5 3309

Q.P. Code:

S.Y.B.Sc. Biotechnology Semester III Examination

Model Answers

Biotechnology:- Cell Biology and Cytogenetics

Q 1	**Do as directed (Any fifteen)**	**15**
1.	Give an example protein associated with microtubules. Tubulin	
2.	State true or false:- Taxol is an example of drug targeting microtubules. True	
3.	Give an example of Dynein-driven cargo. endosomes and lysosomes	
4.	State true or false: Tubulin and Fimbrin are the proteins involved in sliding filament theory. False	
5.	State true or false: Cilia and flagella move because of the interactions of a set of microtubules inside. Collectively, called as an "axoneme". True	
6.	An abnormally high level of phosphorylation of one particular MAP called tau has been associated with several fatal neurodegenerative disorders.	
7.	Give one example of an intermediate filament. Keratin/vimentin/ Desmin/GFAP/ Peripherin/ Neurofilament/ nestin	
8.	Name one energy dependent transport process used by microbes for uptake of nutrients- active transport, group translocation	
9.	Fill in the blank: Adherens junctions and desmosomes are formed by transmembrane adhesion proteins that belong to the cadherin family	
10.	Write True/False: Diffusion involving carrier proteins is called passive diffusion- False	
11.	Define: Connexins- four-pass transmembrane proteins, six of which assemble to form a channel called connexon	
12.	Fill in the blank: The cell coat can be stained with PAS/Alcian blue for the light microscope	

13.	Define: Antiport- linked transport in which transported substances move in opposite directions	
14.	Give an example of facultative heterochromatin.- Barr body	
15.	What is a Karyotype? – A complete chromosome complement of the cell.	
16.	How would you calculate interference value if the coefficient of coincidence is 0.46 ? Ans: Interference = 1- coefficient of coincidence = 1- 0.46 = 0.54	
17.	State true or false: Polytene chromosomes are giant chromosomes common to many dipterans. Ans: True	
18.	Which are the group of proteins involved in packing of chromosomes? Ans: Histones	
19.	State true or false: A normal human male individual has one Barr body. Ans: False	
20.	What is paracentric inversion?- Ans: The inversion of the segment of Chromosome which doesn't involve centromere is a paracentric inversion.	
Q.2 A	Explain the role of microtubules in mitosis and locomotion. Microtubules are hollow, relatively rigid, tubular structures, and they occur in nearly every eukaryotic cell. Microtubules are components of a diverse array of structures, including the mitotic spindle of dividing cells and the core of cilia and flagella . Each protofilament is assembled from dimeric building blocks consisting of one alpha tubulin and one beta tubulin subunit. 2M Microtubules play a role in the migration of chromosomes to opposite ends of anaphase. Explaination 3M The crawling locomotion of animal cells results from a coordinated cycle of protrusion Explaination 3M	**08**
Q.2 B	What are intermediate filaments? Explain the assembly of intermediate filaments. Intermediate filaments are strong, flexible ropelike fibers that provide mechanical strength to cells that are subjected to physical stress, including neurons, muscle cells, and the epithelial cells that line the body's cavities. 2M The basic building block of IF assembly is rod like tetramer formed by two dimers that become aligned side by side in a staggered fashion with their N- and C-termini pointing in opposite (antiparallel) directions . Explaination 5M	**07**
	OR	

Q.2 C	Give the overview of the functions of cytoskeleton. Cytoskeleton is a organ system consisting of hardened lements that support the soft tissues of the body and play a key role in mediating bodily movements. 2M 1.A dynamic scaffold providing structural support that can determine the shape of the cell and resist forces. 2. An internal framework responsible for positioning the various organelles within the interior of the cell. 3. A network of tracks that direct the movement of materials and organelles within cells. Examples of this function include the delivery of mRNA molecules to specific parts of a cell, the movement of membranous carriers from the endoplasmic reticulum to the Golgi complex, and the transport of vesicles containing neurotransmitters down the length of a nerve cell. 4. The force generating apparatus that moves cells from one place to another. 5. An essential component of the cell's division machinery. Cytoskeletal elements make up the apparatus responsible for separating the chromosomes during mitosis and meiosis and for splitting the parent cell into two daughter cells during cytokinesis. Function 6M	**08**
Q.2 D	Give the structure and function of myosin. Myosin act as motors to operate in conjunction with actin filaments. Myosins contains a characteristic motor (head) domain. The head contains a site that binds an actin filament and a site that binds and hydrolyzes ATP to drive the myosin motor. Myosins also contain a variety of low molecular-weight (light) chains. Myosins are generally divided into two broad groups: the conventional (or type II) myosins, which were first identified in muscle tissue, and the unconventional myosins. The unconventional myosins are subdivided on the basis of amino acid sequence into at least 17 different classes. Type II myosins are required for splitting a cell in two during cell division, generating tension at focal adhesions, cell migration, and the turning behavior of growth cones . Function 2M Structure 5M	**07**
Q.3 A	Describe in detail the working of Na^+-K^+ pump Operates as antiporter – 1 mark, example of P-type pump – 1 mark, Mechanism with diagram – 6 marks	**08**
Q.3 B	Explain group translocation in bacterial cells using a suitable example Group translocation definition – 1 mark, example of group translocation system in bacteria – 1 mark, explanation of mechanism of group translocation using PTS – 4 marks, examples of bacteria in which PTS system is present – 1 mark	**07**
	OR	

