Department of Biotechnology

Question Bank

MSc SEM I

Paper I:Cell Biology & Enzymology

1. Discuss in detail structure of Mitochondrial Membrane and explain Oxidative Phosphorylation for ATP production. 16
2. Explain composition of cell membrane. Justify the statement that plasma membrane acts as semipermeable membrane in the living cell. 8
3. Discuss the functions of Lysosomes and Peroxisomes. 8
4. Explain the regulation of cell cycle in S. cerevisiae. 16
5. Write a detailed note on Tyrosine Kinase receptor signaling. 16
6. Explain classification of enzymes with suitable examples. 8
7. What is metal ion catalysis ? Explain with example. 8
8. Explain mechanism of Acid-Base Enzyme Catalysis. 8
9. What are multienzyme complexes ? Give its significance by citing one example. 8

10. Define enzyme inhibition. Explain in detail different types of inhibitors with suitable examples. 16

11. Derive Michaelis-Menton equation. Explain effect of substrate, temperature, pH and product concentration on regulation of enzyme activity. 16

12.. Write notes on Chloroplast 4

13. Light induced signalling in plants 4

14. Allosteric enzymes 4

15. Applications of Immobilized enzymes. 4

16. Describe the structure of mitochondria. Give detailed account of oxidative phosphorylation. 16

17. Give brief account of ion and macromolecules transport through Plasma membrane. 16 2. Discuss in detail light induced signalling. 16

18. Explain role of CDK in cell cycle progression 8

19. Briefly discuss Tyrosine kinase dependant cell signalling. 8

20. Give an account of any two mechanisms of enzyme action. 16

21. Briefly discuss working of Pyruvate dehydrogenase multienzyme complex. 8

22. Describe calmodulin mediated enzyme regulation. 8

23. Explain in detail enzyme engineering. 16

24. Discuss any two modifying factors of enzyme kinetics 8 (b) Derive Michaelis-Menton equation. 8

25. Write short notes on Structure and function of Carotenoids 4

26. Various check points in cell cycle control 4

27. Concept of coenzymes 4

28. Immobilization of enzymes. 4

29. Describe the structure and functions of chloroplasts. 20

30. Write on oxidative phosphorylation 10

31. Write note on Plasmodesmata. 10

32. Describe signalling by Insulin receptors in detail. 20

33. Describe role of GPCR's in sensory perceptions. 10

34. Write a note on RTK dimerization. 10

35. Write on molecular events in cell cycle of Saccharomyces cerevisiae. 20

36. Describe light induced signal transduction. 10

37. Describe voltage gated Ca2+ channels. 10

38. Describe immobilization of enzymes and their industrial applications. 20

39. Explain concept of multienzyme complex and its importance. 10

40. Explain enzyme inhibition kinetics in competitive inhibition. 10

41.. Write short notes on Lysosomes 5

42. G-Proteins Cyclins and Cdks 5

43. Calmodulin mediated enzyme regulation. 5

44. Write a detailed note on Tyrosine Kinase receptor signaling. 16

45. Explain classification of enzymes with suitable examples. 8

46. What is metal ion catalysis ? Explain with example. 8

47. Explain mechanism of Acid-Base Enzyme Catalysis. 8

48. What are multienzyme complexes ? Give its significance by citing one example. 8

49.. Define enzyme inhibition. Explain in detail different types of inhibitors with suitable examples. 16

50. Derive Michaelis-Menton equation. Explain effect of substrate, temperature, pH and product concentration on regulation of enzyme activity. 16

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Paper II:Molecular biology

1. Write a detailed note on the enzymes and accessory proteins involved in prokaryotic replication. 16
2. Write notes on Suppressor mutations. 8
3. SOS repair. 8
4. Describe the bacterial RNA polymerase holoenzyme. Add a note on its role in initiation of transcription. 16
5. Write notes on Splicing of nuclear hnRNA. 8 (
6. Enhancers. 8
7. Describe the features of genetic code. 8
8. Briefly discuss the triplet binding experiment of genetic code determination. 8
9. Write notes on Amino acyl tRNA synthetases. 8
10. Termination of protein biosynthesis. 8

