POSTGRADUATE INSTITUTE OF MEDICINE
UNIVERSITY OF COLOMBO

POSTGRADUATE DIPLOMA IN MOLECULAR MEDICINE
E3 EXAMINATION – JANUARY 2015

Date :- 27th January 2015 **Time :-** 9.00 a.m. – 12.00 noon

SEQ PAPER – MODULE V
(Laboratory Management, Molecular Diagnosis and Therapeutics)

Answer **all six (06)** questions.
Answer each question in a **separate** answer book.

1.

1.1. Briefly explain why nucleic acid based assays are especially important in the detection of extra pulmonary tuberculosis infections. (25 marks)

1.2. Explain the advantage of detecting the serotype of the Dengue virus in patients positive for dengue viral infection. (25 marks)

1.3. Outline the measures you would adopt to prevent false negative PCR results that could arise from PCR inhibition in the detection of *M. tuberculosis*. (25 marks)

1.4. Explain briefly giving reasons the draw backs of the allele specific multiplex PCR technique in detecting JAK2 mutation in routine diagnostic testing. (25 marks)

2.

2.1. Briefly state how codon bias affects expression of heterologous proteins in *E. coli.* (30 marks)

2.2.

2.2.1. List the different protein expression systems. (10 marks)

2.2.2. State the advantages and disadvantages of three (03) such systems in heterologous protein expression (60 marks)

Contd..../2-

3.

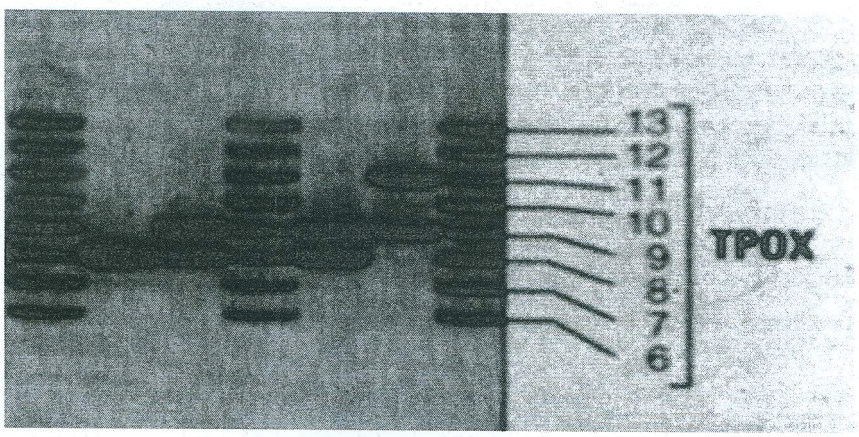
3.1. Briefly outline the applications of molecular based testing in the diagnosis and therapeutic management of patients infected with hepatitis C virus (HCV) (40 marks)

3.2. A gel picture obtained after PCR amplification of the short tandem repeat (STR) locus "TPOX" is shown here.

3.2.1. State the genotypes of the mother, father and the baby for this locus. (15 marks)

3.2.2. Giving reasons, state whether the paternity data is in agreement for this locus. (15 marks)

L C F L B M L



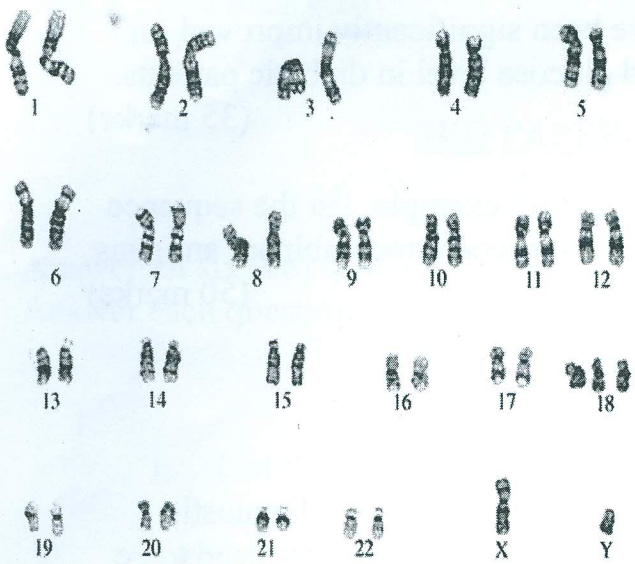
L- Ladder (molecular marker)
C- Control DNA
F – Father's profile
B – Baby's profile
M- Mother's profile

3.3. Explain briefly, how PCR will help to establish the diagnosis of human immuno-deficiency virus (HIV) infection in young infants born to HIV-infected mothers. (30 marks)

Contd..../3-

4.

4.1. A child is suspected of having Down syndrome. A specialist doctor who is looking after him requests a karyotype and the following results were obtained.



4.1.1. State the karyotype finding in the above result. (10 marks)

4.1.2. State the expected karyotype in Down syndrome (10 marks)

4.1.3. List four (04) possible reasons for the findings of the karyotype being different from the condition that was expected (20 marks)

4.1.4. List two (02) actions that the laboratory should take prior to issuing its report. (10 marks)

4.2. Discuss the following (25 marks each)

4.2.1. Vectors used in gene therapy

4.2.2. Limitations of gene therapy

Contd..../4-

5.

