-sided and how many tan-sided?

49. Draw and label the structure of a bacterial transposon that has integrated into the chromosome



Black boxes are direct repeats in genomic flanking sequences. IS elements are inverted or tandem.

50. What is the difference between an allopolyploid and an autopolyploid? An autopolyploid contains additional copies of the entire genome from the same species. An allopolyploid contains additional copies of the genome from another species?

R5967

Sub. Code

501106

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

First Semester

Bio-Technology

BASICS OF MATHEMATICS AND STATISTICS

(CBCS – 2020 onwards)

Time : 3 Hours

Maximum : 75 Marks

Part A

(30 × 1 = 30)

Answer **all** questions.

1. A system of three linear equations in three variables is inconsistent if their planes
 - (a) intersect only at a point
 - (b) intersect in a line
 - (c) coincides with each other
 - (d) do not intersect
2. Graph of a linear polynomial is a
 - (a) straight line
 - (b) circle
 - (c) parabola
 - (d) hyperbola
3. Graphically, the pair of equations $7x - y = 5$;
 $21x - 3y = 10$ represents two lines which are
 - (a) intersecting at one point
 - (b) parallel
 - (c) intersecting at two points
 - (d) coincident

4. The pair of equations $3x - 5y = 7$ and $-6x + 10y = 7$ have
- (a) a unique solution
 - (b) infinitely many solutions
 - (c) no solution
 - (d) two solutions
5. When a number is added to itself, it becomes 24. What is the number?
- (a) 2
 - (b) 4
 - (c) 12
 - (d) 21
6. Customers are asked to stand in the lines. If one customer is extra in a line, then there would be two less lines. If one customer is less in line, there would be three more lines. Find the number of students in the class.
- (a) 40
 - (b) 50
 - (c) 60
 - (d) 70
7. First step in graphing linear equation is to
- (a) connect two points
 - (b) extend straight line
 - (c) substitute values in intercept
 - (d) identify and plot coordinates
8. Variables of linear equation is implicitly raised to
- (a) first power
 - (b) second power
 - (c) third power
 - (d) fourth power
9. What is the limit of $\sin(\theta)/\theta$ when θ approaches zero?
- (a) 1
 - (b) $\sin(\theta)$
 - (c) 0
 - (d) none of these

10. What will be the condition for L'Hôpital's Rule to work?
- (a) The function must possess at least three non-zero derivatives
 - (b) The function must be determinate.
 - (c) The function must be indeterminate.
 - (d) The function must be inconsistent.
11. What will be the second step when we performing anti-differentiation?
- (a) Multiply the coefficient by the new exponential value.
 - (b) Divide the coefficient by the new exponential value.
 - (c) Divide the coefficient by the old exponential value.
 - (d) Subtract the new exponential value from the coefficient.
12. What will be the types of errors that are related to differentials?
- (a) Relative, Controllable.
 - (b) Controllable, Natural.
 - (c) Human, Absolute
 - (d) Absolute, Relative
13. What is meant of the differential?
- (a) A word used a lot on a popular medical television series.
 - (b) A method of directly relating how changes in a dependent variable affect changes in an independent variable.
 - (c) A gearbox on the back end of your car.
 - (d) None of these

14. What is required for full determination of an anti-differentiated function?
- (a) Its real-world application
 - (b) What its value is at (0, 0).
 - (c) A boundary condition.
 - (d) A lot of luck.
15. Mathematical models provide
- (a) estimated results
 - (b) accurate results
 - (c) wrong results
 - (d) approximate results
16. In mathematical modelling of a process, which option is not a characteristic of an analytical solution?
- (a) Mathematical equations are used to describe a process
 - (b) Most practical problems cannot be solved
 - (c) Exact information on the quantities of interest is obtained
 - (d) Finite element method is used
17. What is the integral of $\sin 5 \times \cos 3 \times dx$ if the lower limit is zero and the upper limit is $\pi/2$?
- (a) 0.0203 (b) 0.0307
 - (c) 0.0417 (d) 0.0543
18. In damped oscillation the directions of the restoring force and the resistive force
- (a) Are the same
 - (b) Are opposite
 - (c) May be same or opposite
 - (d) Have no relation with each other

24. The n th root of the product of the values $x_1, x_2, x_3 \dots, x_n$ is called
- (a) arithmetic mean (b) geometric mean
(c) variance (d) harmonic mean
25. Which of the following is a branch of statistics?
- (a) Descriptive statistics
(b) Inferential statistics
(c) Industry statistics
(d) Both (a) and (b)
26. A bar chart constructed in which the area of each bar is proportional to the number of items in each group is known as
- (a) Pie chart
(b) Histogram
(c) Frequency distribution table
(d) Polygon
27. A numerical value used as a summary measure for a sample, such as sample mean, is known as a
- (a) population parameter
(b) sample parameter
(c) sample statistic
(d) population mean
28. A designed experiment is a test or series of tests in which _____ changes are made to the input variables so that we may observe and identify corresponding changes in the output response.
- (a) Systematic (b) Random
(c) Purposeful (d) Non-purposeful

29. The uncontrollable factors are the factor _____.
- (a) That varies according to a normal distribution
 - (b) That does not vary at all
 - (c) That can be controlled by the user
 - (d) That cannot be changed according to the wish of the user
30. Experimental design methods are not used _____.
- (a) Evaluating the process capability
 - (b) In process development
 - (c) In process troubleshooting to improve process performance
 - (d) To obtain a process that is robust and insensitive to external sources of variability

Part B

(10 × 2 = 20)

Answer any **ten** questions.

31. What is meant by slope intercepts?
32. Draw a graph of binomial distribution.
33. Define vector with an example.
34. Define a limit of function.
35. Prove that the differential coefficient of a constant is zero.
36. State quotient rule.
37. Define integrand with an example.
38. What is meant by circadian rhythms?
39. Define size limit and scaling.

40. What is meant by random variable?
41. Define statistical significance.
42. When nonparametric hypothesis is useful?

Part C

(5 × 5 = 25)

Answer any **five** questions.

43. Explain about constructing linear models in biological systems.
44. Describe graphing and constructing sinusoidal functions with examples.
45. Find $\lim_{x \rightarrow 0} \frac{1 - \cos x}{x^2}$.
46. Evaluate $\int \frac{x^2}{(a + bx)^2}$.
47. Explain about modeling of fractal geometries.
48. Describe about development patterns, symmetry in biological systems.
49. Differentiate populations and samples with suitable illustrations.
50. Illustrate analysis of variance with examples.

R5968

Sub. Code

501107

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

First Semester

Biotechnology

BASICS OF CHEMISTRY AND PHYSICS

(CBCS – 2020 onwards)

Time : 3 Hours

Maximum : 75 Marks

Part A

(30 × 1 = 30)

Answer **all** questions.

All questions carry equal marks.

1. If either the detector or the source is moving, or both are moving, the emitted frequency f and the detected frequency f , are related by _____?
(a) C/λ (b) $1/2 \pi \sqrt{k/m}$
(c) $\omega/2 \pi$ (d) $(v \pm v_D/v \pm v_S) f$
2. Mass spectrometry measures
(a) Mass to charge ratio of charged particles
(b) Mass of charged particles
(c) Charge of charged particles
(d) Mass to charge ratio of neutral molecules
3. What is the unit of Capacitance?
(a) Coulomb (b) Ohm
(c) Volt (d) Farad

4. Which of the following are isotopes?
(a) ^{14}C and ^{13}C (b) ^{14}C and ^{14}N
(c) ^1H and ^{14}C (d) ^{14}N and ^1H
5. SI unit of power is,
(a) watt (b) joule
(c) watt/second (d) erg/s
6. Which of the following is paramagnetic?
(a) K_2O_2 (b) NO_2
(c) N_2O_2 (d) K_2O
7. If the Reynolds number calculated is greater than 2000, then the flow through the pipe is said to be _____?
(a) Laminar (b) Viscous
(c) Turbulent (d) Transitional flow
8. Luminescence that is caused by the absorption of radiation at one wavelength followed immediately by nearly reradiation occurs at a longer wavelength and that ceases when the incident radiation stops is called
(a) Phosphorescence
(b) Bioluminescence
(c) Fluorescence
(d) Quenching
9. The CGS unit of kinetic energy is
(a) joule (b) $\text{kg} \cdot \text{m}^2 \cdot \text{s}^{-2}$
(c) erg (d) dyne

10. Process of a liquid flowing in a narrow space without the assistance of, or even in opposition to, any external forces like gravity is called
- (a) Reflux action (b) Mass action
(c) Chemical action (d) Capillary action
11. The dimension of acceleration is,
- (a) $[L T^{-2}]$ (b) $[L T^{-1}]$
(c) $[L T^{-3}]$ (d) $[M L T^{-2}]$
12. The sum of the kinetic and potential energies of its atoms and molecules is called
- (a) Activation energy
(b) Free energy
(c) Entropy
(d) Internal energy
13. Static friction while pushing an object is,
- (a) Newton's first law
(b) Newton's second law
(c) Newton's third law
(d) Both first law and second law
14. _____ bonds can rotate in polypeptide.
- (a) C_{α} and Oxygen
(b) Nitrogen and carbon
(c) Partial double bond between C and N
(d) $C_{\alpha} - N$ and $C_{\alpha} - C$
15. Ohm's law is?
- (a) $V = IR$ (b) $I = R/V$
(c) $V = I/R$ (d) $R = VI$

