

Name :

Roll No. :

Invigilator's Signature :

CS/M.Tech(MBT/PHMB/PHMC)/SEM-2/MBT/PHMB/PHMC-204/2011

2011

GENETICS AND CELL BIOLOGY

Time Allotted : 3 Hours

Full Marks : 70

The figures in the margin indicate full marks.

*Candidates are required to give their answers in their own words
as far as practicable.*

GROUP – A

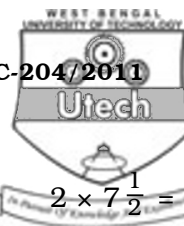
(GENETICS)

Total Marks (5 + 15 + 15) = 35

Question No. 1 is compulsory.

1. Answer any *five* of the following : 5 × 1 = 5

- i) What is EST ?
- ii) What is holandric inheritance ?
- iii) What is the function of antisense mRNA ?
- iv) What is coefficient of coincidence ?
- v) What is liposome ?
- vi) What is FISH ?

**Module – I**

Answer any *two* of the following : $2 \times 7 \frac{1}{2} = 15$

2. Define genetic counselling. What are the steps involved in genetic counselling ? Why is consanguineous marriage considered to be harmful ? $1 + 3 + 3 \frac{1}{2}$
3. What is the difference between *in vivo* and *ex vivo* gene therapy ? Explain the process of ADA (Adenosine deaminase deficiency) gene therapy. $2 + 5 \frac{1}{2}$
4. Explain with pedigree chart the inheritance pattern in autosomal recessive, X-linked recessive and X-linked dominant characters with suitable examples. $2 \frac{1}{2} + 2 \frac{1}{2} + 2 \frac{1}{2}$

Module – II

Answer any *two* of the following : $2 \times 7 \frac{1}{2} = 15$

5. a) State Hardy-Weinberg principle.
- b) The following data for the M-N blood types were obtained from two blocks of Salt lake city :

Group	Sample Size	M	MN	N
BF Block	86	53	29	4
FD Block	278	78	61	139

Calculate the frequency of the L^M and L^N alleles for the two groups. $2 \frac{1}{2} + 5$

6. What is HAT medium ? How is the process of somatic cell hybridization used in the localization of genes on the chromosome ? Explain with a suitable experiment. $2 + 5 \frac{1}{2}$
7. What are the genes involved in sex determination in mammals ? Explain the role of major genes in testis determination. $3 + 4 \frac{1}{2}$



GROUP – B
(CELL BIOLOGY)

Total Marks (10 + 15 + 10) = 35

Module – I

Answer any *ten* of the following : 10 × 1 = 10

8. What are the relative volumes occupied by cytosol and mitochondria in hepatocytes ?
9. Draw a sketch to explain how mitochondria was originated in early aerobic eukaryotic cells.
10. Name four kinds of cell junctions occur in vertebrates.
11. Fill in the bank :

The membranes contact each other through openings in the cell wall called

12. What is the basic difference between integrins and cadherins ?
13. Name the enzyme which catalyzes the oxidation of free sulfhydryl (SH) groups on cysteines to form disulphide (S – S) bonds in Endoplasmic Reticulum (ER).



14. Which coats are utilized in vesicular traffic ?

15. Fill in the blank :

Microtubules are straight, hollow cylinders whose wall is made up of a ring of protofilaments.

16. Draw a diagram to explain how G-protein-linked receptors work for a signal molecule to activate an enzyme.

17. Fill in the blank :

Mis-regulation of the Wnt signalling pathway leads to vascular defects in the eye which is one of the human genetic diseases called osteoporesis syndrome.

18. Fill in the blank :

When a cell is in any phase of the cell cycle other than mitosis, it is often said to be in

19. What is the ultimate in vitro experiment to prove cent per cent efficiency of a proposed antimicrobial agent ?

20. What is the signal sequence to import protein into peroxisomes ?



21. "Cytokinesis is a process which is different in animal and plant cells." Explain.

22. Fill in the blanks :

For plasma membranes integral membrane proteins may be solubilized using but solution is needed to solubilize peripheral proteins.

Module – II

Answer any *three* of the following : 3 × 5 = 15

23. Draw the major intracellular compartments of an animal cell considering their tentative positions. Draw the steps to explain how selected contents from a donor compartment reach to the target compartment through vesicular transport.

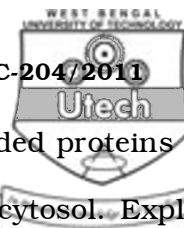
2 + 3

24. What are Desmosomes ? Why does "Pemphigus" which is an autoimmune disease, develop ? Name two types of Microtubule Motor proteins. Where does Microtubules originate in animal cells ?

1 + 2 + 1 + 1

25. Name protein translocators in outer and inner membranes of Mitochondria. Draw a diagram to explain how protein glycosylation takes place in the Rough ER.

2 + 3



26. Explain diagrammatically how improperly folded proteins are exported from the ER and degraded in the cytosol. Explain how attachment of a GPI anchor to a protein in the ER takes place. 3 + 2

27. Why should a cell commit suicide ? Write a short note on Caspases. 2 + 3

Module – III

Answer any *one* of the following : 1 × 10 = 10

28. What kind of energy is used in Active Transport ? Define ABC Transporters. How does $\text{Na}^+ - \text{K}^+$ ATPase work ? Name different types of ion channel present in a plasma membrane and draw a diagram to show their roles in membrane transport. 2 + 1 + 3 + 2 + 2
29. Define Prophase, Metaphase, Anaphase and Telophase. Which are the key players to control Cell cycle in an animal cell. What is Endoreplication ? What is the impact of p53 protein towards Cell cycle ? Name a genetically engineered adenovirus which can only replicate in human cells lacking p53. 4 + 2 + 1 + 2 + 1



30. What is low density lipoprotein particle (LDL) ? Provide a diagrammatic explanation to describe possible fates for endocytosed transmembrane receptor proteins. Describe how Cyclic AMP and Inositol triphosphate mediate cell signalling as second messengers.

2 + 3 + 5

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