5.1.

5.1.1. List three (03) recombinant growth factors and their uses in human therapy. (15 marks)

5.1.2. State the different analogues of recombinant insulin available and indicate how they have been significantly improved for long-term control of blood glucose level in diabetic patients. (35 marks)

5.2. Taking either dengue or chikungunya as an example, list the sequence of activities that need to be performed to prepare recombinant antigens for ELISA testing. (50 marks)

6.

6.1. Your institute is planning to set up a molecular biology diagnostic laboratory. Describe the basic structural requirements that need to be conveyed to the engineering department. (40 marks)

6.2. Compare and contrast biosafety level class two and class three safety cabinets with regard to structural features relevant to safety.(30 marks)

6.3. Describe in a stepwise manner the actions that would be taken in the event of a spill of a sample of blood on a tiled floor. (30 marks)

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E3 EXAMINATION – JANUARY 2015

Date :- 28th January 2015 **Time :-** 9.00 a.m. – 12.00 noon

SEQ PAPER – MODULE VI
(Special Topics)

Answer **all six (06)** questions.
Answer each question in a **separate** answer book.

1.

1.1. List three advantages and three disadvantages of a cohort study. (30 marks)

1.2. The following table presents results of a statistical comparison of the FEV1 (forced expiratory volume during the first second) of two groups of children with and without respiratory symptoms.

Respiratory symptoms	Number of study units	FEV1 (Litres)		
		Mean	Standard deviation	Standard error of mean
Present	145	1.4792	0.33247	0.02761
Absent	491	1.6288	0.28727	0.01296

($t = -5.308$, $df = 634$, $p < 0.001$)

1.2.1. Name the statistical test used in the above calculation. (10 marks)

1.2.2. What is the p value? (10 marks)

1.2.3. Interpret the above findings. (30 marks)

1.2.4. What are the criteria for selecting an appropriate statistical test in finding differences between groups? (20 marks)

Contd..../2-

2.

2.1. Discuss the ethical issues which arise in the following situations.

2.1.1. The laboratory you work at has a collection of tissue biopsies from patients with breast cancer. The samples have been collected for basic histopathological studies. You decide to analyse the request forms and the results to present the findings at a national research forum. (25 marks)

2.1.2. You decide to expand your study by establishing a collaboration with a foreign colleague. The tissue samples will be used for analysis of genetic tumour markers during this study. (25 marks)

2.2.

2.2.1. What is homology modeling? (05 marks)

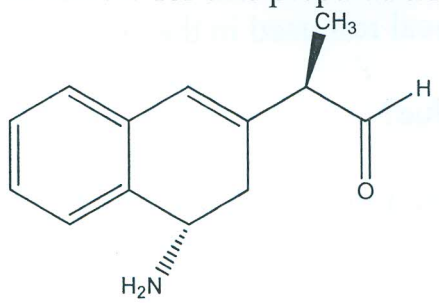
2.2.2. List four (04) applications of homology modeling in protein research. (05 marks)

2.2.3. List the assumptions made in homology modeling of proteins. (15 marks)

2.3.

2.3.1. The *rigid docking model* is one of the three models predominately used in molecular docking. State the other two docking models. (10 marks)

2.3.2. The following molecule has to be prepared by using HyperChem software for Computer Aided Drug Design (CADD). List the steps one has to follow for this preparation. (15 marks)



Contd..../3-

3.

3.1. Briefly explain the following:

3.1.1. Gap penalty in sequence alignment. (20 marks)

3.1.2. Character based methods in phylogenetic analysis. (20 marks)

3.2. Briefly discuss three (03) of the following giving examples where ever possible (20 marks each)

3.2.1. OMIM database and relevance to man

3.2.2. BLAST family of tools

3.2.3. Sequence retrieval from a database

3.2.4. Primary nucleic acid sequence databases

3.2.5. Gene annotation

4.

4.1. Briefly outline the requirements that need to be fulfilled to obtain Intellectual Property Protection. (35 marks)

4.2. What is meant by commercialization of research? (30 marks)

4.3. If you want to start a Biotechnology company in Sri Lanka, outline three (03) problems that you may face and how you would overcome them. (35 marks)

Contd...../4-

5.

5.1. What do you understand as a transgenic/genetically modified GM crop plant? (15 marks)

5.2. What are the environmental biosafety issues associated with cultivation of transgenic /genetically modified (GM) crop plants? (35 marks)

5.3. Briefly explain the possible economic impacts of growing insect resistant corn? (35 marks)

5.4. What do you understand as "food safety" issues of food derived from genetically modified crops? (15 marks)

6.

6.1. Propose two methods to preserve DNA evidence. (20 marks)

6.2. Outline the scientific basis of applying the two methods stated above to preserve biological DNA evidence. (40 marks)

6.3.

6.3.1. List three (03) applications of forensic DNA typing in Sri Lanka. (15 marks)

6.3.2. Outline giving examples for each of the applications given in your answer in 6.3.1. (25 marks)