Roll No. _____

International Institute of Health Management Research (IIHMR), New Delhi

PGDM (HOSPITAL AND HEALTH MANAGEMENT)

(2024-2026 PGDM Batch)

SUPPLEMENTARY EXAM (4th Semester)

HIT 720-Bioinformatics and Precision Medicine for Healthcare (BPMH)

Date: 22-06-2026 Timing & Duration: 10:30 A.M. – 01:30 P.M. (3 Hrs.) Max. Marks: 100

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 (10 questions x 2 Marks = 20 Marks) – One liner, MCQs, True/False

1. Which of the following best describes the role of bioinformatics in precision medicine?
A. Replacing laboratory testing with manual diagnosis
B. Analyzing biological data to support individualized healthcare decisions
C. Managing hospital finances and billing systems
D. Conducting surgical procedures using robots

2. A researcher is studying genetic variations associated with adverse drug reactions in cancer patients. Which precision medicine approach would be most appropriate?
A. Prescribing the same drug dosage to all patients
B. Using pharmacogenomic information to guide treatment selection
C. Relying solely on patient age for treatment decisions
D. Eliminating genetic testing from clinical practice

3. A scientist wants to compare an unknown DNA sequence against millions of known sequences to identify potential matches. Which bioinformatics tool would be most suitable?
A. PubMed
B. BLAST
C. PDB
D. HIS

4. A clinician is investigating whether a newly identified gene variant has been previously associated with cardiovascular disease. Which combination of resources would provide the most comprehensive information?
A. Hospital billing records and pharmacy inventory databases
B. PubMed literature and genomic databases such as GenBank
C. Social media platforms and hospital websites
D. Insurance claim databases only

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5. Which scenario best illustrates the application of precision medicine?
A. Administering the same chemotherapy regimen to all cancer patients
B. Selecting treatment based on an individual's genetic profile and clinical characteristics
C. Replacing physicians with automated software systems
D. Eliminating laboratory testing from diagnosis

6. A public health agency sequences viral samples collected from different regions and constructs phylogenetic trees. What is the primary purpose of this analysis?
A. Determining hospital bed occupancy rates
B. Tracking pathogen evolution and transmission patterns
C. Reducing healthcare costs through automation
D. Managing electronic health records

7. A researcher identifies a mutation through NGS and wants to determine whether the resulting protein structure may affect drug binding. Which database would be most useful?
A. PubMed
B. GenBank
C. Protein Data Bank (PDB)
D. MedlinePlus

8. Which statement best explains the relationship between genomics and precision medicine?
A. Genomics eliminates the need for clinical assessment.
B. Genomics provides molecular information that can guide individualized prevention, diagnosis, and treatment strategies.
C. Genomics focuses only on infectious diseases.
D. Precision medicine can be implemented without biological data.

9. A healthcare organization plans to establish a precision medicine program. Which factor would be most critical for ensuring responsible use of patient genomic information?
A. Faster internet connectivity alone
B. Strong data governance, privacy protection, and ethical oversight
C. Larger hospital parking facilities
D. Increased advertising expenditure

10. A research team integrates NGS data, BLAST analysis, protein structure information from PDB, and clinical records. What is the greatest advantage of this integrated approach?
A. Reducing the need for healthcare professionals
B. Eliminating all diagnostic uncertainty
C. Generating comprehensive insights that support disease understanding, diagnosis, and personalized treatment planning
D. Replacing public health surveillance programs

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

11. A cancer center plans to incorporate genomic, transcriptomic, and proteomic data into its clinical workflow. However, clinicians report difficulty interpreting large volumes of molecular information, and patients often receive conflicting recommendations from different specialists. Analyze how a multi-omics approach can improve personalized cancer treatment. Differentiate the role of each omics layer and explain how Clinical Decision Support Systems (CDSS) can assist clinicians in translating molecular data into treatment decisions

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12. A children's hospital has implemented an AI platform that analyzes Electronic Health Records (EHRs), genomic sequencing results, and imaging data to identify rare genetic disorders. The system successfully reduces diagnostic delays but occasionally generates false-positive recommendations. Evaluate the benefits and limitations of using AI-assisted diagnostic systems for rare disease detection. In your answer, discuss clinical accuracy, explainability, patient safety, and the role of healthcare professionals in validating AI recommendations.

13. 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.

14. Patients undergoing chemotherapy are provided with wearable devices that continuously monitor physiological parameters such as heart rate, activity levels, sleep quality, and temperature. Analyze how wearable-generated data can contribute to precision medicine. Explain how these data can be integrated with EHRs and CDSS platforms to support proactive clinical interventions.

15. A healthcare organization seeks to become a leader in precision medicine by integrating genomic testing, AI analytics, telehealth, EHRs, and connected healthcare technologies. Develop a strategic transformation roadmap for the organization. Your plan should address governance structures, workforce development, infrastructure requirements, stakeholder engagement, and outcome evaluation.

Part-C: Q.16 to Q.20 (4 questions x 15 Marks = 60 Marks) Attempt any four – Long Notes

16. A tertiary hospital plans to deploy an AI-powered pharmacogenomic platform that automatically recommends drug selection and dosing based on patient genomic profiles. Critically evaluate the opportunities and risks associated with AI-driven pharmacogenomics. 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.
    Include the following in your answer:
    i) Potential improvements in medication safety and effectiveness
    ii) Risks related to algorithmic bias and explainability
    iii) Governance mechanisms required for responsible implementatio

17. 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.

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18. A healthcare organization proposes a precision mental health program integrating genomic markers, digital phenotyping, wearable sensors, and AI-assisted risk assessment for depression and anxiety disorders. Evaluate the opportunities and challenges of implementing precision mental healthcare. Include the following in your answer:
    i) Clinical applications of genomics and digital biomarkers
    ii) Ethical concerns regarding privacy and patient autonomy
    iii) Strategies for ensuring responsible and equitable deployment

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.

20. A healthcare network stores genomic data from thousands of patients in a centralized cloud-based platform. Researchers seek access to these datasets for secondary analysis and AI model development. Critically, evaluate the ethical and governance issues associated with large-scale genomic data sharing. Discuss informed consent, privacy protection, data ownership, cybersecurity, and regulatory oversight