11. Describe the working of lac operon in detail. Please discuss both, negative and positive controls. 16

12. Discuss in detail the Britten—Davidson model. 16

13. Write short notes on Ames test. 4

14. Sigma factors. 4

15. Elongation factors in prokaryotic translation. 4

16. Negative autogenous control. 4

17. Explain the Meselson and Stahl experiment to prove that DNA replication is semi conservative. 8

18. Explain the Nucleotide Excision Repair pathway in prokaryotes. 8

19. Discuss the mechanism of suppressor mutations. 8

20. Give a brief account of DNA Polymerase I. 8

21. Discuss the three types of eukaryotic RNA Polymerases. 16

22. Explain the salient features of a bacterial promoter. 8

23. Write a note on alternative splicing. 8

24. Describe the experiments (any two) which led to the deciphering of genetic code. 16

25. Write notes on Amino acyl tRNA Synthetases 8

26. Mechanism of elongation in prokaryotic translation. 8

27. Discuss regulation of gene expression with respect to lac operon. 16

28. Write notes on Britten-Davidson Model 8

29. DNA binding domains of transcription factors. 8

30.. Write short notes on Helicases 4

31. s32 protein 4

32. Clover leaf model 4

33. 3' UTR motifs. 4

34. Describe in detail the positive and negative control of the lac operon. 20

35. Explain regulation of trp operon 10

36. Interrupted genes. 10

37. Describe in detail the eukaryotic DNA replication with a note on fidelity of replication and enzymes involved. 20

38. Transposable genetic elements 10

39. Repair of double-strand breaks. 10

40. Explain in detail the prokaryotic transcription. 20

41. Different types of RNA polymerases 10

42. Nascent mRNA processing. 10

43. Describe in detail the protein biosynthesis in prokaryotes. 20

44. Regulation of translation by 3¢ and 5¢ UTR motifs. Explain. 10

45. Characteristics of Genetic Code. 10

46. Write notes on Splicing of nuclear hnRNA. 8 (

47. Enhancers. 8

48. Describe the features of genetic code. 8

49. Briefly discuss the triplet binding experiment of genetic code determination. 8

50. Write notes on Amino acyl tRNA synthetases. 8

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MSc SEM I

Paper III:Biomolecule

1. Describe the structure of the energy storage molecules – starch and glycogen. 16

2. Write a detailed note on glycolipids and proteoglycans. 16

3. What are lipoproteins ? Describe lipid micelles and liposomes. 16

4. Describe phospholipids with suitable examples. 16

5. Describe the different secondary structures of Proteins. 16

6. Describe the various models of Protein folding. 16

7. Describe the Watson-Crick Structure of DNA. 16

8. Discuss Southern hybridization in detail. 16

9. . Write short notes on Chitin 4

10. Terpenes 4

11. Chaperones 4

12. Structure of tRNA. 4

13. Discuss the structure of starch and glycogen in detail. 16

14. Describe the chemistry and functions of glycolipids and proteoglycans. 16

15.. Describe in detail sterols and lipoproteins and add a note on their functions. 16

16. Classify Phospholipids and describe their functions. 16

17. Discuss the secondary structures of proteins. 8

18. Describe briefly various models of protein folding. 8

19. Discuss in detail protein sequencing. 16

20. Give a detailed discussion on topological structure of DNA. 16

21. Discuss the A and Z forms of DNA. Add a note explaining why Z-DNA is left handed. 16

22.. Write notes on Chitin. 4

23. Liposomes. 4

24. Collagen. 4

25. DNA denaturation and renaturation. 4

26. Write a detailed account on structure and functions of : (a) Glycogen 8

27. Cellulose. 8

28. Discuss in detail cell surface molecules. 16

29. Discuss in detail the structure and clinical importance of lipoproteins. 16

30. Discuss Triglycerides 8

31. Liposomes. 8

32. Discuss Tertiary structure of Proteins 8

33. Domain structure of Proteins. 8

34. Give a detailed account of protein sequencing. 16

35. Explain in detail Nucleic acid Hybridization. 16

36. Write notes on Novel structures of DNA 8

37. Denaturation and Renaturation of DNA. 8

38. Write notes on Chitin 4

39. Sterols 4

40. Collagen 4

41. Z-form of DNA. 4

42. Discuss in detail cell surface molecules. 16

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Paper IV: BIOPHYSICAL TECHNIQUE

1. Describe principle, working and applications of spectrofluorimetry. 16
2. Describe various components and working of UV-VIS spectrophotometer. Add a note on its applications. 16
3. Explain affinity chromatography with its applications. 16
4. Describe paper chromatography techniques with appropriate emphasis on solvent system and detection techniques used. 16
5. Describe various aspects of gel electrophoresis. 16
6. Describe the following Discontinuous gel electrophoresis 8
7. Pulse field gel electrophoresis. 8
8. Explain principle and procedure of density gradient centrifugation. 16
9. Geiger Muller Counter 8
10. Liquid Scintillation Counter. 8
11. Write notes on : (a) Luminometry 4

