IIHMR DELHI | INTERNATIONAL INSTITUTE OF HEALTH MANAGEMENT RESEARCH

Post Graduate Diploma in Management (Hospital & Health Management)

PGDM – 2024-2026 Batch

2nd Year – 4th Semester End Examination

Subject & Code	:	**Bioinformatics and Precision Medicine for Healthcare (BPMH)-HIT 720**	**Reg. No.:**
Semester & Batch	:	**IV, 2024-2026**	**Date : 07-03-2026**
Time & Duration	:	**10:30 A.M.-01:30 P.M. (3 Hrs.)**	**Max. Marks : 70**

Instructions:

- Budget your time as per the marks given for each question and write your answer accordingly.
- Don't write anything on the Question Paper except writing your Registration No.
- Mobile Phones are not allowed even for computations.

Part A: Q.1 to Q.10 all questions are compulsory (10 X 2 Marks = 20 Marks)
One liner, MCQs, True/False

1. Which of the following best defines Bioinformatics?
A. Use of robots in surgery
B. Application of computational tools to analyze biological data
C. Digital storage of hospital billing data
D. Manual gene sequencing in laboratories

2. Precision medicine primarily aims to:
A. Provide identical treatment to all patients
B. Reduce hospital paperwork
C. Tailor treatment based on individual variability
D. Replace clinicians with AI

3. In the precision medicine ecosystem, which stakeholder primarily regulates ethical use of genomic data?
A. Pharmaceutical sales representatives
B. Regulatory authorities and ethics committees
C. Hospital receptionists
D. Medical equipment vendors

4. A clinician wants to retrieve articles from PubMed that focus specifically on *"BRCA1 mutation in breast cancer published between 2020 and 2023, limited to review articles."*
Which of the following search strategies would MOST effectively retrieve the relevant articles?
A. BRCA1 breast cancer
B. BRCA1 AND breast cancer NOT 2020
C. "BRCA1 mutation" AND "breast cancer" AND ("2020"[Date - Publication] : "2023"[Date - Publication]) AND (Review[Publication Type])
D. BRCA1 OR breast cancer 2023

Contd…2..

5. Which database primarily stores nucleotide (DNA/RNA) sequences?
A. UniProt
B. PDB
C. GenBank
D. Swiss-Prot

6. Why is the Protein Data Bank (PDB) important in drug discovery?
A. It provides hospital admission statistics
B. It contains 3D protein structures useful for molecular docking
C. It stores insurance claims
D. It provides patient lifestyle data

7. A clinician wants to analyze the amino acid sequence and functional domains of a protein linked to breast cancer. Which database would be most appropriate?
A. UniProt
B. GenBank
C. ClinicalTrials.gov
D. EMBL Imaging

8. What is the primary function of Next-Generation Sequencing (NGS)?
A. Align protein sequences
B. Generate high-throughput genomic data
C. Construct phylogenetic trees
D. Store hospital billing records

9. How does phylogeny contribute to public health surveillance?
A. By sequencing DNA faster
B. By tracing the spread and evolution of infectious diseases
C. By replacing vaccination programs
D. By reducing hospital admissions

10. A hospital uses NGS data, identifies mutations using BLAST, and then builds a phylogenetic tree. What is the most comprehensive benefit of integrating these three approaches?
A. Faster hospital discharge
B. Reduction in paper-based records
C. Precise diagnosis combined with outbreak tracking and strategic intervention
D. Elimination of laboratory technicians

Part B: Q.11 to Q.15 attempt any four questions (4 X 5 Marks = 20 Marks) - Short Notes

11. A tertiary hospital integrates Next-Generation Sequencing (NGS), BLAST/Multiple Sequence Alignment, and Phylogenetic analysis into its infectious disease management system. Analyze how the integration of these three technologies collectively enhances clinical decision-making and outbreak control compared to using NGS alone. Differentiate the functional role of each component and explain how they complement one another in a precision medicine framework.