<table>
<tr><td>Q.3 C</td><td>Give an account of structural organisation and functions of gap junctions
Structure of gap junctions (along with connexins, connexon) – 4 marks
Any four functions – 4 marks</td><td>08</td></tr>
<tr><td>Q.3 D</td><td>Elaborate on the significance and types of ionophores with the help of suitable examples
Ionophores definition – 1 mark, Significance – 1 mark, name of two-types – 1 mark, explanation of 1 example of mobile ion carrier – 2 marks, explanation of 1 example of channel forming ionophore – 2 marks</td><td>07</td></tr>
<tr><td></td><td></td><td></td></tr>
<tr><td>Q.4 A</td><td>Diagrammatically explain chromosomal deletions and duplications.
Deletions- causes types terminal and interstitial effects with diagrams- 4 Marks
Duplications- causes types effects with diagrams - 4 marks</td><td>08</td></tr>
<tr><td>Q.4 B</td><td>Explain with an example XX-XY mechanism of sex determination.
XX- XY – examples – humans Drosophila 1 mark
Concept of heterogametic males and homogametic females- 2 marks
Cross- 4 marks</td><td>07</td></tr>
<tr><td></td><td>OR</td><td></td></tr>
<tr><td>Q.4 C</td><td>Solve:- A researcher working on a Neurospora crassa strain found that the mutant strain required histidine and tryptophan (his and trp) for growth. He mated this strain to a wild type of strain (his+ and trp+). He scored the obtained products as follows.
<table>
<tr><td></td><td>I</td><td>II</td><td>III</td><td>IV</td></tr>
<tr><td>Spore pair 1</td><td>his+ trp+</td><td>his trp</td><td>his+ trp+</td><td>his+ trp+</td></tr>
<tr><td>Spore pair 2</td><td>his+ trp+</td><td>his+ trp+</td><td>his+ trp</td><td>his trp+</td></tr>
<tr><td>Spore pair 3</td><td>his trp</td><td>his+ trp+</td><td>his trp</td><td>his+ trp</td></tr>
<tr><td>Spore pair 4</td><td>his trp</td><td>his trp</td><td>his trp+</td><td>his trp</td></tr>
<tr><td>Total</td><td>25</td><td>08</td><td>06</td><td>14</td></tr>
<tr><td></td><td>PD</td><td>PD</td><td>TT</td><td>TT</td></tr>
<tr><td></td><td>V</td><td>VI</td><td>VII</td><td>VIII</td></tr>
<tr><td>Spore pair 1</td><td>his+ trp+</td><td>his+ trp+</td><td>his+ trp+</td><td>his+ trp</td></tr>
<tr><td>Spore pair 2</td><td>his trp</td><td>his trp</td><td>his+ trp+</td><td>his+ trp</td></tr>
<tr><td>Spore pair 3</td><td>his+ trp</td><td>his+ trp</td><td>his trp</td><td>his trp+</td></tr>
<tr><td>Spore pair 4</td><td>his trp+</td><td>his trp+</td><td>his trp</td><td>his trp+</td></tr>
<tr><td>Total</td><td>14</td><td>16</td><td>15</td><td>02</td></tr>
<tr><td></td><td>TT</td><td>TT</td><td>PD</td><td>NPD</td></tr>
</table>
a. Compute the distance between the centromere and two genes.
Centromere and his = %of second division segregation Asci/2 (1 mark formula (= 08+14+14+16/2 =52/2 = 26 mu
Centromere and trp = 8+6+14+16/2 = 44/2 = 22 mu (4 Marks)
b. Identify the PD, NPD and TT tetrads. (tetrads 1,2 and 7 PD and ,8 NPD and 3,4,5,6 are TT) (3 Marks)</td><td>08</td></tr>
</table>

Q.4 D	Discuss the cytogenetics and any four characteristics of Turner and Klinefelter syndrome. Turners Syndrome- cytogenetics 45 = 44 A + X – 1 mark Deletion of one X chromosome 1 mark Characteristics – any 2 - 2 marks Klinefelter syndrome. cytogenetics 47 = 44 A + XXY – 1 mark Characteristics – any 2 - 2 marks	**07**
Q.5	Write Short notes on **any three** of the following	**15**
a.	Treadmilling of microfilaments Actin assembly/disassembly depend on the concentration of actin monomers. As long as the concentration of ATP-actin monomers remains high, subunits will continue to be added at both ends of the filament. As the monomers are consumed by addition to the ends of the filaments, the concentration of free ATP-actin continues to drop until a point is reached where net addition of monomers continues at the plus end, which has a higher affinity for ATP-actin, but stops at the minus end, which has a lower affinity for ATP-actin. As filament elongation continues, the free monomer concentration drops further. At this point, monomers continue to be added to the plus ends of the filaments, but a net loss of subunits occurs at their minus end. As the free monomer concentration falls, a point is reached where the two reactions at opposite ends of the filaments are balanced so that both the lengths of the filaments and the concentration of free monomers remain constant. Because subunits are being added to the plus ends and removed from the minus ends of each filament at steady state, the relative position of individual subunits within each filament is continually moving a process known as tread milling. Defination -2M,Explaination -3M.	
b.	Facilitated diffusion in prokaryotes Definition – 1 mark, Mechanism – 3 marks, Example – 1 mark	
c.	Adherens junctions Definition – 1 mark, Structure/Mechanism – 4 marks	
d.	Downs Syndrome. Cytogenetics= 47 = 45 A + XX or 47= 45A + XX 1 Mark Characteristics any 4 = 4 marks	
e.	Pedigree analysis- Sign, symbols and importance. Pedigree analysis – explanation- 1 Mark Signs and symbols- 2 Marks 2 points of importance- 2 marks	