12. HPLC 4

13. Gradient gel electrophoresis 4

14. Radioimmunoassay. 4

15. Discuss in detail the applications of fluorescence spectrophotometry. 16

16. Give a detailed account on detectors used in UV-visible spectrophotometer. 16

17. How can we separate proteins with different PIs using chromatography ? Explain with suitable examples. 16

18. Explain the principle and working of affinity chromatography in enzyme purification. 16

19. Discuss in detail the principle and applications of SDS-PAGE. 16

20. Write notes on Pulsed field gel electrophoresis 8

21. Gradient Electrophoresis 8

22. Discuss cell component isolation using centrifugation. 16

23. Write notes on : (a) GM counter 8

24. Liquid scintillation counters 8

25.. Write short notes on : (a) Raman spectrophotometry 4

26. Viscosity for protein conformational study 4

27. Partition principle 4

28. Radioimmunoassay. 4

29. Discuss various types of mass analyzers used in mass spectrometry. 20

30. Write note on Various sources of radiant energy in UV, visible and IR spectrophotometers. 10

31. Applications of spectrophotometers in biological sciences. 10

32. Describe principle of DEAE–cellulose ion exchange chromatography. Describe this technique in separation of a mixture of proteins.

33. Discuss various factors affecting migration of DNA through agarose gels. 20

34. Discuss differential centrifugation used for separation of various cell organelles. 20

35. Write note on Zonal rotors. 5

36. Stoke's Law. 5

37. Relative centrifugal force. 5

38. Cesium chloride density gradient centrifugation. 5

39. Discuss various applications of isotopes in Biochemistry. 20

40. Write short note on Cutoradiography. 5

41. Radioactive decay. 5

42. Cerenkov radiation. 5

43. Units of radioactivity. 5

44. Write note Pulsed Field Gel Electrophoresis. 5

45. Applications of circular dichroism. 5

46. Molecular weight determination using sedimentation velocity. 5

47. Falling drop method for measurement of stable isotopes. 5

48. Gradient gel electrophoresis 4

49. Radioimmunoassay. 4

50. Discuss in detail the applications of fluorescence spectrophotometry. 16

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MSc SEM II

Paper I: MICROBIOLOGY

1. Describe in detail the capsid structure and symmetries of viruses. 16
2. Write notes on Applications of algae in Biotechnology. 8
3. Quantification of viruses. 8
4. . Discuss transduction as a method of horizontal gene transfer in bacteria. 16
5. Describe the process of Sporulation in endospore forming bacteria. 16
6. Explain the different types of media used for cultivation of bacteria with examples. 16
7. Discuss the role of Oxygen as a factor influencing microbial growth. Add a note on methods of anaerobic cultivation of bacteria. 16
8. . Write a detailed note on mechanism of action of different Chemotherapeutic agents. 16
9. Discuss high temperature as a method of sterilization. 16

10. Write short notes on Prions. 4

11. 16 S rRNA gene sequencing. 4

12. Synchronous cultures. 4

13. MDR. 4

14. Symmetries of Viral capsids. 8

15. Biotechnological applications of filamentous fungi. 8

16. Events of lytic cycle. 8

17. Biotechnologically important algae. 8

18. Describe in detail use of 16 SrRNA sequencing in microbial classification. 16

19. Give an account of bacterial conjugation. 16

20. Types of bacteriological media. 8

21. Lyophilization. 8

22. Synchronous culture. 8

23. Measurement of direct cell number. 8

24. Describe in detail various physical methods involved in control of microbes. 16

25. Write an essay on chemotherapeutic agents. 16

26. Describe the Prions 4

27. Mycobacteria 4

28. Chemostat 4

29. Management of drug resistant pathogens. 4

30. Explain classification of Bacteria according to Bergey's manual. 20

31. Explain the role of Denaturating gradient gel electrophoresis (DGGE) and Temperature gradient gel Electrophoresis (TGGE) in assessing microbial diversity. 20