16. A two Litres of a concentrated HCl was purchased for the laboratory. If the solution contains 868.8 g of HCl. What is the molarity of the solution?
- (a) 11.9 M (b) 12.6 M
(c) 9.2 M (d) 5 M
17. The significance of Bernoulli's principle can be summarized as,
- (a) "total pressure is constant along a streamline"
(b) "total pressure is not constant along a streamline"
(c) "total pressure is not constant"
(d) "total pressure is along a streamline"
18. _____ proteins are soluble in water.
- (a) Fibrous (b) Globular
(c) Membrane (d) Enzyme
19. Give the equation for Hooke's law from below
- (a) $F(x) = k.x$ (b) $F(x) = -k.x$
(c) $F(x) = k.d$ (d) $F(x) = -k$
20. State in which both the reactants and products are present in concentrations which have no further tendency to change with time, where no observable change is noted in the system. In that case, the properties of the system will be in _____
- (a) Transition state
(b) Reversible reaction
(c) Irreversible reaction
(d) Equilibrium state

21. Dimension of angular momentum is.
- (a) $[M^2 L^2 T^{-3}]$ (b) $[M L^2 T^{-2}]$
(c) $[M L^2 T^{-1}]$ (d) $[M L T^{-1}]$
22. The product of concentrations of H^+ and OH^- ions in water at a particular temperature is known as
- (a) Ionic product of water
(b) Solubility product of water
(c) Equilibrium product of water
(d) Sparingly soluble product of water.
23. Find out the one which is other than a heating process,
- (a) Conduction (b) Convection
(c) Radiation (d) Refraction
24. The attractive force exerted upon the surface molecules of a liquid by the molecules beneath that tends to draw the surface molecules into the bulk of the liquid and makes the liquid assume the shape having the least surface area is known as
- (a) Physisorption (b) Surface tension
(c) Evaporation (d) Viscosity
25. _____ are conserved in elastic collision.
- (a) Mass
(b) Momentum
(c) Potential energy
(d) Momentum and Kinetic energy
26. Process of increasing the rate of a chemical reaction by adding a substance known as a catalyst is
- (a) Pyrolysis (b) Catalysis
(c) Photolysis (d) Hydrolysis

27. The internal energy is,
(a) The energy contained within it
(b) The energy contained on the surroundings
(c) The energy given by the system
(d) The energy liberated from the system.
28. _____ are building blocks of protein.
(a) Glucose (b) Fats
(c) Vitamins (d) Amino acids
29. An object moving with a speed of 67 m/s and has a kinetic energy of 500 J. what is the mass of the object.
(a) 0.22 Kg (b) 0.20 Kg
(c) 0.21 Kg (d) 2.2 Kg
30. The geometry of NH_3 according to VSEPR theory is _____
(a) Planar (b) Tetrahedral
(c) Octahedral (d) Trigonal pyramidal

Part B

(10 × 2 = 20)

Answer any **ten** questions.

31. What is the difference between Average velocity and Instantaneous velocity?
32. What is the coefficient of static friction?
33. What is mean by chemical assemblies?
34. What is scalar and vector quantity with examples?
35. Write a note on Fick's law.

36. Calculate the mass of the object which moving with a speed of 53 m/s (kinetic energy = 500 J).
37. Define structural and molecular formula. Write the structural and molecular formula for the nitric acid
38. Mention any two differences between order and molecularity.
39. What is bond enthalpy and reaction enthalpy?
40. What is amino acids and proteins? Give examples.
41. What is bioluminescence? Give examples.
42. Compare electronegativity and polarity.

Part C

(5 × 5 = 25)

Answer any **five** questions.

43. (a) State Newton's 1st 2nd and 3rd laws.
(b) Write the difference between centripetal and centrifugal forces.
44. Explain simple harmonic oscillation with suitable examples.
45. Explain about the Maxwell Boltzmann distribution.
46. Illustrate the structure of F₀-F₁ complex and its role in ATP synthesis.
47. Explain Arrhenius and Lewis concept of acid-base pair with example.

48. Compare the paramagnetism and diamagnetism with suitable examples.
 49. Write the postulates and limitations of VSEPR theory. Predict the shape of BF_3 using the VSEPR theory.
 50. What are molecular motors? Describe its role in Eukaryotic cells with examples.
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R5969

Sub. Code

501108

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

First Semester

Biotechnology

**Lab I: BIOCHEMISTRY AND ANALYTICAL
TECHNIQUES**

(CBCS – 2020 onwards)

Time : 3 Hours

Maximum : 75 Marks

Part A

(30 × 1 = 30)

Answer **all** the questions.

1. Regarding the dissociation of ammonium ion, if the $pK_a = 9.3$, what form would be predominantly found at $pH = 7.4$?
 - (a) Carbonic acid Ammonium ion
 - (b) Lactic acid, pK_a
 - (c) Phosphoric acid
 - (d) Ammonia
2. Tandem mass spectroscopy combines which of the following devices?
 - (a) Mass spectrometer and gas-solid chromatograph
 - (b) Mass spectrometer and gas-liquid chromatography
 - (c) Mass spectrometer and gas chromatograph
 - (d) Mass spectrometer and mass spectrometer

3. Analysis of a sample of DNA found that 20% of the bases were adenine. What percentage of the bases would be pyrimidines?
- (a) 20% (b) 30%
(c) 60% (d) 50%
4. 250 ml of a sodium carbonate solution contains 2.65 grams of Na_2CO_3 . If 10 ml of this solution is diluted to one litre, what is the concentration of the resultant solution? (Molecular weight of $\text{Na}_2\text{CO}_3 = 106$)
- (a) 0.1 M (b) 0.001 M
(c) 0.01 M (d) 10^{-4} M
5. Ethanol can be removed from protein precipitate by
- (a) lyophilisation (b) ultra-sonication
(c) homogenization (d) dialysis
6. How much agarose would you need to make 50ml at 0.75%?
- (a) 3.75g (b) 150mg
(c) 0.75 g (d) 375 mg
7. Which of the following concentration determine techniques gives a more accurate value?
- (a) Molarity (b) Molality
(c) Formality (d) Normality
8. Molality is
- (a) measure of the number of moles of solute in a solution
(b) measure of the number of molecules of solute
(c) measure of the number of moles in solvent
(d) none of the above

9. Which of the following involves carrying genetic information from DNA for protein synthesis?
- (a) m-RNA (b) t-RNA
(c) r-RNA (d) sn-RNA
10. DNA denaturation is measured by absorbance at
- (a) 220nm (b) 330nm
(c) 260nm (d) 290nm
11. Which of the following is true abt. t_m ?
- (a) It can be termed as renaturation temperature
(b) The higher the content of G \equiv C base pairs, the higher the t_m
(c) The higher the content of A = T base pairs, the higher the t_m
(d) The higher the content of G \equiv C base pairs, the lower the t_m
12. What is use of mass spectroscopy?
- (a) Determination of molecule weight
(b) Elucidating the chemical structures of molecules
(c) (a) and (b)
(d) None of the above
13. In mass spectrometer, the ions are sorted out in which of the following ways?
- (a) By accelerating them through electric field
(b) By accelerating them through magnetic field
(c) By accelerating them through electric and magnetic field
(d) By applying a high voltage

14. Following SDS-PAGE electrophoresis, protein is found to be 100kDa. After treatment with beta mercaptoethanol it shows 2 bands of 20kDa and 30kDa widely separated
- (a) protein has undergone S-S linkage hydrolysis
 - (b) it is a dimer of 2 subunits 20 and 30kDa
 - (c) it is a tetramer of 220 and 230kDa
 - (d) protein breaks down due to noncovalent linkage.
15. Which of the following statements is not true about mass spectrometry?
- (a) Impurities of masses different from the one being analyzed interfere results.
 - (b) It has great sensitivity
 - (c) It is suitable for data storage
 - (d) It is suitable for library retrieval
16. Mass spectrometer separates ions on the basis of which of the following?
- (a) Mass
 - (b) Charge
 - (c) Molecular weight
 - (d) Mass to charge ratio
17. Beer's law states that the intensity of light decreases with respect to
- (a) Concentration
 - (b) Distance
 - (c) Composition
 - (d) Volume
18. What is the unit of molar absorptivity which is used to determine absorbance "A" in Beer Lambert's formula?
- (a) $L mol^{-1} cm^{-1}$
 - (b) $L gm^{-1} cm^{-1}$
 - (c) Cm
 - (d) No unit

19. Holoenzyme is made of
- (a) Apoenzyme and Zymogen
 - (b) Apoenzyme and Co-enzyme
 - (c) Co-enzyme and Prosthetic group
 - (d) Prosthetic group and Co-factor
20. The spectroscopic technique also known as vibrational spectroscopy
- (a) IR spectroscopy
 - (b) CD spectroscopy
 - (c) UV-Visible spectroscopy
 - (d) NMR spectroscopy
21. What is the general mechanism of an enzyme?
- (a) It acts by reducing the activation energy
 - (b) It acts by increasing the activation energy
 - (c) It acts by decreasing the pH
 - (d) It acts by increasing the pH
22. Which category of enzymes belongs to class two in the international classification?
- (a) Hydrolases
 - (b) Ligases
 - (c) Transferases
 - (d) Isomerase
23. The enzyme inhibition can occur by
- (a) Reversible inhibitors
 - (b) Irreversible inhibitors
 - (c) Both (a) and (b)
 - (d) None of these

24. The plot commonly used for determining the value of V_{\max} is
- (a) Lineweaver Burk plot
 - (b) Langmuir plot
 - (c) Eadie Hofstee plot
 - (d) All of these
25. A noncompetitive inhibitor of an enzyme-catalyzed reaction
- (a) increases K_M and increases V_{\max}
 - (b) increases K_M and reduces V_{\max}
 - (c) reduces K_M and increases V_{\max}
 - (d) reduces K_M and reduces V_{\max}
26. Ethanol can be removed from protein precipitate by
- (a) lyophilization (b) ultrasonication
 - (c) homogenization (d) dialysis
27. Which one of the following cannot be used as alternative to ammonium sulphate?
- (a) Lysozyme (b) Methanol
 - (c) Acetone (d) Propan-2-ol
28. The chromatographic method of separating biochemical mixture of compounds, based on highly specific biological interactions is referred to as
- (a) thin layer chromatography
 - (b) ion-exchange chromatography
 - (c) affinity chromatography
 - (d) gel permeation chromatography

29. What is the wavelength range for UV spectrum of light?
- (a) 400 nm— 700 nm
 - (b) 700 nm to 1 mm
 - (c) 0.01 nm to 10 nm
 - (d) 10 nm to 400 nm
30. What are the main criteria on which mass spectrometer used for?
- (a) Composition in sample
 - (b) Relative mass of atoms
 - (c) Concentration of elements in the sample
 - (d) Properties of sample

Part B

(10 × 2 = 20)

Answer any **ten** questions.

