Indian Institute of Technology Kharagpur QUESTION-CUM-ANSWERSCRIPT		
		Stamp/Signature of the Invigilator
MID-SEMESTER / END-SEMESTER EXAMINATION		SEMESTER (Autumn / Spring)
Roll Number		Section / Name
Subject Number	B S 2 0 0 0 1	Subject Name: Science of Living Systems
Department/Centre/School	School of Bioscience	Additional Sheets

Important Instructions and Guidelines for Students

1. You must occupy your seat as per the Examination Schedule/Sitting Plan.
2. Do not keep mobile phones or any similar electronic gadgets with you even in the switched off mode.
3. Loose papers, class notes, books or any such materials must not be in your possession; even if they are irrelevant to the subject you are taking examination.
4. Data book, codes, graph papers, relevant standard tables/charts or any other materials are allowed only when instructed by the paper-setter.
5. Use of instrument box, pencil box and non-programmable calculator is allowed during the examination. However, the exchange of these items or any other papers (including question papers) is not permitted.
6. Write on both sides of the answer-script and do not tear off any page. **Use last page(s) of the answer-script for rough work**. Report to the invigilator if the answer-script has torn or distorted page(s).
7. It is your responsibility to ensure that you have signed the Attendance Sheet. Keep your Admit Card/Identity Card on the desk for checking by the invigilator.
8. You may leave the Examination Hall for wash room or for drinking water for a very short period. Record your absence from the Examination Hall in the register provided. Smoking and the consumption of any kind of beverages are strictly prohibited inside the Examination Hall.
9. Do not leave the Examination Hall without submitting your answer-script to the invigilator. **In any case, you are not allowed to take away the answer-script with you**. After the completion of the examination, do not leave your seat until the invigilators collect all the answer-scripts.
10. During the examination, either inside or outside the Examination Hall, gathering information from any kind of sources or exchanging information with others or any such attempt will be treated as '**unfair means**'. Don't adopt unfair means and also don't indulge in unseemly behavior.

Violation of any of the above instructions may lead to severe punishment.

Signature of the Student

To be Filled by the Examiner

Question Number	Module-1	Module-2	Module 3 & 4		Total
Marks Obtained					

Marks Obtained (in words)	Signature of the Examiner	Signature of the Scrutineer

PLEASE READ THE FOLLOWING INSTRUCTIONS CAREFULLY

§1. Mid-Autumn semester of "Science of Living Systems (BS20001)" consists of UNIT-I. Students have to answer all the questions in the corresponding question paper-cum answer script in 2 hrs time.

§2. No query will be entertained regarding the questions during examination.

§3. No separate answer script is permissible.

§4. Tick the correct answer for the multiple choice questions.

§5. For descriptive or quantitative questions, write the answer in the space provided below the question.

§6. There is no negative marking.

MARKS OBTAINED

Module-1	Module-2	Module3 & 4	TOTAL
Signature	Signature		Signature

Indian Institute of Technology Kharagpur

Mid-Autumn semester examination 2015

Subject: Science of living system (BS20001)

NAME: **Roll #**

Module-1

Answer all questions (13 x 0.5 +1 = 7.5)

1. *E. coli* chromosomal DNA is
   (A) Double stranded, circular and right handed
   (B) Double stranded, linear and right handed
   (C) Single stranded, circular and right handed
   (D) Double stranded, circular and left handed

2. Enzyme (P) helps to unwind double stranded DNA and enzyme (Q) helps to remove superhelical structure of DNA. What are 'P" and 'Q' enzymes /
   (A) P= Topoisomerase, Q=helicase
   (B) P= DNA polymerase, Q= Helicase
   (C) P= Helicase, Q= Topoisomerase
   (D) P=Phosphatase, Q= Helicase

3. The diameter of B-form of DNA is (P) and the distance between two adjacent bases in any of the DNA strands is (R). What are the correct values of 'P' and 'R'?
   (A) P=2.0 nm, R= 0.34 nm
   (B) P=20 nm, R= 3.4 nm
   (C) P=2.0 mm, R= 0.34 mm
   (D) P=2.0 nm, R=R=3.4 nm

4. Most of the DNA replication is
   (A) Conservative and bi-directional process
   (B) Semi-conservative and bi-directional process
   (C) Dispersive and unidirectional process
   (D) None of the above

