

R4552

Sub. Code

25MBM2C1

M.Sc. DEGREE EXAMINATION, APRIL – 2026

Second Semester

Biomedical Science

MEDICAL AND APPLIED GENETICS

(CBCS – 2025 onwards)

Time : 3 Hours

Maximum : 75 Marks

Part A

(10 × 1 = 10)

Answer **all** the following objective type questions by choosing the correct option.

1. Which chromosome banding technique is most useful for identifying AT-rich regions of chromosomes? (CO1, K2)
 - (a) Q-banding
 - (b) G-banding
 - (c) R-banding
 - (d) C-banding
2. The Philadelphia chromosome $t(9;22)$ is an example of (CO2, K2)
 - (a) Robertsonian translocation
 - (b) Reciprocal translocation
 - (c) Pericentric inversion
 - (d) Isochromosome duplication
3. Comparative Genomic Hybridization (CGH) is especially useful in clinical genetics for: (CO2, K4)
 - (a) Detecting balanced chromosomal rearrangements
 - (b) Identifying genome-wide copy number changes
 - (c) Sequencing individual genes
 - (d) Analyzing epigenetic modifications

4. Which of the following disorders follows an X-linked recessive inheritance pattern and predominantly affects males? (CO2, K4)
- (a) Down syndrome
 - (b) Hemophilia
 - (c) Turner syndrome
 - (d) Klinefelter syndrome
5. Epigenetic regulation of gene expression differs from genetic mutations because epigenetic changes are: (CO3, K4)
- (a) Permanent and irreversible
 - (b) Associated with DNA sequence changes
 - (c) Potentially reversible and do not alter DNA sequence
 - (d) Limited only to germ cells
6. Phenylketonuria (PKU) is caused by a defect in the metabolism of which amino acid? (CO3, K4)
- (a) Tyrosine
 - (b) Phenylalanine
 - (c) Leucine
 - (d) Valine
7. Multiplex interactome Profiling Array (MIPA) is mainly used to study: (CO4, K4)
- (a) DNA mutations
 - (b) Protein—protein interaction networks in disease states
 - (c) Chromosomal banding patterns
 - (d) RNA splicing mechanisms

8. The variability in clinical symptoms among related individuals with a human mitochondrial disease is best explained by (CO4, K2)
- (a) Variable expressivity of nuclear genes
 - (b) Heteroplasmy of mitochondrial DNA
 - (c) X chromosome inactivation
 - (d) Epigenetic modifications
9. Huntington disease follows which inheritance pattern and why is it clinically significant? (CO5, K5)
- (a) Autosomal recessive; late onset
 - (b) Autosomal dominant; anticipation and neurodegeneration
 - (c) X-linked recessive; male predominance
 - (d) Mitochondrial; maternal inheritance
10. Thalassemia is classified as a hemoglobinopathy because it results from: (CO5, K5)
- (a) Structural alteration of hemoglobin
 - (b) Reduced or absent synthesis of globin chains
 - (c) Increased red blood cell production
 - (d) Autoimmune destruction of erythrocytes

Part B

(5 × 5 = 25)

Answer **all** questions not more than 500 words each.

11. (a) Discuss the principles, methodology, and clinical applications of karyotype analysis in the diagnosis of chromosomal disorders. (CO1, K2)

Or

(b) Explain the role of chromosome banding techniques in identifying structural chromosomal abnormalities. (CO1, K2)

12. (a) Discuss the role of epigenetic modifications in the regulation of metabolic pathways and disease development. (CO3, K4)

Or

(b) Explain the biochemical basis and clinical manifestations of disorders of branched chain amino acid metabolism. (CO3, K4)

13. (a) Describe the genetic and molecular mechanisms involved in the development of hypertension. (CO4, K4)

Or

(b) Explain how gene–environment interactions contribute to the development of common multifactorial diseases. (CO4, K4)

14. (a) Explain the molecular pathology of hemoglobinopathies with reference to thalassemia. (CO5, K2)

Or

(b) Describe the molecular basis of mitochondrial disorders and their inheritance patterns. (CO5, K2)

15. (a) Explain autosomal dominant and autosomal recessive inheritance patterns with suitable examples of human genetic disorders. (CO1, K5)

Or

(b) Discuss the importance of family history analysis in genetic counseling and disease risk prediction. (CO1, K5)

Part C

(5 × 8 = 40)

Answer **all** questions not more than 1000 words each.