32. Explain in detail how transduction transfers genes in between bacteria. 10

33. Give in detail the classification of animal viruses with examples. 10

34. Give salient feature of E.Coli genetic map. 10

35. Explain in detail the process of conjugation. 10

36. Define a culture medium ; enumerate different types of culture media with suitable examples and composition. 20

37. How are bacteria classified on the basis of nutritional requirements ? 10

38. Describe continuous culture method. 10

39. What are the different mechanisms by which bacteria acquire drug resistance ? 10

40. Give the strategies for management of drug resistance in hospitals. 10

41. Explain various methods of preservation of bacterial cultures. 10

42. Give the mechanism of action of cephalosporins, 10

43. Give the principle used in Amplified rDNA Restriction Analysis. 5

44. Explain the ultrastructure of yeast. 5

45. Give any two methods for isolation of bacteria in pure culture. 5

46. Give the importance of MDR pathogens in health sector. 5

47. Explain in detail how transduction transfers genes in between bacteria. 10

48. Give in detail the classification of animal viruses with examples. 10

49. Give salient feature of E.Coli genetic map. 10

50. Explain in detail the process of conjugation. 10

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MSc SEM II

Paper II: IMMUNOLOGY

1. Describe in detail cellular and humoral components of innate immunity. 16
2. Explain briefly the structure and functions of secondary lymphoid organs. 16
3. Give a detailed account on B-cell maturation, activation and differentiation. 16
4. Explain in detail the properties and therapeutic uses of cytokines. 16
5. Describe briefly active immunization with different forms of vaccines. 8
6. Explain the concept of DNA and protein based vaccines. 8
7. Write notes on Antibody engineering 8
8. Catalytic antibodies. 8
9. Elaborate upon mechanism and role of CD4+ Tcells in autoimmune responses. 16
10. Write notes on Immunosuppressive therapy 8
11. Cancer immunotherapy. 8

12. Write short notes on Haptens and immunogens 4

13. Antibody classes 4

14. Plant based vaccines 4

15. MHC in autoimmunity. 4

16. Describe in detail the structure and functions of primary lymphoid organs. Explain why a large population of lymphocytes undergo death during their maturation in primary lymphoid organs. 16

17. Write notes on Mucosal immunity 8

18. HLA typing. 8

19.. Discuss in detail the process of antigen recognition by TCR and subsequent events leading to activation of T-Cell. 16