31. What is titration of amino acids.
32. How is Lactate dehydrogenase estimated?
33. Write composition of Acetic-Na Acetate buffer
34. How do you calculate the specific activity of an enzyme
35. Briefly describe about ion exchangers used in chromatography.
36. How do you prepare 6N HCL from concentrated 36%.
37. Write the principle behind the Henderson-Hasselbalch equation
38. Justify SDS-PAGE is still an indispensable technique
39. Briefly discuss the principle behind GC-MS.

40. Write four methods to determine the purity of an enzyme.
41. Outline the method involved in dialysis.
42. Briefly write about the whole cell DNA extraction method from a goat liver.

Part C

(5 × 5 = 25)

Answer any **five** questions.

43. Write about the Beer-lambert law and its significance.
 44. Discuss about the affinity chromatography.
 45. Write a note on the cell homogenization methods
 46. Outline the principle of fluorescence? What is fluorescence quenching? How does fluorescence spec help in biological research.
 47. Outline the kinetics involved in V_{\max} and K_{cat}
 48. Write few applications of Ion exchange Chromatography.
 49. Explain the method to characterize lactate dehydrogenase? How the study is important in assessing the disease states?
 50. Outline the principle and instrumentation involved in mass spectroscopy.
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R5970

Sub. Code

501109

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

First Semester

Biotechnology

Lab II: MICROBIOLOGY

(CBCS – 2020 onwards)

Time : Three Hours

Maximum : 75 Marks

Section A

(30 × 1 = 30)

Answer **all** questions.

1. Which of the following items could be sterilized by dry heat sterilization?
 - (a) Plastic petri dishes
 - (b) Glass pipette
 - (c) Rubber gloves
 - (d) Intravenous (IV) solution

2. The absence of all forms of microbial life, including spores, is known as
 - (a) Sanitization
 - (b) Disinfection
 - (c) Decontamination
 - (d) Sterility

3. Name the sterilization agent that is most frequently used in hospitals and clinical laboratories for the heat labile liquid substances or antibiotics
- (a) Dry heat
 - (b) Radiation
 - (c) Filtration
 - (d) Formaldehyde
4. Select all the common and widely used methods for drinking water treatment that helps in reducing the highly transmissible waterborne infections like typhoid and cholera
- (a) Boiling of the water
 - (b) Using chlorine
 - (c) Pasteurization process
 - (d) Use of water filters
5. What is the correct meaning of the term known as terminal sterilization process?
- (a) The initial sterilization of the raw materials for the product
 - (b) The final sterilization of the healthcare products and medical devices
 - (c) The decontamination of the environmental biohurdens
 - (d) The aseptic technique used during the manufacturing process of the product

6. The Quality and Safety of products in pharmaceutical industries, food and other biotechnology companies are mainly controlled by which of the following regulation departments in the USA?
- (a) Food and drug administration
 - (b) International Standard Organization 9001
 - (c) Good manufacturing practices
 - (d) Center for Disease Control and prevention
7. Culture media are sterilized by
- (a) Autoclaving
 - (b) Beta radiation
 - (c) Hot air oven
 - (d) Tyndalisation
8. Autoclave indicator bacterium is
- (a) Clostridium tetani
 - (b) B. stearothermophilus
 - (c) B. pumilis
 - (d) B.subtilis
9. Which of the following are not performed in lyophilization?
- (a) agar slant is covered with mineral oil
 - (b) cell suspension is frozen at -60 degree to -78 degree C
 - (c) vials are connected to high-vacuum line
 - (d) bacterial sample is dehydrated

10. Nichrome loop wire is used in which of the following techniques?
- (a) Pour-plate
 - (b) Streak-plate
 - (c) Spread-plate
 - (d) Roll-tube technique
11. Which device is used to pick a single bacterial cell from a mixed culture?
- (a) microscope
 - (b) micropipette
 - (c) microprobe
 - (d) micromanipulator
12. Which of the following method can be used to determine the number of bacteria quantitatively?
- (a) Streak-plate
 - (b) Spread-plate
 - (c) Pour plate
 - (d) Pour-plate and spread plate
13. Which of the following is used as a solidifying agent for media?
- (a) Beef extract
 - (b) Peptone
 - (c) Agar
 - (d) Yeast extract

14. Which of the following is a Complex media for fungal growth?
- (a) Nutrient broth
 - (b) Luria-Bertani media
 - (c) Potato Dextrose Agar(PDA) media
 - (d) Mac Conkey Agar media
15. Which of the following bacteria selectively growing in Mannitol salt agar?
- (a) Staphylococcus aureus
 - (b) Nitrosomonas sp.
 - (c) Escherichia coli
 - (d) Leuconostoc mesenteroides
16. Blood agar is used for the cultivation of?
- (a) Mosquitoes
 - (b) Fastidious bacteria
 - (c) Halophiles
 - (d) Red algae only
17. Which bacteria appears purple-violet colour after staining?
- (a) Gram-positive
 - (b) Gram-negative
 - (c) Both Gram-positive and Gram-negative
 - (d) Neither Gram-positive nor Gram-negative

18. Which of the following are true for Gram-negative bacteria?
- (a) upon alcohol treatment, the permeability of the cell wall increases
 - (b) crystal violet-iodine (CV-I) complex is extracted
 - (c) pore size decreases and the CV-I complex cannot be extracted
 - (d) alcohol treatment increases the permeability of the cell wall and the CV-I complex can be extracted
19. Gram-positive bacteria are usually more susceptible to?
- (a) streptomycin
 - (b) tetracycline
 - (c) penicillin
 - (d) None of the above
20. Principle of Kirby Bauer test
- (a) Diffusion of antibiotic agents
 - (b) Confluent growth of microorganism
 - (c) Dilution of antibiotic agents
 - (d) Solubility of chemical agents
21. Which of the following acts as a test organism in the procedure of phenol-coefficient method?
- (a) Escherichia coli
 - (b) Streptococcus faecalis
 - (c) Staphylococcus aureus
 - (d) Lactobacillus

22. A bacteriological stain also known as the differential stain is used for the identification of acid-fast organisms, what is the name of the stain?
- (a) Negative stain
 - (b) Gram stain
 - (c) Ziehl-Neelsen stain
 - (d) Schaeffer Fulton stain
23. All of the statements regarding *Bacillus anthracis* are true, Except
- (a) The causative agent of smallpox
 - (b) Nonhemolytic colonies appear on Blood agar
 - (c) Commonly transmitted from animals to humans
 - (d) Endospore-forming bacteria
24. Which of the following bacteria have a hemolytic property that can grow cell in blood agar?
- (a) *Bacillus anthracis*
 - (b) *Proteus vulgaris*
 - (c) *Streptococcus pyogenes*
 - (d) *Candida albicans*
25. Which of the following media is used for the routine bacteriological isolation of *Salmonella* and *Shigella* spp?
- (a) Xylose lysine deoxycholate agar
 - (b) Thiosulfate citrate bile salts agar
 - (c) Mannitol salt agar
 - (d) Bile esculin agar

26. Air filter present in Laminar air flow chamber
- (a) Membrane filter
 - (b) HEPA filter
 - (c) Seitz filter
 - (d) Vacuum filter
27. After each streak on the plate with the inoculating loop, what is done to the loop?
- (a) Discarded
 - (b) Re-introduced to stock culture
 - (c) Flamed until loop glow
 - (d) Wiped with disinfectant
28. Which of the following can be used to measure viable cell counts?
- (a) Standard plate method
 - (b) Turbidimetric measurements
 - (c) Direct microscopic counts
 - (d) Cell mass determination
29. Which of the following is the type of reproduction found in most unicellular procaryotic microorganisms?
- (a) Meiosis
 - (b) Mitosis
 - (c) Fragmentation
 - (d) Binary fission

30. Which of the following best describes a microbial control protocol that inhibits the growth of molds and yeast?
- (a) Bacteriostatic
 - (b) Fungicidal
 - (c) Bactericidal
 - (d) Fungistatic

Part B

(10 × 2 = 20)

Answer any **ten** questions.

31. What is the thermal death point?
32. Differentiate dry heat sterilization and moist heat sterilization
33. What type of bacteria grows on MacConkey agar?
34. What is the role of eosin and methylene blue in EMB Agar?
35. What is the difference between laminar flow and biosafety cabinet?
36. Calculate the Serial dilution factor.
37. Differentiate the Minimum Bactericidal Concentration (MBC) and Minimum Fungicidal Concentration (MFC) assays.
38. Antibiotic Resistance Testing.

39. Why Mueller Hinton Agar medium is used for performing antibiotic susceptibility test?
40. How do you maintain stock cultures?
41. What is McFarland Standard of antimicrobial susceptibility test?
42. What are the methods of testing for minimum inhibitory concentration MIC ?

Part C

(5 × 5 = 25)

Answer any **five** questions.

43. Explain the Class I, II and III biosafety cabinet.
44. Discuss the objective and methods of streak plate method.
45. Demonstrate the isolation and identification from E.coli from water.
46. What is Phenol Coefficient? How do you perform the Phenol Coefficient test.
47. Perform serial dilution and pour plate technique.
48. Elaborate Agar and broth dilution methods to determine the minimal inhibitory concentration (MIC) of antimicrobial substances.
49. Explain the principal and procedure for glycerol stock for bacterial cultures.
50. Illustrate the isolation of bacteria from soil by stands plat count method.