5. The linkage between sugar and base is called
   (A) Phosphodiester (B) Glycosidic (C) Hydrogen bond (D) Vander-Wall

6. Melting of DNA at high temperature means
   (A) Cleavage of DNA into nucleotides
   (B) Separation of base from the sugar
   (C) Separation of phosphate from the sugar
   (D) Separation of two strands of DNA

7. DNA replication in*E. coli* begins from
   (A) AUG (B) TATAAT (C) *Ori C* (D) AAUAAA

8. Central Dogma of molecular Biology is
   (A) DNA→RNA→Protein (B) DNA→Protein→RNA
   (C) RNA→DNA→Protein (D) None of the Above

9. Which of the following would not occur during complementary base pairing?
   (A) A-T (B) U-G (C) C-G (D) A-U

10. First protein that binds to the *E. coli* origin during initiation of replication is
   (A) Hellicase (B) topoisomerase (C) Dna-A (D) Dna-G

11. Which of the following statement is not TRUE for DNA polymerase III
   (A) Can synthesize DNA from 5' to 3' direction
   (B) It has 3' to 5' exonuclease activity
   (C) It can unwind the double stranded DNA
   (D) It cannot initiate but can add nucleotide at 3'OH ofprimer.

12. How many DNA molecules are present in one normal human somatic cell?

13. Name the enzyme which synthesizes RNA primer during DNA replication.

14. Which protein binds to *Ter* site to terminate *E. coli* DNA replication?

BS- Module-2

Answer all questions (15 x 0.5 = 7.5)

1. The enzyme required for transcription is
a) Restriction enzymes b) DNA polymerase c) RNA polymerase d) RNAase

2. Transcription is the transfer of genetic information from
a) DNA to RNA b) tRNA to mRNA c) DNA to mRNA d) mRNA to tRNA

3. RNA required for the protein synthesis
a) mRNA b) tRNA c) rRNA d) siRNA

4. A promoter site on DNA
a) Initiates transcription b) Regulates termination
c) Codes for RNA d) Transcribes repressor

5. Sigma factor is component of
a) DNA ligase b) DNA polymerase c) RNA polymerase d) endonuclease

6. What is the main function of tRNA in relation to protein synthesis?
a) Inhibits protein synthesis b) Proof reading
c) Identifies amino acids and transport them to ribosomes d) all of these

7. RNA polymerase (Ochoa 1953) has polypeptide chains
a) 2 b) 3 c) 4 d) 5

8. Which site of tRNA molecule hydrogen bonds to a mRNA molecule?
a) Codon b) Anticodon
c) 5'ends of the tRNA molecule d) 3'ends of the tRNA molecule

9. The DNA chain acting as template for RNA synthesis has the following order of bases, AGCTTCGA. What will be the order of bases in mRNA?
a) TCGAAGCT b) UGCUAGCT c) TCGAUCGU d) UCGAAGCU

10. What role does messenger RNA play in the synthesis of proteins?
a) it catalyses the process b) it provides the genetic blueprint for the protein
c) it translates the genetic code to a specific amino acid
d) it modifies messenger RNA molecules prior to protein synthesis

11. On which of the following molecules would you find a codon?
a) messenger RNA b) ribosomal RNA c) transfer RNA d) small nuclear RNA

12. Which one of the following is the initiator codon of the peptide chain?
a) Threonine b) leucine c) cysteine d) methionine

13. The complex of RNA polymerase, DNA template and new RNA transcript is called
a) transcription bubble b) replication bubble
c) a translation bubble d) none of these

14. Rho-dependent termination of transcription in *E. coli*
a) requires ATP b) requires about 50 nucleotides of uncomplexed mRNA
c) both (a) and (b) d) removes mRNA and holoenzyme from the DNA

15. The function of the sigma factor of RNA polymerase is to
a) assure that transcription begins at the proper point b) assure that transcription ends at the proper point
c) assure that translation begins at the proper point d) assure that translation ends at the proper point