20. Write notes on T-helper cell mediated activation of macrophages in CMI for killing of microbes.

21. ADCC. 8

22. Write notes on Synthetic peptide vaccines 8

23. Recombinant DNA vaccines. 8

24. Plant based vaccines 8

25. Live attenuated vaccines. 8

26. Discuss in detail the proposed mechanisms for the induction of autoimmunity. 16

27. Write notes on Role of CD4+ T-cells in Autoimmunity 8

28. Transgenic mice. 8

29. Write notes on Structure and function of spleen 4

30. Hapten – carrier system 4

31. Adjuvants 4

32. Treatment of autoimmune diseases. 4

33. Explain in detail the mechanisms involved in innate immunity. 8

34. Write about the primary lymphoid organs with suitable diagrams. 8

35. Describe the major histocompatibility complex and HLA typing. 16

36. Compare the structure and functions of various types of immunoglobulins. 16

37. Explain in detail the cell mediated immune response. 16

38. Explain active and passive immunization. What agents are used for passive immunization ? 16

39. What are recombinant DNA and protein based vaccines ? Explain each giving suitable examples. 16

40. Classify Hypersensitivity reactions. Describe in detail type-I hypersensitivity reaction. 16

41. What is autoimmunity ? Discuss the various types of autoimmune diseases. 16

42.. Write briefly on Mucosal associated lymphoid tissues 4

43. Antigenic determinants 4

44. Plant based vaccines 4

45. Cancer immunotherapy. 4

46. Describe in detail cellular and humoral components of innate immunity. 16

47. Explain briefly the structure and functions of secondary lymphoid organs. 16

48. Give a detailed account on B-cell maturation, activation and differentiation. 16

49. Explain in detail the properties and therapeutic uses of cytokines. 16

50. Describe briefly active immunization with different forms of vaccines. 8

51. Explain the concept of DNA and protein based vaccines. 8

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MSc SEM II

Paper III: FUNDAMENTALS OF GENETIC ENGINEERING

1. Discuss restriction enzymes in rDNA technology. 16

2. Describe shot gun method for producing gene library. 8

3. Explain the methods for cloning specific gene by hybridization. 8

4. Discuss the various blunt end ligation techniques. 16

5. Explain Boyer-Cohen-Chang experiment. 8

6. Explain Berg's terminal transferase method. 8

7. Describe the procedure for making cDNA library and enlist its applications. 16

8. In detail discuss Sanger's method of DNA sequencing. 16

9. Give a detailed account of the pUC cloning vectors. 16

10. Write a note on Cosmid Vectors. 8

11. Write a note on M-13 Vectors. 8

12. Write notes on Topoisomerases. 4

13. Linkers. 4

14. Immunoprecipitation. 4

15. Any one retroviral vector. 4

16. Explain the role of DNA modification enzymes in genetic engineering. 16

17. Describe the shotgun method for producing gene library. 8

18. Reverse transcriptase method for gene cloning. 8

19. Write notes on Berg's terminal transferase method 8

20. Boyer-Cohen-Chang experiment. 8

21. Describe in detail the blunt-end ligation techniques. 16

22. Discuss the advantages and disadvantages of cDNA library over genomic DNA library. 8

23. Explain the process of screening of recombinants by complementation method. 8

24. Describe the Sanger-Coulson method of DNA sequencing. Give its advantages over the chemical cleavage method. 16

25. Describe the general characteristics of plasmid vectors considering pUC18 as an example. 16

26. Discuss the application of lambda and MB phage as cloning vectors. 16

27.. Write short notes on Topoisomerases 4

28. Butt joints 4

29. Immunoprecipitation 4

30. Cosmid vectors. 4

31. Give a detailed account of DNA modification enzymes used in genetic engineering. 16

32. Write brief notes on Restriction endonucleases. 8

33. Reverse transcriptase method for gene cloning. 8

34. Explain the role of linkers and adaptors in DNA ligation. 8

35. Write a note on Berg's terminal transferase method. 8

36. Describe the Boyer-Cohen-Chang experiment. 8

37. Explain the role of T4 DNA ligase in DNA insertion and ligation. 8

38. Describe the Sanger-Coulson dideoxynucleotide method of DNA sequencing. 16

39. Discuss the screening of recombinants by complementation. 8

40. Describe the method of construction of cDNA library. 8

41. Explain the role of phage vectors in DNA cloning. 16

42. Write notes on Yeast vector plasmids. 8

43. Retroviral vectors. 8

44. Write short notes on Topoisomerases 4

45. Homopolymer tailing 4

46. Southern hybridization 4

47. Cosmid vectors. 4

48. Boyer-Cohen-Chang experiment. 8

49. Describe in detail the blunt-end ligation techniques. 16

50. Discuss the advantages and disadvantages of cDNA library over genomic DNA library. 8

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MSc SEM II

Paper IV: APPLIED MOLECULAR BIOLOGY

1. Discuss the process of homologous recombination with reference to Rec A and other recombinases. 16
2. Write notes on Fluorescence in situ hybridization. 8
3. Compare RAPD and AFLP analysis. 8
4. Discuss the concept of antisense molecules and give a detailed treatment of the various mechanisms through which they operate. 16 OR Enumerate and briefly describe various types of ribozymes. 16
5. Discuss the basis of carcinogenesis by polyoma virus. 16
6. Discuss how the Rbgene suppresses cell division. 16
7. Write a detailed note on angiogenesis and its role in cancer. 16
8. Elaborate on the concept and role of cancer stem cells. 16
9. Write brief notes on RFLP 4
10. Chromatin marking systems 4
11. Two stage animal model of carcinogenesis 4

12. Epithelial mesenchymal transition. 4

13. Discuss homologous recombination by RecBCD pathway. 16

14. Describe physical mapping of genomes using RFLP and fluorescence in situ hybridization. 16

15. Write notes on Molecular mechanism of antisense molecules. 8

16. Hammerhead ribozymes. 8

17. Discuss the importance of chemical modifications of DNA in epigenetics. 16

18. Discuss comprehensively the animal models used to study cancer. Add a note on transfection assay. 16

19. Write a detailed note on polyoma viruses and cancer. 16

20.. Describe the factors affecting angiogenesis. 16

21. Write notes on Epithelial-mesenchymal transition in metastasis. 8

22. Invasion metastasis cascade. 8

23. Write short notes on Cre/Lox recombination 4

24. RNA 4

25. P 53 4

26. Cancer stem cells. 4

27. Discuss briefly the construction of genetic map. 16

28. Explain procedure and applications of in situ hybridization. 8

29. Explain RFLP and its applications.

30.. Discuss the Molecular mechanism of antisense technology with its applications. 16

31. Write a note on RNAi. 8

32. Explain the biochemistry of Ribozymes. 8

33. Discuss the role of tissue culture in the study of cancer. 16

34. Write a note on polyoma virus. 8

35. Explain the mechanism of P 53 suppressor gene. 8

36. Describe the basic process of tumor induced angiogenesis. 16

37. Explain the prerequisites for metastasis. 8

38. Write a note on epithelial-mesenchymal transition. 8

39. Write notes on RAPD 4

40. Chromatin marking systems. 4

41. Role of Ras gene in cancer 4

42. Cancer stem cells. 4