R5971

Sub. Code

501110

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

First Semester

Biotechnology

LAB III – PLANT AND ANIMAL BIOTECHNOLOGY

(CBCS – 2020 onwards)

Time : Three Hours

Maximum : 75 Marks

Part A

(30 × 1 = 30)

Answer **all** questions.

1. How much sucrose is required to produce half a litre MS medium preparation
 - (a) 15 g
 - (b) 30 g
 - (c) 40 g
 - (d) 10 g

2. How much volume of major salt solution should be taken from 50X stock to prepare 1 litre MS medium
 - (a) 10ml
 - (b) 0.02 ml
 - (c) 200 μ l
 - (d) 20 ml

3. The ideal size of the shoot tip explant
 - (a) 1 cm
 - (b) 10 cm
 - (c) 0.1 to 1 mm
 - (d) 5 mm to 10 mm

4. Which one of the following is correct about explant inoculation
- (a) the explant cut end should touch the medium
 - (b) the explant cut end should not touch the medium
 - (c) the explant should be fully inserted and dipped into the medium
 - (d) none of the above
5. What is *in vitro* gynogenesis
- (a) Plant regenerated from axillary buds
 - (b) Plant regenerated from corolla
 - (c) Plant regenerated from female gamete
 - (d) Plant regenerated from microspore culture
6. Role of macerozyme in protoplast isolation
- (a) degrades the middle lamella
 - (b) Degrade the cytoplasm
 - (c) Aggregates the cells
 - (d) Stabilizes the pH
7. The function of mannitol in protoplast isolation
- (a) avoids the contamination of protoplast
 - (b) Protoplasts are stable at hypertonic solution
 - (c) To improve the regeneration of protoplast
 - (d) none of the above

8. Why washing step is performed after the co-cultivation of Agrobacterium
- (a) To confirm the transgenic tissue
 - (b) To kill the E.Coli cells
 - (c) To kill the Agrobacter turn cells
 - (d) None of the above
9. Which substrate is used to perform the GUS assay
- (a) X-gal (b) IPTG
 - (c) X-gluc (d) both (a) and (b)
10. To perform ISSR experiment the following instrument is essential
- (a) Real – Time PCR machine
 - (b) PCR machine
 - (c) Hybridization oven
 - (d) Western blot
11. Usual RAPD experiments uses
- (a) single primer
 - (b) separate forward and reverse primer
 - (c) two sets of primer
 - (d) degenerate primers
12. Chromosome karyotyping is the observation of
- (a) size of the chromosome
 - (b) shape of the chromosome
 - (c) number of the chromosome
 - (d) all of the above answers

13. Chromosome karyotyping carried out at which one of the following phases
- (a) telophase
 - (b) anaphase
 - (c) metaphase
 - (d) prophase
14. Meiosis could be easily observed in
- (a) Pollen mother cell
 - (b) Onion root tip cells
 - (c) Mesophyll cells
 - (d) none of the above
15. CTAB is a
- (a) buffer
 - (b) detergent
 - (c) enzyme that degrades cell wall
 - (d) osmotic compound
16. The function of EDTA in DNA isolation is
- (a) catalyses the enzyme reaction
 - (b) degrade the enzymes
 - (c) chelates the divalent cation
 - (d) thermoprotectant
17. Action of Polyvinylpyrrolidone in DNA extraction
- (a) removal of polyphenol contamination
 - (b) removal of protein molecule
 - (c) removal of fat molecule
 - (d) none of the above

18. For the quantification of DNA
- (a) A280 reading should be taken
 - (b) A360 reading should be taken
 - (c) Both (a) and (b)
 - (d) A260 reading should be taken
19. Which one is the function of the random primer
- (a) binds with the coding sequences only
 - (b) binds with the non coding sequences only
 - (c) binds with the promoter regions
 - (d) binds with any place of the genome
20. DNA polymorphism can be visualized in
- (a) Agarose gel
 - (b) Native PAGE gel
 - (c) DNA column
 - (d) Spectrophotometer
21. The polymorphism of individual could be measured by
- (a) by measuring molecular weight of the amplified band
 - (b) by measuring Intensity of the bands in the gel
 - (c) by PIC calculation
 - (d) by band shift value calculation
22. Most of the mammalian cell culture thrives at
- (a) 27°C
 - (b) 37°C
 - (c) 38.5°C
 - (d) 26°C

23. Which one of the following technique rapid and simple disaggregation method for animal cell culture
- (a) Enzymatic method
 - (b) Using chelating agents
 - (c) Physical disaggregation
 - (d) None of the above
24. Passaging of cell culture means
- (a) Passing the cells to next experiment
 - (b) Keeping the culture in refrigerator
 - (c) Changing of culture to different environment
 - (d) Transfer of cells to fresh growth medium
25. In Trypan Blue staining experiment
- (a) Live cells takes the blue staining
 - (b) Dead cells takes the blue staining
 - (c) Both live and dead cells take the blue staining
 - (d) None of the above
26. The important requirements for cell doubling time
- (a) Light microscope and slide
 - (b) Stereomicroscope and haemocytometer
 - (c) Spectrophotometer
 - (d) Inverted microscope and haemocytometer
27. Cell fusion was encouraged by the chemical
- (a) Polyvinylpyridone
 - (b) Polyphenol
 - (c) Polyethylene Glycol
 - (d) None of the above

28. Cell fusion products could be isolated by
- (a) Velocity sedimentation
 - (b) Enzymatic degradation
 - (c) Continuous shaking
 - (d) Membrane filtration
29. The fused cell products could be identified by
- (a) Safranin dye test
 - (b) CMFDA and CMTMR cell tracker dyes
 - (c) TRYPAN Blue dye
 - (d) Acrydine orange test
30. Role of SDS in animal DNA isolation
- (a) disruption of lipid structure in the membrane
 - (b) denatures proteins
 - (c) inactivates DNA degrading enzymes
 - (d) all of the above

Part B

(10 × 2 = 20)

Answer any **ten** questions.

31. List out the sterilization techniques used in plant tissue culture.
32. How would you use sterilization procedure for the explants taken *in vivo*?
33. Write the preparation of the explant from *Datura stramonium* for androgenesis
34. How would you test the viability of protoplast culture?
35. How would you design the primers for ISSR experiment?

36. How would you test the quality of isolated DNA by spectrophotometer?
37. What is polymorphic information content?
38. Write the slide preparation procedure for karyotyping
39. Write the basic components of animal cell culture medium
40. How would you count the cells in animal suspension culture?
41. What are the media and supplement requirements for thymus cell culture?
42. Write the role of PEG in animal cell fusion

Part C

(5 × 5 = 25)

Answer any **five** questions.

43. Write the shoot tip, nodal and leaf explant extraction technique from *Valleriana* species
 44. Write the enzymatic procedure for protoplast isolation from leaf tissues
 45. Write the *Agrobacterium* culture, infection, co-cultivation and selection of transgenic plant procedures.
 46. Explain the methodology for RAPD reaction.
 47. How would you remove polyphenol, polysaccharide, protein, fat, RNA in plant DNA isolation
 48. How would you measure the doubling time of animal cell culture
 49. Write the chromosome preparation method for animal cell culture
 50. Explain SDS method of DNA isolation from animal tissues
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R5972

Sub. Code

501301

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

Third Semester

Biotechnology

BIOPROCESS ENGINEERING AND TECHNOLOGY

(CBCS – 2020 onwards)

Time : Three Hours

Maximum : 75 Marks

Part A

(30 × 1 = 30)

Answer **all** questions.

1. What are the two key parameters that relate the growth rate to the concentration of a single growth-controlling substrate [$\mu = f(s)$] in Monod's model?
 - (a) Maximum specific substrate consumption rate (q_{max}) and Degree of induction for substrate (i)
 - (b) Maximum specific growth rate (μ_{max}) and the substrate affinity constant (K_s)
 - (c) Maximum specific substrate consumption rate (q_{max}) and Maximum specific growth rate (μ_{max})
 - (d) Substrate affinity constant (K_s) and Degree of induction for substrate (i)
2. _____ is the enzyme routinely used for beer chill proofing
3. The time required for the reduction of bacterial population by 90% or one log₁₀ at a specific temperature can be termed as _____

14. The microbial growth models in which the variation in biomass composition in response to environmental changes is totally neglected is said to be _____ .
15. Degree of reduction is developed for _____ balance in a bioreactions
- (a) Proton-electron
 - (b) Substrate —product
 - (c) Product-biomaterial
 - (d) Substrates Proton- products electron
16. In the bioconversion process, the rate of effluent conversion increases with increases in
- (a) catalyst active
 - (b) cellular concentration
 - (c) temperature
 - (d) pressure gradient
17. The characteristic feature of solid-state fermentation is
- (a) high nutrient content
 - (b) low moisture content
 - (c) highly sterile
 - (d) balanced nutrient
18. Nitrogen deprivation of the medium can possibly increases the _____ content of the microalgal cells
- (a) protein
 - (b) lipids
 - (c) carotenoids
 - (d) vitamins

19. Which of the following process doesn't come under Separation of an insoluble product
- (a) Sonication
 - (b) centrifugation
 - (c) precipitation
 - (d) coagulation
20. Mercaptoethanol acts asin combination with SDS for the determination of protein using SDS-PAGE
- (a) reducing agent (b) oxidising agent
 - (c) chelating agent (d) fluorescent tag
21. The chromatography, which works under the principle of weak Van der Waals force and steric interaction, is known as
- (a) Ion exchange chromatography
 - (b) Adsorption chromatography
 - (c) High pressure chromatography
 - (d) Hydrophobic chromatography
22. _____ is final product purification process by which the highly purified product acquired at low temperature
- (a) Crystallization
 - (b) Drying
 - (c) Lyophilization
 - (d) Purification
23. Agitation in a fermenter is vital for the
- (a) microbial growth
 - (b) buoyancy of strain
 - (c) homogeneous of media
 - (d) increased oxygen level

24. Concerning animal cell fermentation _____ culture mode is considered to be an efficient approach to increase the cell yield
- (a) semi-continuous
 - (b) perfusion
 - (c) fed-batch
 - (d) batch
25. _____ is used to convert the starch to more dextrose by the action of glucoamylase in liquified starch slurry
- (a) Glycolysis
 - (b) Bioconversion
 - (c) Saccharification
 - (d) Biotransformation
26. In cheese industry, protease is used in milk to _____ caseins
27. Which of the following step doesn't fall under downstream processing
- (a) removal of insoluble
 - (b) polishing
 - (c) purification
 - (d) screening
28. The process of conversion of Triglyceride into fatty acid methyl esters with the presence of alcohol is known as
- (a) Pyrolysis
 - (b) Transesterification
 - (c) Hydrothermal liquification
 - (d) Condensation

29. _____ can be defined as the number of equivalents of available electrons per gram C atom.
30. _____ is called as the volume of CO₂, released over the volume of oxygen absorbed during respiration.

