

**Test Code: RHGI (Short answer type) & RHGII 2005**  
**Junior Research Fellowship in Human Genetics**

**Syllabus**

1. Cell growth, Division, Differentiation
2. Replication, Transcription, Translation, Genetic code & protein synthesis, Enzymes, Co-enzymes, Receptor mediated cell functions, regulation of gene expression
3. Cancer genetics, Etiological factors for different types of cancers
4. Population genetics, genetics of single and multi loci diseases
5. Modern methodologies in cell/tissue culture, Chromosome techniques, PCR ELISA, Immunocyto/histochemical techniques, Hybridization techniques
6. Gene therapy and gene modification (anti-sense RNA, RNAi, transgenic and knockout mouse, tissue specific knock-out of gene
7. Cancer biology, Abnormal cell growth, Oncogenes & Tumour suppressor genes, Programmed cell death, Cell signaling, Immunomodifiers
8. Basic Statistics: Mean, Median, Mode, Standard deviation, Correlation and Regression, Simple probability calculations

**Sample Questions: Short Answer Type (RHGI)**

1. The standard deviation of heights of 10 persons measured in cms is 12 cms. If the heights were measured in mms (instead of cms) then what would the standard deviation has been?
2. The average molecular weight of the 20 standard amino acids is 128. What is the molecular weight of a protein composed of 100 of these amino acids?

3. How many copies of a specific gene sequence can be obtained after 10 and 30 cycles of PCR amplification from a haploid and a diploid cell, respectively?
4. Digestion of human chromosomal DNA and plasmid DNA by KpnI gives rise to a smear and discrete bands, respectively, in an agarose gel. Explain why?
5. Calculate the ratio of the concentrations of acetate and acetic acid required in a buffer system of pH 5.3 ( $pK_a=4.76$ ).
6. What is the probability that three children in a family will be males?

**Sample Questions: Descriptive type (RHGII)**

1. Describe precisely the principles involved in Southern, Northern and Western blotting techniques. How do the in situ hybridization methods differ from these?
2. Write short notes on-
  - a) Telomerase activation and cancer
  - b) Chromatin structure
  - c) Signal transduction
3. Transgenic and knockout mice are both used as animal models of human diseases. Explain these models and state, which is better.
4. Discuss how programmed cell death/apoptosis participates in maintaining cellular homeostasis. Explain why DNA from apoptotic cells show up as 200bp ladder in agarose gels.
5. Explain Lambert-Beers Law. Why does the absorbance of equimolar amounts of tryptophan and tyrosine differ, at 280 nm? Explain why mutation of a protein can lead to change in absorbance at 280nm?
6. If the blood groups of father and mother are 'A' and 'B', what could be their genotypes? What could be the blood groups of their children?