Module -3 and Module -4

Answer all the questions **(30 X 0.5) = 15**

1. Length of an alpha-helix along its helical axis with 30 amino acid residues is:

   A) 45 Å B) 300 Å C) 30 Å D) 450 Å

2. Which one is positively charged amino acid:

   A) Arg B) Ala C) Thr D) Trp

3. Human plasma retinol binding protein binds

   A) Ca B) Na^+ C) Vitamin A D) Vitamin C

4. The direction vector of the dipole moment of a peptide unit forming an α-helical is along:

   A) N to C terminus B) C to N terminus

   C) Perpendicular to helical axis D) None of the above

5. In sickle cell anemia which of the following mutation takes place in normal hemoglobin molecule

   A) GLU to VAL B) VAL to GLU

   C) GLU to GLY D) VAL to GLN

6. Protein synthesis is done by

   A) Proteasome B)Ribosome C)Spliceosome D) Nucleosome

7. Alpha helices are formed when a stretch of consecutive residues all having the phi,psi angle pair in the Ramachandran map is approximately:

   A) -60° & -50 ° B) -80° & -60 ° C) -60° & -80 ° D) -30° & -30 °

8. Which of the following amino acid residues have two covalent linkages with the backbone and side chain atoms.

   A) Gly B) Ala C) Pro D) Phe

9. Arrange the following amino acids according to their decreasing size

   A) ALA B) VAL C) ILE D) ARG

10. If a protein contains 450 amino acid residues, how many peptide bonds will be there

11. Write down the quaternary structure of a protein with two polypeptide chains

12. In a helical wheel each residue can be plotted every _____ degree around a spiral path

13. Most commonly observed alpha helices are _____handed

14. What is the quaternary structure of hemoglobin?

15. Define the chemical nature of peptide bond.

16. In a Lock and Key model of enzyme action, the part of the enzyme that recognizes the substrate is known as

(a) Enzyme-substrate complex (b) Product-substrate complex

(c) Active site (d) Inactive site

17. An enzyme exhibiting Michaelis-Menton kinetics has a velocity of '0.2 V_{max}' at a substrate concentration of 2.0 mM. What substrate concentration is required to triple the velocity?

(a) 6 mM (b) 8 mM (c) 10 mM (d) 12 mM

18. In the presence of catalytic enzyme in a particular reaction lowers down the activation barrier by a quarter. Find the ratio of reaction rate for catalyzed to uncatalyzed reaction at room temperature (Given, R=8.314 SI unit)

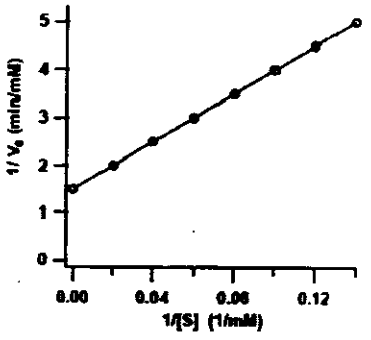
19. An efficient enzyme has

(a) Large K_{cat} and Large K_M (b)Large K_{cat} and Small K_M

(c)Small K_{cat} and Large K_M (d) Small K_{cat} and Small K_M

20. A protein consists of 101 amino acids and each residue can have 3 different conformations. This protein fold into single native state. Find the change in the conformational entropy (at 27 ^{0}C) of this protein

21. Estimate the catalytic efficiency (in M-1 s-1) of an enzyme whose turn over number is 1.5×10^6/s from the Lineweaver-Burk Plot between 1/[V] and 1/[S] (symbols has their usual meaning)



22. Estimate the iso-electric point of an amino acid having pK_1 =1.88, pK_R =3.65, pK_2 =9.6

23. Which one is 'protein misfolding' disease
(a) Alzheimer (b) Tuberculosis (c) Pneumonia (d) Hepatitis

24. Peptide bond is formed between
(a) Purine and Pyrimidine bases

(b) Carbon and Oxygen of different amino acid

(c) Carbon and Oxygen of same amino acid

(d) α-carboxyl group of one amino acid and α-amino group of another amino acid

25. At what temperature the enzymatic reaction velocity is maximal

26. Write any two different experimental techniques by which structure of protein can be study

27. Tryptophan an amino acid absorb light of wavelength (in A^0)

28. Ramachandran Plot tells about
    (a) Structure of Vitamins

    (b) Structure of Carbohydrate

    (c) Conformation of DNA

    (d) Conformation of amino acids

29. Which one is very similar to CPU of a computer which does all calculations in a human body

    (a) Vitamins (b) Proteins (c) DNAs (d) RNA

30. The maximum activity of an enzyme occurs at
    (a) Starting of a reaction
    (b) at low concentration of substrate
    (c) When all enzymes are combined with substrate
    (d) When only 1/e th concentration of enzymes combined with substrate