Part B (10 × 2 = 20)

Answer any **ten** questions.

31. Write about the necessity of high-throughput screening in strain selection.
32. What is the specific growth rate.
33. Define respiratory quotient.
34. Write about the methodology used to generate immobilized cells.
35. Define water reclamation.
36. Define synchronous cell division.
37. What is predictive microbiology?
38. What is thermal death time?
39. Write down any two unique applications of using *Ruminococcus flavefaciens* for biohydrogen production.
40. Write about the lantibiotics with an example.
41. Define Biorefinery.
42. Write down the importance of triacylglycerides in biodiesel production.

Part C

(5 × 5 = 25)

Answer any **five** questions.

43. Explain the process of generating analogue-resistant mutants and brief the pros and cons of those mutants.
 44. Would you prefer the evolutionary engineering approach over the rational metabolic engineering approach for non-model organisms? Justify your answer.
 45. Which type of centrifugation do you choose for preparing extracellular vesicles? Justify it.
 46. How would you overcome the acetate co-production in engineered *Escherichia* coil during recombinant protein fermentations?
 47. Explain the process of high-performance liquid chromatography.
 48. Describe the steps involved in enzymatic starch conversion.
 49. Explain the principle involved in liquid-liquid extraction.
 50. Explain the method to prepare bioethanol from molasses.
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R5973

Sub. Code

501302

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021

Third Semester

Biotechnology

EMERGING TECHNOLOGIES

(CBCS – 2020 onwards)

Time : Three Hours

Maximum : 75 Marks

Part A

(30 × 1 = 30)

Answer **all** the questions.

1. Proteomics is the study of —————
 - (a) set of carbohydrates
 - (b) set of proteins
 - (c) set of specific proteins in the cell
 - (d) set of entire proteins in a cell

2. If the eyepiece magnification on light microscope is ×10 and the objective is ×40, what is the overall magnification?
 - (a) × 10
 - (b) × 40
 - (c) × 400
 - (d) × 4

3. Which of the following main component of mass spectroscopy deal with resolving the ions into their characteristics mass components according to their mass-to-charge ratio?
- (a) Ion Source
 - (b) Analyzer
 - (c) Detector System
 - (d) Analyzer tube
4. Which of the following components on a light microscope should be focused first?
- (a) The two eye pieces
 - (b) Objective lenses
 - (c) Condenser
 - (d) Revolving nosepiece
5. Hertz is a unit of
- (a) Loudness
 - (b) Intensity
 - (c) Frequency
 - (d) Power
6. In fluorescence microscopy, which of the following performs the function of removing all light except the blue light?
- (a) Exciter filter
 - (b) Barrier filter
 - (c) Dichroic mirror
 - (d) Mercury arc lamp

7. Which of the goals is achieved by fixative used in electron microscopy?
- (a) Stopping metabolism
 - (b) Fixing structures of organelles and molecules in their current position
 - (c) Making material accessible and stable during further processing
 - (d) All of the above
8. CSLM Microscope uses one of the following combinations:
- (a) Laser rays, Fluorescence staining and Computer
 - (b) Laser rays, Beams of positrons and Computer
 - (c) X-rays, Fluorescence staining and Probe
 - (d) X-rays, Scan pictures and Computer
9. What are the main criteria on which mass spectrometer used for?
- (a) Composition in sample
 - (b) Relative mass of atoms
 - (c) Concentration of elements in the sample
 - (d) Properties of sample
10. Which species of the following is used to bombard with the sample for which mass spectroscopy has been performed?
- (a) Alpha particles
 - (b) Neutrons
 - (c) Electrons
 - (d) Protons

11. Zip-tips having C-18 columns are used for sample enrichment and salt removal. Sample containing digested peptides binds to the C-18 column matrix because of which of the following biological interactions?
- (a) Ionic interactions
 - (b) Covalent bond
 - (c) Hydrogen bond
 - (d) Hydrophobic interactions
12. Which of the following criteria is used to select the matrix for sample analysis in MALDI-TOF/TOF?
- (a) Charge on the sample
 - (b) Molecular weight and nature of sample
 - (c) Iso-electric point of sample
 - (d) All of the above
13. Which of the following techniques is used to determine the protein structures?
- (a) X-ray crystallography
 - (b) Kryptonics X-ray vision
 - (c) Magnetic resonance imaging
 - (d) None of the above
14. In Mass Spectrometry, the path of ions after deflection depends on _____
- (a) only the mass of the ion.
 - (b) only the charge on the ion.
 - (c) both the charge and mass of the ion.
 - (d) None of the above

15. When quantifying proteins from an MS experiment, how do you work out what level a change is likely to be due to biology, and not experimental or technical variation?
- (a) Use 2-fold as a generic cut-off
 - (b) Use pathway analysis software
 - (c) Look in the literature to see what other people use
 - (d) Analyze replicates to measure experimental noise
16. A good way to increase total proteome penetration by gel-free LC-MS/MS methods is to:
- (a) Use two, orthogonal types of chromatography
 - (b) Enrich for phosphopeptides only
 - (c) Analyze whole proteins
 - (d) Label the proteins with a chemical tag
17. PDB is _____
- (a) composite database for sugar
 - (b) dimensional database for micromolecules
 - (c) primary database for macromolecules
 - (d) electrophoresis database
18. Spotting of cDNA on the inert surface like glass slides is
- (a) DNA probes
 - (b) DNA polymerase
 - (c) DNA microarrays
 - (d) DNA fingerprinting

19. The computational methodology that tries to find the best matching between two molecules, a receptor and ligand are called
- (a) Molecular fitting
 - (b) Molecular matching
 - (c) Molecular docking
 - (d) Molecule affinity checking
20. Which of the following is false about NMR spectroscopy?
- (a) NMR is an abbreviated form of Nuclear Magnetic Resonance
 - (b) The intramolecular magnetic field around an atom in a molecule changes the resonance frequency giving structural information about the atom
 - (c) The intermolecular magnetic field around an atom in a molecule changes the resonance frequency giving structural information about the atom
 - (d) It is a technique that exploits magnetic properties of atomic nuclei
21. In Diffractometer, the identification of a component of the sample from its powder diffraction pattern is based upon the _____ of lines and their relative _____ .
- (a) Number, length
 - (b) Number, intensity
 - (c) Position, length
 - (d) Position, intensity

22. In AFM, which operating mode allows for the fastest scanning speeds?
- (a) Contact mode
 - (b) Non-contact mode
 - (c) Tapping mode
 - (d) None of the above
23. The process of finding the relative location of genes on a chromosome is called
- (a) Gene tracking
 - (b) Genome walking
 - (c) Genome mapping
 - (d) Chromosome walking
24. CRISPR refers to repeated sequences located in the
- (a) Bacterial DNA
 - (b) Viral DNA
 - (c) Fungal DNA
 - (d) Viral RNA
25. Which of the following proteins have not been used in genome editing?
- (a) ZFN
 - (b) TALENs
 - (c) CRISPR-Cas9
 - (d) MHC

26. What is the name of the chemical reaction that catalyzes the cleavage of a peptide bond?
- (a) Oxidation
 - (b) Reduction
 - (c) Dehydration
 - (d) Hydrolysis
27. Who pioneered phage-display technology?
- (a) Kary Mullis
 - (b) Charles Chamberland
 - (c) Robert Brown
 - (d) George Smith
28. Which of the following describes the advantage of the yeast two-hybrid method for analysis of protein interactions?
- (a) The assay works well for membrane bound proteins
 - (b) The assay can screen for interaction partners of a protein without the need for protein purification
 - (c) The assay only detects direct association between 2 proteins
 - (d) The assay secretes proteins from the cell and thus works well for proteins with disulphide bridges
29. To direct a nuclease to a statistically unique DNA sequence on the human genome, it must be able to recognize a sequence that is at least
- (a) 10 base pairs long
 - (b) 16 base pairs long
 - (c) 32 base pairs long
 - (d) 5 base pairs long

30. As proteins fold, amino acids with carbon-rich sidechains, like leucine and phenylalanine, are usually placed
- (a) on the surface of the protein
 - (b) inside the protein
 - (c) near positively charged residues
 - (d) near polar residues

Part B

(10 × 2 = 20)

Answer any **ten** questions.