16. (a) Describe in detail the principles, methodology, applications, and limitations of Non-Invasive Prenatal Testing (NIPT) in clinical genetics. (CO2, K2)

Or

- (b) Explain human chromosome classification and nomenclature, highlighting their role in identifying numerical and structural abnormalities. (CO1, K2)
17. (a) Discuss the molecular and biochemical basis of inborn errors of carbohydrate metabolism with suitable examples. (CO3, K4)

Or

- (b) Elaborate on the role of pharmacogenetics in personalized medicine, focusing on drug metabolism and adverse drug reactions. (CO3, K4)
18. (a) Explain the molecular basis, inheritance, and clinical significance of inherited immunodeficiency disorders. (CO4, K4)

Or

- (b) Provide a detailed account of blood group inheritance and its immunogenetic implications. (CO4, K4)

19. (a) Discuss the classification of gene mutations in humans and explain how loss-of-function and gain-of-function mutations lead to disease. (CO5, K2)

Or

- (b) Describe the molecular pathology, inheritance pattern, and clinical features of cystic fibrosis and Huntington disease. (CO5, K2)

20. (a) Analyze the role of pedigree analysis in genetic diagnosis, risk assessment, and counseling, with suitable examples. (CO1, K5)

Or

- (b) Discuss in detail the molecular mechanisms underlying allelic interactions such as codominance, incomplete dominance, multiple alleles, and lethal alleles. (CO1, K5)
-

R 4553

Sub. Code

25MBM2C2

M.Sc. DEGREE EXAMINATION, APRIL – 2026

Second Semester

Biomedical Science

PHARMACOLOGY AND TAXICOLOGY

(CBCS – 2025 onwards)

Time : 3 Hours

Maximum : 75 Marks

Part A

(10 × 1 = 10)

Answer **all** the following objective type questions by choosing the correct option.

1. The first-pass metabolism of orally administered drugs primarily occurs in (CO1, K2)
 - (a) Kidney
 - (b) Liver
 - (c) Lungs
 - (d) Intestine
2. Which of the following metabolic reactions is primarily associated with Phase I drug metabolism? (CO1, K2)
 - (a) Glucuronidation
 - (b) Sulfation
 - (c) Oxidation mediated by cytochrome P450 enzymes
 - (d) Acetylation
3. The mechanism of action of non-steroidal anti-inflammatory drugs (NSAIDs) primarily inhibits (CO2, K4)
 - (a) Histamine receptors
 - (b) COX enzymes
 - (c) Opioid receptors
 - (d) GABA receptors

4. Which class of drugs is commonly used as first-line therapy for hypertension due to their effect on renin—angiotensin system? (CO2, K4)
- (a) Calcium channel blockers
 - (b) ACE inhibitors
 - (c) Diuretics
 - (d) β -blockers
5. Which phase of clinical trials typically involves a large patient population to confirm efficacy, monitor side effects, and compare the new drug to standard treatments? (CO2, K4)
- (a) Phase I
 - (b) Phase II
 - (c) Phase III
 - (d) Phase IV
6. In *silico* methods in drug discovery refer to (CO3, K4)
- (a) Animal testing of drug toxicity
 - (b) *In vitro* biochemical assays
 - (c) Computer-based simulation of drug candidates
 - (d) Use of patient-derived xenograft models
7. The Drugs and Cosmetics Act of 1940 governs (CO4, K2)
- (a) The production, sale, and distribution of narcotic drugs
 - (b) The manufacturing, import, and sale of drugs and cosmetics in India
 - (c) The prevention of drug addiction and abuse
 - (d) International drug monitoring programs

8. MedDRA is mainly used in pharmacovigilance for (CO4, K2)
- (a) Rabbit (b) Mouse
(c) Dog (d) C. elegans
9. Signal detection in PV mainly relies upon (CO5, K5)
- (a) Animal data
(b) Spontaneous reporting system
(c) Phase I trials
(d) Gene mapping
10. Which heavy metal is classically associated with neurological toxicity and Minamata disease? (CO5, K5)
- (a) Lead
(b) Mercury
(c) Arsenic
(d) Cadmium

Part B

(5 × 5 = 25)

Answer **all** questions not more than 500 words each.