Contd…3..

12. A 52-year-old patient with breast cancer undergoes genomic testing that reveals a BRCA mutation. The hospital uses a Clinical Decision Support System (CDSS) integrated with the Electronic Health Record (EHR) to recommend targeted therapy. The patient is also monitored remotely using a wearable device that tracks heart rate and physical activity during chemotherapy.

    Apply your understanding of genomic technologies, digital health tools, and CDSS to explain how these systems collectively support personalized treatment and ongoing patient monitoring in this case.

13. A pediatric patient is diagnosed with a rare inherited genetic disorder. The clinical team proposes using CRISPR-based gene editing as a potential therapeutic intervention. The hospital's AI-powered predictive model suggests a high probability of treatment success. However, long-term safety data is limited, and concerns are raised about ethical implications and data privacy.
    Evaluate the clinical potential and ethical implications of implementing CRISPR-based therapy in this case. In your answer, consider patient safety, long-term risks, data governance, and the responsibilities of healthcare providers.

14. A 500-bed tertiary hospital plans to launch a Precision Medicine Program integrating genomic testing, AI-based analytics, and Clinical Decision Support Systems (CDSS). However, an internal review reveals:

    - Limited genomic literacy among clinicians
    - Inadequate IT infrastructure for storing large-scale molecular data
    - Resistance from senior physicians who prefer traditional treatment protocols
    - Uncertainty about long-term financial sustainability

The hospital board has requested a structured implementation roadmap. Differentiate between clinical, technical, and cultural readiness gaps.

15. A multi-specialty tertiary hospital plans to transition from traditional protocol-based treatment to a fully integrated Precision Medicine Program incorporating genomic testing, AI-driven analytics, interoperable Electronic Health Records (EHRs), and Clinical Decision Support Systems (CDSS).
    The hospital currently faces:

    - Limited clinician training in genomics
    - Fragmented IT systems with poor interoperability
    - Budget constraints and unclear return on investment
    - Concerns about long-term sustainability

The hospital board has asked you, as a healthcare strategy consultant, to propose a structured transformation plan. Develop a phased implementation strategy (short-, medium-, and long-term).

Contd…4..

Part C: Q.16 to Q.19 attempt any three questions (3 X 10 Marks = 30 Marks) - Long Notes

16. A tertiary cancer center is implementing genomic tumour profiling to guide targeted therapy. Pharmacogenomic testing is also being used to adjust chemotherapy dosing. However, concerns have been raised regarding cost, unequal access, and uncertain long-term benefit in low-resource settings. Evaluate the clinical, economic, and ethical implications of integrating precision oncology and pharmacogenomics into routine cancer care. Include the following in your answer

    - Clinical benefit vs. traditional treatment approaches
    - Cost-effectiveness and access disparities
    - Ethical issues related to genetic data privacy and equity

17. A national health authority plans to launch a Family Health Risk Screening Program integrating genomic testing, AI-based risk prediction, and preventive interventions for cardiovascular and metabolic diseases. Design a precision public health framework for implementing a nationwide family risk screening program including i) Integration of predictive analytics and preventive strategies; ii) Data governance, consent, and privacy safeguards

18. A Paediatric hospital introduces genomic sequencing for early diagnosis of rare genetic disorders. While diagnostic accuracy improves, incidental findings and uncertain variants create ethical dilemmas for families. Critically evaluate the clinical utility and ethical challenges of using genomic sequencing for rare disease diagnosis in pediatric care. Also discuss the benefits of early molecular diagnosis and long-term psychosocial implications.

19. During a viral outbreak, a hospital integrates pathogen genomic sequencing, AI-based predictive modelling, and personalized cardiac risk monitoring for high-risk patients. Develop an integrated precision care model combining infectious disease genomics and precision cardiology for managing high-risk patients during an outbreak. The model should i) outline diagnostic and monitoring workflows; ii) integrate AI and wearable technologies; iii) include real-time decision support.