- 31. Write a note on dot matrix method?
- 32. What are the methods to detect mutations?
- 33. What are the types of clustering?
- 34. Where do CRISPRs come from?
- 35. Distinguish between cDNA and Oligonucleotide microarray.
- 36. What are the advanced techniques used in Genomics?
- 37. What is the difference between contact and non-contact mode?
- 38. How does CRISPR-Cas9 compare to other genome editing tools?
- 39. Write short note on limitations of nanobodies.

40. Define Post translational modification and mention the cellular sites for major post translational modifications.
41. Define EMR and mention its importance with reference to protein engineering.
42. Write the difference between peptide mapping and peptide sequencing?

Part C

(5 × 5 = 25)

Answer any **five** questions.

43. Describe the principle and components of confocal microscopy with diagram. Brief the different types of confocal microscopy.
44. Describe the processes and instrumentation involved in the following ionization techniques used in mass spectrum.
45. List the types of biophysical techniques used to study the biomolecules. Explain the principle of any one of the techniques used in protein structure elucidation.
46. Explain the classification of biological databases. Write notes on applications of databases in molecular biology.
47. Explain Peptide mass fingerprinting.
48. How does CRISPR–CPfl differ from CRISPR–Cas9?
49. Describe the different between Nanobodies and Conventional Antibodies provides examples.
50. Enumerate the protein secondary structure prediction tools.

R5975

Sub. Code

501304

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021.

Third Semester

Biotechnology

BIOENTREPRENEURSHIP

(CBCS – 2020 onwards)

Time : 3 Hours

Maximum : 75 Marks

Part A

(30 × 1 = 30)

Answer **all** questions.

1. The capacity to develop new ideas, concepts and processes is known as
 - (a) Innovation
 - (b) Invention
 - (c) Skill
 - (d) Creativity

2. The MSME Development Act came into force in
 - (a) 2005
 - (b) 2006
 - (c) 2010
 - (d) 2001

3. An individual who initiates, creates and manages a new business can be called
 - (a) A leader
 - (b) A manager
 - (c) A professional
 - (d) An entrepreneur

4. _____ is primarily concerned with the identification of the project demand potential and the selection of the optimal technology.
- (a) Techno-economic analysis
 - (b) Feasibility analysis
 - (c) Input analysis
 - (d) Financial analysis
5. EDP (Entrepreneurship Development Programmes) is required to help:
- (a) Existing entrepreneurs
 - (b) First generation entrepreneurs
 - (c) Future generations entrepreneurs
 - (d) None of the above
6. Which of these is not a state level promotional institutions
- (a) KITCO (b) KSIDC
 - (c) NIESBUD (d) SIDCO
7. What is the hallmark of a successful entrepreneur?
- (a) Risk bearing capacity
 - (b) Persistence
 - (c) Flexibility
 - (d) Self-confidence

8. Decisions which are concerned with policy matters and exercise fundamental influence on the objectives of the organization are called as _____
- (a) Organizational decisions
 - (b) Personal decisions
 - (c) Routine decisions
 - (d) Strategic decisions.
9. Innovative small firms are more likely in
- (a) Biotechnology
 - (b) Automobile manufacture
 - (c) Knowledge based centers
 - (d) Aerospace manufacture
10. Innovative entrepreneurs face special issues in raising
- (a) Structural capital
 - (b) Development capital
 - (c) Seed capital
 - (d) Human resource
11. Innovation can be defines as
- (a) The generation of new ideas
 - (b) The evolution of new ideas
 - (c) The opposite of creativity
 - (d) The successful exploitation of new ideas.

12. Which of the list below does not form Intellectual Property?
- (a) Patent (b) trade mark
- (c) copy right (d) tangible assets
13. The activity which occurs when the new venture is started is called
- (a) Business skills
- (b) Motivation
- (c) Departure point
- (d) Goal Orientation
14. Large investment is made in fixed assets, the project will be termed as
- (a) Capital intensive
- (b) product intensive
- (c) labour intensive
- (d) market intensive
15. To obtain a high rate of return on investments, makes risk investment from a pool of equity capital
- (a) venture capitalist
- (b) entrepreneur
- (c) businessman
- (d) buyer

16. A Micro Enterprise is an enterprise where investment and machinery does not exceed (According to MSMED Act, 2018)
- (a) \leq Rs. 5 crore
 - (b) $>$ Rs. 5 crore but below 75 crore
 - (c) $>$ Rs.10 crore
 - (d) $<$ 10 crore
17. The Micro, Small and Medium Enterprises (MSME) are classified on the basis of
- (a) Capital investment
 - (b) Assets
 - (c) Annual turnover
 - (d) Expenditure
18. Trademark ownership is usually acquired through use of a term or word or symbol to identify the origin of the goods or services.
- (a) Use of a term (b) Use of a word
 - (c) Use of symbol (d) (a), (b), and (c)
19. GST was passed by the Parliament on
- (a) March 2017
 - (b) March 2019
 - (c) February, 2020
 - (d) July 2016

20. GST is _____ levied on the supply of goods and services
- (a) Indirect tax
 - (b) Direct tax
 - (c) Sales tax
 - (d) Excise duty
21. _____ is a business model that describes the full range of activities needed to create a product or service
- (a) Innovative idea (b) Discovery
 - (c) Value chain (d) Product development
22. Supply chain is dealing with the _____ and _____ of getting the product to market;
- (a) producer and mediator
 - (b) suppliers and logistics
 - (c) mediator and consumer
 - (d) none of the above
23. _____ is a right granted by the Government of a country to the inventor for a limited period of time
- (a) Geographical indications
 - (b) Invention
 - (c) Patent
 - (d) Monopoly

24. _____ is adopted by an organization to identify its goods or services and distinguish the from those of the others.
- (a) Trade mark
 - (b) Advertisement
 - (c) Audio
 - (d) Audio - video aids
25. *Kangra tea* is Geographical indication of
- (a) West Bengal
 - (b) Himachal Pradesh
 - (c) Tamil Nadu
 - (d) Madhya Pradesh
26. NBA accredits _____ run by the organisation
- (a) Programmes
 - (b) Institution
 - (c) College
 - (d) Industry
27. _____ role is to set the quality benchmarks targeted at global and national stockpile of human capital in all fields of technical education
- (a) NAAC
 - (b) NBA
 - (c) GCP
 - (d) GMP

28. _____ is to help nascent entrepreneurs grow their business.
- (a) Start-up incubator
 - (b) Offering capital
 - (c) Product development
 - (d) Selling
29. The commercialization strategy of a biotech involves the decisions it makes about “what”, “when” and “how” it will interact with its
- (a) Product (b) Consumer
 - (c) Demand (d) Value chain
30. _____ is an initiative by the Government of India to make and encourage companies to develop, manufacture and assemble products made in India.
- (a) Start ups (b) Make in India
 - (c) Swasth Bharath (d) Clean India

Part B

(10 × 2 = 20)

Answer any **ten** questions

- 31. What is Bio Entrepreneurship?
- 32. List out the Characteristics of Biotechnology Industry.
- 33. Write the concept and objectives of ‘Make in India’.
- 34. How identification of Problem helps the entrepreneur?
- 35. What factors will you take into account while assessing the market?

36. Write the classification of MSME based on its annual turnover.
37. Define Value chain
38. Write the benefits of IPR
39. What are Geographical indications? Mention any two GI tags of India.
40. Brief the role of BIRAC in developing entrepreneurship
41. Short notes on technology transfer agencies.
42. How do you assess the business feasibility?

Part C

(5 × 5 = 25)

Answer any **five** questions.

43. Discuss about strategies and operation protocol of bio sector firms.
44. Describe about strategic dimensions of patenting and commercialization.
45. What are all the challenges faced in marketing bio business?
46. Describe the different types of agreement and contract terms of joint venturing.

47. Narrate the role of information technology in Bio business.
 48. Understanding regulatory compliances and procedures are mandatory- Justify.
 49. Discuss issues related to procurement of capital and management of costs.
 50. Discuss in detail about Entrepreneurial Opportunity in the field of biotechnology.
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R5976

Sub. Code

501305

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021.

Third Semester

Biotechnology

**INTELLECTUAL PROPERTY RIGHTS, BIO SAFETY
AND BIOETHICS**

(CBCS – 2020 onwards)

Time : 3 Hours

Maximum : 75 Marks

Part A

(30 × 1 = 30)

Answer **all** questions.

1. _____ for brand identification of goods and services allow distinctions to be made between different traders
 - (a) copyrights
 - (b) trademarks
 - (c) patents
 - (d) geographical indications

2. The Protection of Plant Varieties and Farmers Rights Act was enacted in
 - (a) 2005
 - (b) 2010
 - (c) 2001
 - (d) 1990

3. WIPO stands for
 - (a) World Intellectual Property Organization
 - (b) World Information Policy Organization
 - (c) World Investment Policy Organization
 - (d) World Institute for Prevention of Organized crime

4. TRIPS agreement is administered by
(a) WTO (b) WIPO
(c) USPTO (d) EPO
5. A registered GI is valid for _____ years and can be renewed.
(a) 30 (b) 60
(c) 5 (d) 10
6. EPO delivers services defined under
(a) European Patent Convention
(b) Indian Patent Act
(c) GATT
(d) WTO
7. _____ facilitates the process of obtaining patent protection in multiple countries
(a) Budapest Treaty
(b) Patent Cooperation Treaty
(c) Patent Law Treaty
(d) WIPO Copyright Treaty
8. Product patent was extended to fields of technology including food, drugs and microorganisms by amendment of Indian Patent Act in
(a) 1970 (b) 2010
(c) 2005 (d) 2010
9. _____ define the invention in one or more single-sentence paragraphs and serve as the legal definition of the invention
(a) Summary (b) Claims
(c) Objectives (d) Background