11. (a) Discuss the various routes of drug administration including their advantages and disadvantages with suitable examples. (CO1, K2)

Or

- (b) Discuss dose—response relationships, including graded and quantal dose—response curves. (CO1, K2)

12. (a) Discuss the pharmacological actions and uses of antidepressant drugs. (CO2, K4)

Or

- (b) Elaborate on drugs acting on the respiratory and gastrointestinal systems with suitable examples. (CO2, K4)

13. (a) Explain gene therapy, principles, vectors used and clinical applications. (CO3, K4)

Or

- (b) Describe the steps involved in drug discovery and development process. (CO3, K4)

14. (a) Describe animal handling, care and ethical considerations in research. (CO4, K4)

Or

- (b) Discuss pharmacovigilance systems at national and international levels. (CO4, K4)

15. (a) Elaborate on alternatives to animal testing and the principle of 3Rs in toxicology. (CO2, K5)

Or

- (b) Discuss methods of adverse drug reaction detection, signal generation and evaluation, risk management strategies, and the role of regulatory frameworks such as MedDRA in pharmacovigilance. (CO5, K5)

Part C

(5 × 8 = 40)

Answer **all** questions not more than 1000 words each.

16. (a) Describe in detail the sources of drugs, routes of administration and their impact on bioavailability. (CO1, K2)

Or

- (b) Write in detail about methods to prolong drug effect and the clinical importance of sustained release formulations. (CO1, K2)
17. (a) Explain central nervous system drugs including sedatives, hypnotics, antipsychotics, antidepressants and opioids. (CO2, K4)

Or

- (b) Describe the pharmacology of cardiovascular drugs such as diuretics, antihypertensives and antianginals with mechanisms. (CO2, K4)
18. (a) Discuss clinical trials in detail, including phases, objectives, and ethical considerations. (CO3, K4)

Or

- (b) Explain gene therapy and transgenic animal models in drug development. (CO3, K4)
19. (a) Discuss pharmacovigilance systems at national and international levels. (CO4, K4)

Or

- (b) Explain the key provisions of the NDPS Act, 1985, and its role in controlling and preventing drug abuse and addiction. (CO4, K4)

20. (a) Discuss mechanisms of toxic effects including cellular damage, carcinogenicity, and mutagenicity.
(CO5, K5)

Or

- (b) Explain diagnosis and management of poisoning due to drugs, chemicals, and snake venom.
(CO5, K5)
-

R 4554

Sub. Code

25MBM2E1

M.Sc. DEGREE EXAMINATION, APRIL – 2026

Second Semester

Biomedical Science

Elective – FORENSIC SCIENCE

(CBCS – 2025 onwards)

Time : 3 Hours

Maximum : 75 Marks

Part A

(10 × 1 = 10)

Answer **all** the following objective type questions by choosing the correct option.

1. Forensic science is primarily applied in (CO1, K2)
 - (a) Civil engineering
 - (b) Criminal investigations
 - (c) Environmental studies
 - (d) Biotechnology

2. The principle of individuality in forensic science states that (CO1, K2)
 - (a) No two objects are identical
 - (b) All crimes are unique
 - (c) All evidence is transferable
 - (d) Every crime leaves a witness

3. Which of the following is considered biological evidence? (CO2, K2)
 - (a) Glass fragment
 - (b) Blood stain
 - (c) Tool mark
 - (d) Fingerprint powder

4. Which branch of forensic science deals with blood group analysis? (CO2, K2)
- (a) Toxicology (b) Serology
(c) Ballistics (d) Anthropology
5. Rigor mortis is a postmortem change related to (CO3, K1)
- (a) Cooling of body (b) Muscular stiffening
(c) Decomposition (d) Drying of tissues
6. Adipocere formation occurs due to (CO3, K1)
- (a) Oxidation (b) Fermentation
(c) Hydrolysis of fats (d) Protein denaturation
7. Which technique is used for personal identification based on ridge patterns? (CO4, K2)
- (a) Serology (b) Dactyloscopy
(c) Odontology (d) Anthropology
8. DNA profiling is mainly useful in (CO4, K1)
- (a) Determining cause of death
(b) Identification of individuals
(c) Estimating time since death
(d) Detecting poisons
9. Which type of autopsy is conducted for medico-legal purposes? (CO5, K2)
- (a) Clinical autopsy (b) Anatomical autopsy
(c) Forensic autopsy (d) Virtual autopsy
10. In suspected poisoning cases, viscera are preserved mainly for (CO5, K1)
- (a) Histopathology (b) Toxicological analysis
(c) DNA profiling (d) Serological testing

Part B

(5 × 5 = 25)

Answer **all** questions not more than 500 words each.

11. (a) Explain the definition, scope and significance of forensic science. (CO1, K4)

Or

- (b) Describe the historical development of forensic science and its pioneers. (CO1, K2)

12. (a) Explain the duties and responsibilities of a forensic scientist. (CO2, K4)

Or

- (b) Describe the types of evidence encountered at a crime scene. (CO2, K5)

13. (a) Explain the early postmortem changes occurring after death. (CO3, K4)

Or

- (b) Write a short note on late postmortem changes. (CO3, K4)

14. (a) Explain the role of fingerprints in forensic identification. (CO4, K5)

Or

- (b) Discuss the importance of forensic anthropology in identification. (CO4, K5)

15. (a) Describe the objectives and significance of forensic autopsy. (CO5, K3)

Or

- (b) Discuss the legal aspects involved in medico-legal autopsy. (CO5, K3)

Part C

(5 × 8 = 40)

Answer **all** questions not more than 1000 words each.

