*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 marrige 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 defficiency ) 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 exmaples. $2\frac{1}{2} + 2\frac{1}{2} + 2\frac{1}{2}$

## 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 $Na^+$ - $K^+$ 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