10. An applicant can file _____ to the invention which has been applied or patented already if there is a modification
- (a) Divisional Application
 - (b) PCT international application
 - (c) PCT national phase application
 - (d) Patent of addition
11. Which of the following statement is false?
- (a) License is an agreement signed by patent owner
 - (b) License needs to abide by the agreement
 - (c) Licensee can be sued of infringement by patent owner if he abides by the agreement
 - (d) Patent owner cannot sue licensee of infringement if he abides by the agreement
12. A prohibited act with respect to a patented invention without permission from the patent holder is termed as
- (a) Patent infringement
 - (b) Patent claim
 - (c) Licensing
 - (d) Innovation
13. _____ filter if found in biological safety cabinets
- (a) Cellulose acetate
 - (b) PVDF
 - (c) Nitrocellulose
 - (d) HEPA
14. The minimum requirement to study infectious agents or toxins that may be transmitted through the air and cause potentially lethal infection through inhalation exposure is
- (a) BSL-1
 - (b) BSL-2
 - (c) BSL-3
 - (d) BSL-4

15. _____ provides information that can be informative for the risk assessment of food and feed for the safety of humans and animals
- (a) Biochemical analysis
 - (b) Molecular characterization
 - (c) Taxonomical studies
 - (d) Phylogenetic studies
16. _____ is the genetic modification of a recipient species with a natural gene from a crossable, sexually compatible organism (same species or a closely related species)
- (a) Intragenesis
 - (b) Cisgenesis
 - (c) Breeding
 - (d) Interference
17. The longer dsRNA are cleaved by the enzyme
- (a) Dicer
 - (b) Methyl esterase
 - (c) KpnI
 - (d) Caspase 9
18. Shocks in transformation methods of plants and animals are given by
- (a) genome editing
 - (b) electroporation
 - (c) microinjection
 - (d) diffusion
19. _____ has developed harmonized international food standards, guidelines and codes of practice
- (a) Hague Agreement
 - (b) Cartagena protocol
 - (c) Codex Alimentarius Commission
 - (d) Strasbourg Agreement

20. Planning and execution of a nation-wide programme for the prevention, control and abatement of pollution in the environment was a measure in
- (a) The Plastic Waste Management Rules, 2016
 - (b) Environment Protection Act, 1986
 - (c) Environment Prevention Act, 1991
 - (d) Water (Prevention and Control of Pollution) Cess Act, 1977
21. IBSC stands for
- (a) International Biomedicine and Science Consortium
 - (b) International Biosafety Committee
 - (c) Institutional Biomedicine and Science Committee
 - (d) Institutional Biosafety Committee
22. Which of the following belong to Category I rDNA experiments?
- (a) Breeding, housing and experiments of gene knockout
 - (b) Experiments with approved host/vector systems, in which the gene inserted is a pathogenic determinant.
 - (c) Experiments involving GE plants containing genes directly involved in the production of toxins/allergens
 - (d) Experiments on animals using DNA which encodes a vertebrate toxin
23. The planting of one or more regulated events in a single experimental plot is called
- (a) trial spot
 - (b) landmarks
 - (c) isolation distance
 - (d) field trial

24. GM labelling is required for packaged food products where genetically modified ingredients reaches over
- (a) 15%
 - (b) 1%
 - (c) 5%
 - (d) 2%
25. The right for an individual to have personal, identifiable medical information kept private and only available to physician and other necessary health care staff is termed as
- (a) infringement
 - (b) litigation
 - (c) confidentiality
 - (d) disclosure
26. _____ should be the starting point of diagnostic genetic screening
- (a) Pedigree analysis
 - (b) Chromosome mapping
 - (c) Karyotyping
 - (d) PCR
27. Cadaveric organs are the organs sourced from
- (a) directed donors
 - (b) non-directed donors
 - (c) live donors
 - (d) recently deceased donors
28. Stem cells derived from inner cell mass of a blastocyst are termed as
- (a) adult stem cells
 - (b) embryonic stem cells
 - (c) umbilical cord blood stem cells
 - (d) induced pluripotent stem cells

29. The principles of 3Rs for performing more humane animal research include
- (a) Reduction, Reuse and Recycle
 - (b) Reduction, Repurpose and Refinement
 - (c) Replacement, Reduction and Refinement
 - (d) Replacement, Reuse and Recycle
30. Conserving the animals and plants in their natural habitats is known as
- (a) in vitro conservation
 - (b) in vivo conservation
 - (c) in situ conservation
 - (d) ex situ conservation

Part B

(10 × 2 = 20)

Answer any **ten** questions

31. Define IP and mention its types?
32. What are patent databases?
33. Mention the features of Budapest Treaty.
34. Give an example of patent infringement.
35. When does one need to pay royalty for the use of any material?
36. What are GRAS organisms?
37. Define GMOs. Give two examples.
38. State the role of RNAi in gene silencing.
39. What are the functions of GEAC?

40. Give the background of GM labeling in food by FSSAI.
41. What is biopiracy?
42. Mention the advantages of gene therapy.

Part C

(5 × 5 = 25)

Answer any **five** questions.

43. How TRIPS agreement help in protection of IP?
44. Explain the concept of prior art.
45. What are the procedures for filing a PCT application?
46. Brief the requirements and processes involved in international patenting.
47. Discuss on primary containment of biohazards.
48. What is genome editing? List few tools used for genome editing and mention their applications.
49. Detail the standard operating procedures of biosafety research.
50. Elaborate the rationales for prenatal testing.

R5977

Sub. Code

501308

**M.Sc. (Biotechnology) DEGREE EXAMINATION,
NOVEMBER – 2021.**

Third Semester

**Lab VI : BIOPROCESS ENGINEERING AND
TECHNOLOGY**

(CBCS – 2020 onwards)

Time : 3 Hours

Maximum : 75 Marks

Part A

(30 × 1 = 30)

Answer **all** questions.

1. What are the two key parameters that relate the growth rate to the concentration of a single growth-controlling substrate $[\mu = f(s)]$ in Monod's model?
 - (a) Maximum specific substrate consumption rate (q_{max}) and Degree of induction for substrate (i)
 - (b) Maximum specific growth rate μ_{max} and the substrate affinity constant (K_S)
 - (c) Maximum specific substrate consumption rate (q_{max}) and Maximum specific growth rate μ_{max}
 - (d) Substrate affinity constant (K_S) and Degree of induction for substrate (i)

2. In a light microscope, the light ray passes from the specimen to eye piece through
 - (a) Magnifying lens (b) condenser lens
 - (c) Subjective lens (d) objective lens

3. Spectrophotometer works on the principle of _____ law
4. Which of the following assays is not a microplate reader assay
 - (a) ELISA
 - (b) Immunoassays
 - (c) SPV
 - (d) Bead-based epitope
5. The wavelength of the visible spectrum of light ranges between
 - (a) 200-440 nm
 - (b) 400-700 nm
 - (c) 200-800 nm
 - (d) 150-540 nm
6. _____ plating technique in which three-phase streaking pattern
7. Identify the chemical which is being used as a cryoprotectant in Cryopreservation
 - (a) Phosphoenol
 - (b) Glycerol
 - (c) SDS
 - (d) Phenol
8. The incorporation of baffle in bioreactor is meant to mainly prevent _____
 - (a) Microbial growth on walls
 - (b) Prevent clumping
 - (c) To increase growth
 - (d) Evenly spread media
9. Bioreactor used for small scale cultivation of microorganism for laboratory purposes is known as _____
10. Agitating peddle attached to the centre shaft of the motor found in a bioreactor is known as _____

11. Inhibitors-mediated modification of enzyme structure resulting in unfit substrate-binding site leads to inhibition of the reaction, this type of inhibition is known as _____
12. Production and utilization rate of metabolites can be determined by using _____
13. Analytical technique used for separation of a different compound in a mixture is generally known as _____
14. _____ is the preferred non-polar solvent to extract the fatty acid methylesters
15. Adsorbent used in adsorption chromatography has the capacity to hold the molecule on their surface this is due to _____ force.
16. Spectroscopy which uses Infrared spectrum absorption or emission from the sample for analysis, is said to be
 - (a) FTIR
 - (b) Raman spectroscopy
 - (c) XRD
 - (d) MS
17. Carbohydrate content cannot be determined using
 - (a) Anthrone method
 - (b) Phenol-sulfuric acid test
 - (c) Dubois method
 - (d) Bligh and Dyer method
18. Find out the correct statement
 - (a) bead mill and osmotic shock are mechanical cell disruption method
 - (b) autoclave is not a cell disruption method
 - (c) use of microwave is a mechanical cell disruption method
 - (d) sonication uses low-frequency sound waves to disturb cells

19. Detection of specific DNA sequence in DNA sample can be done using
- (a) Northern blotting
 - (b) Southern blotting
 - (c) Western blotting
 - (d) RT-PCR
20. Drinking water purification is based on principle of _____
21. Autoclavable plastics are made out of
- (a) Polyethene
 - (b) Polypropylene
 - (c) Polyvinyl chloride
 - (d) Polystyrene
22. Most commonly used buffer for DNA extraction in plant tissue is
- (a) DMSO
 - (b) Polyacrylamide
 - (c) Tris-HCL
 - (d) CTAB
23. Which of the following is not a technique to separate the cells from the broth
- (a) Flocculation
 - (b) Filtration
 - (c) Acclimatization
 - (d) Centrifugation
24. Which of the following is a flocculating agent
- (a) alum
 - (b) calcium hypochlorite
 - (c) ZnO
 - (d) sodium carbonate
25. The technique by which the cell is encapsulated into a matrix for better grow and productivity is known as _____

26. _____ catalyzes the oxidation of $\beta - d$ -glucose to gluconic acid
27. The solvent used to separate components in a liquid sample for HPLC analysis is called _____
28. Hard water is preferred for the English Burton bitter beer production due to the high content of _____
29. When the filtration method is not found suitable for separation, _____ can be used to remove microorganisms and other similar-sized particles from a broth.
30. In industrial fermentation, _____ are added to the broth to aid dewatering.

Part B

(10 × 2 = 20)

Answer any **ten** questions.

31. Describe the role of dimethyl sulfoxide in cryopreservation.
32. What are the key concerns arise during the continuous subculture of industrially important microbes.
33. Define Beer-Lambert law.
34. List out any two applications of the microplate reader.
35. Predict the growth rate of the cells if the dilution rate and residual concentration is increased and decreased, respectively.
36. List out the advantages of the multistage chemostat system.
37. What is synchronous cell division?

38. List out any two applications of the semi-continuous culture system.
39. Define biomass productivity.
40. List out the applications of solid-phase microextraction.
41. What is reversed-phase thin-layer chromatography?
42. List any two applications of a scanning electron microscope.

Part C

(5 × 5 = 25)

Answer any **five** questions.

43. How can the cryopreserved bacterial cells be revived and subcultured into the liquid broth?
44. Describe the working principle of the microplate reader.
45. Explain in detail the methods applicable to sterilize the bioreactor.
46. Write in detail about the external feedback system in continuous culture with a diagram.
47. Describe the “Tower Fermenter” system for the beer brewing with a schematic representation
48. Describe the kinetics of variable volume fed-batch culture.
49. Which membrane-based method is suitable to remove the particles having an average molecular weight >400kDa? Write the principle with the aid of a diagram.
50. Explain the working principle and components of FPLC.

R5978

Sub. Code

501309

M.Sc. DEGREE EXAMINATION, NOVEMBER – 2021.

Third Semester

Biotechnology

Lab - VII : BIOINFORMATICS

(CBCS-2020 onwards)

Time : 3 Hours

Maximum : 75 Marks

Part A

(30 × 1 = 30)

Answer **all** questions.

1. Genbank is maintained by
 - (a) EMBL
 - (b) NCBI
 - (c) EBI
 - (d) SIB
2. Human diseases information can be accessed from _____ database
 - (a) HTGS
 - (b) EST
 - (c) PDB
 - (d) OMIM
3. To find the required protein sequence information quickly, the user should enter the
 - (a) sequence deposition date, protein name and journal name
 - (b) publication date, protein name, or volume
 - (c) sequence accession number, protein name, or name of gene
 - (d) properties, protein name, or title word

4. Which of the following databases is derived from mRNA information?
- (a) dbEST (b) PDB
(c) OMIM (d) HTGS
5. SCOP and CATH are derived by using the protein structures of _____
- (a) UniPROT
(b) Ensembl
(c) InterPro
(d) Protein Data Bank
6. To get the literature information, which of these below database is used?
- (a) Lit-UniPROT (b) Entrez
(c) PubMed (d) Lit-EMBL
7. Homology modeling may be distinguished from ab initio prediction because
- (a) Homology modeling requires a model to be built.
(b) Homology modeling requires alignment of a target to a template
(c) Homology modeling is usefully applied to any protein sequence
(d) The accuracy of homology modeling is independent of the percent identity between the target and the template.
8. The researchers use the sequence alignment concept
- (a) to trace out evolutionary relationship
(b) to infer the functions of newly sequenced genes
(c) to predict new members of gene families
(d) all the above

9. You have a DNA sequence. You want to know which protein in the main protein database “nr,” the non-redundant database) is most similar to some protein encoded by your DNA. Which program should you use?
- (a) blastn (b) blastp
(c) blastx (d) tblastx
10. How can multiple sequence alignment programs improve performance?
- (a) By performing PSI-BLAST
(b) By incorporating data on secondary structure
(c) By incorporating data on three-dimensional structures
(d) All of the above
11. The two main features of any phylogenetic tree are:
- (a) The clades and the nodes
(b) The topology and the branch lengths
(c) The clades and the root
(d) The alignment and the bootstrap
12. In a CLUSTALW multiple sequence alignment ‘?’ represents
- (a) Strongly conserved regions
(b) Non conserved regions
(c) Gapped regions
(d) None of the above

13. Which one of the Following is a character-based phylogenetic algorithm?
- (a) Neighbor joining
 - (b) Kimura
 - (c) Maximum likelihood
 - (d) PAUP
14. You have two distantly related proteins. Which BLOSUM or PAM matrix is best to use to compare them?
- (a) BLOSUM45 or PAM 250
 - (b) BLOSUM45 or PAM 10
 - (c) BLOSUM80 or PAM 250
 - (d) BLOSUM80 or PAM 10
15. The first complete genome of free living organism to be sequenced was:
- (a) *Saccharomyces cerevisiae* chromosome III
 - (b) *Haemophilus influenzae*
 - (c) Φ X174 bacteriophage
 - (d) The human mitochondrial genome
16. Which are the most abundant RNA types?
- (a) rRNA and tRNA
 - (b) rRNA and mRNA
 - (c) tRNA and mRNA
 - (d) mRNA and microRNA

17. Which one of the following is not the correct criterion for the primer design?
- (a) Length of the primer between 15 and 30 nucleotides
 - (b) No self-complementary or complementary to other primers
 - (c) >3 G/C nucleotide at the 3' end to avoid nonspecific priming
 - (d) GC content (40 – 60%)
18. Which of the parameters is NOT computed by ProtParam
- (a) molecular weight and theoretical PI
 - (b) amino acid and atomic composition
 - (c) grand average of hydropathicity
 - (d) stability index and coefficient
19. The wrapped view of multi-panelled electropherogram in visualization of DNA sequences. the multiple (overlapping) peaks with the same height, or of differing heights, overlapping one another may be observed due to
- (a) Clone contamination
 - (b) Heterozygous PCR template due to indels present in a diploid organism
 - (c) Impurities in the PCR products.
 - (d) All the above

20. Which one of the following is the correct order of homology modeling steps?
- (a) Template recognition, Alignment correction, Loop modeling, Backbone generation
 - (b) Template recognition, Side chain modeling, Loop modeling, Model optimization
 - (c) Template recognition, Backbone generation, Loop modeling, Side chain modeling
 - (d) Template recognition, Backbone generation, Side chain modeling, Loop modeling
21. Which of the following is calculated, if more than three atoms are picked in PyMol?
- (a) Bond length (b) Dihedral
 - (c) Distance (d) Bond angle
22. Which one of the information is NOT needed for protein – small molecule docking method?
- (a) Biological activity and functions
 - (b) Active site of the receptor
 - (c) Bond pattern and 3D structure of the ligand
 - (d) Feasibility of binding of a particular small molecule to that receptor, the knowledge gained from literatures
23. A _____ is defined in SCOP as a collection of superfamilies
- (a) Primary structure
 - (b) Protein Fold
 - (c) Mutated protein
 - (d) Secondary structure

24. Which one of the following methods is not used in pairwise sequence alignment?
- (a) Dot matrix analysis
 - (b) Dynamic programming algorithm
 - (c) k-tuple method
 - (d) Support Vector Machine
25. The Lipinski's rule of five is used for
- (a) Docking
 - (b) Similarity search
 - (c) Drug likeness
 - (d) Dynamics simulation
26. The VAST, DALI and CE are very useful
- (a) To accelerate the protein structure comparison
 - (b) To find alignments of coding region between human and puffer fish
 - (c) To analyze the input during phylogenetic analysis
 - (d) To compare small sequences
27. BLOSUM matrices are used for
- (a) phylogenetic analysis
 - (b) pair-wise sequence alignment
 - (c) multiple sequence alignment
 - (d) None of these

28. Which one of the following is a biological database, web resource of known and predicted protein—protein interactions and the retrieval of interacting genes/proteins?
- (a) KEGG
 - (b) MetaCyc
 - (c) Cytoscape
 - (d) SIRING
29. Protein secondary structure prediction algorithms typically calculate the likelihood that a protein forms
- (a) α helices, β sheets, and coils
 - (b) α helices and β sheets
 - (c) α helices, β sheets, coils, and multimers
 - (d) α helices and π helices
30. What are some of the properties of ultraconserved elements?
- (a) They have variable lengths (from 50 to >1000 base pairs) and are nearly perfectly conserved
 - (b) They have variable lengths (from 50 to >1000 base pairs), are nearly perfectly conserved, and typically correspond to protein-coding regions
 - (c) They have lengths ≥ 200 base pairs and are perfectly or nearly perfectly conserved between relatively closely related species such as rats and mice
 - (d) They have lengths ≥ 200 base pairs and are perfectly or nearly perfectly conserved between relatively distantly related species such as humans and rodents

Part B

(10 × 2 = 20)

Answer any **ten** the questions

31. What is the difference between RefSeq and GenBank?
32. What are six frames of translations?
33. Define E-value. Explain the use of E-value in BLAST.
34. What are consensus protein secondary structure and its importance?
35. Define contig assembly.
36. Expand T-Coffee and give its uses.
37. Write a note on Entrez.
38. Define global and local alignments.
39. The PSI-BLAST is more effective in detecting distantly related proteins than BLASTP — Justify.
40. What are the advantages of doing a restriction map using computer programs?
41. What is the need for Grid Generation in AutoDock tool?
42. What are the different forms of beta sheets?

Part C

(5 × 5 = 25)

Answer any **five** questions.

43. Explain the uses of various genome databases.
44. NCBI database is the major resource for bioinformatics research — Justify.

45. Elucidate briefly about the sequence description and alignments in BLAST 'OUTPUT' page.
46. Explain the following; (a) Rooted tree, (b) Unrooted tree, (c) Common ancestor. (d) Cladogram and (e) Phylogram
47. List the various display options in any molecular visualization tool for the protein 3D structure and explain its significance.
48. Write in detail about the steps involved in homology modeling.
49. How could you predict genes from newly sequenced chromosome of *Drosophila melanogaster* and explain the steps involved in any one the tools?
50. Explain the basic concept of designing and prediction of miRNA with its uses. List its software and tools.