16. (a) Write in detail about the organization and functions of forensic science laboratories in India. (CO1, K2)
Or
(b) Discuss the fundamental principles of forensic science with suitable examples. (CO1, K2)
17. (a) Explain crime scene investigation procedures and evidence handling protocols. (CO2, K4)
Or
(b) Describe the divisions of crime investigation and their roles. (CO2, K5)
18. (a) Discuss in detail the postmortem changes used to estimate time since death. (CO3, K4)
Or
(b) Explain medico-legal certification of cause of death. (CO3, K4)
19. (a) Explain forensic identification methods using physical and biological features. (CO4, K5)
Or
(b) Describe advanced forensic techniques such as DNA fingerprinting and BEOSP. (CO4, K5)
20. (a) Discuss forensic autopsy procedures in suspected poisoning cases. (CO5, K3)
Or
(b) Explain protocols for collection, preservation and analysis of viscera and body fluids. (CO5, K4)
-

R 4555

Sub. Code

25MBM2S1

M.Sc. DEGREE EXAMINATION, APRIL – 2026

Second Semester

Biomedical Science

AI FOR LIFE SCIENCE

(CBCS – 2025 onwards)

Time : 3 Hours

Maximum : 75 Marks

Part A

(10 × 1 = 10)

Answer **all** the following objective type questions by choosing the correct option.

1. Artificial Intelligence systems primarily function by
(CO1, K2)
 - (a) Following fixed hardware instructions
 - (b) Learning patterns from data
 - (c) Eliminating human involvement
 - (d) Performing arithmetic operations only

2. Which learning paradigm allows an agent to learn through reward and punishment? (CO1, K2)
 - (a) Supervised learning
 - (b) Unsupervised learning
 - (c) Reinforcement learning
 - (d) Transfer learning

3. Which method is commonly used to reduce dimensionality in gene expression datasets? (CO2, K2)
- (a) k-means clustering
 - (b) Principal Component Analysis
 - (c) Decision tree
 - (d) Naïve Bayes
4. Identification of single nucleotide polymorphisms (SNPs) mainly involves (CO2, K1)
- (a) Image processing techniques
 - (b) Sequence comparison algorithms
 - (c) Speech recognition models
 - (d) Reinforcement learning
5. Which stage of drug discovery benefits most from virtual screening techniques? (CO3, K2)
- (a) Clinical trials
 - (b) Lead identification
 - (c) Drug marketing
 - (d) Pharmacovigilance
6. Which deep learning architecture is best suited for biological sequence analysis? (CO3, K2)
- (a) Convolutional Neural Networks
 - (b) Recurrent Neural Networks
 - (c) Autoencoders
 - (d) Radial Basis Networks

7. Detection of tumors from radiological images mainly uses (CO4, K2)
- (a) Clustering algorithms
 - (b) Computer vision techniques
 - (c) Association rule mining
 - (d) Genetic algorithms
8. Predictive analytics in healthcare is mainly used to (CO4, K2)
- (a) Store medical images
 - (b) Forecast patient outcomes
 - (c) Manufacture medical devices
 - (d) Encrypt clinical data
9. Algorithmic fairness in AI systems refers to (CO5, K5)
- (a) Increasing computational speed
 - (b) Eliminating all human errors
 - (c) Ensuring unbiased decision-making
 - (d) Maximizing data volume
10. Regulatory approval of AI-based medical tools primarily focuses on (CO5, K5)
- (a) Model complexity
 - (b) Ethical compliance and patient safety
 - (c) Programming language used
 - (d) Cloud deployment strategy

Part B

(5 × 5 = 25)

Answer **all** questions not more than 500 words each.

11. (a) Explain the basic architecture of an Artificial Intelligence system with suitable examples. (CO1, K4)

Or

- (b) Illustrate the role of machine learning in solving biological problems. (CO1, K2)

12. (a) Describe feature extraction and selection techniques used in biological data analysis. (CO2, K4)

Or

- (b) Explain the application of AI tools in variant detection and genome annotation. (CO2, K4)

13. (a) Explain how artificial intelligence supports target identification and validation in drug discovery. (CO3, K4)

Or

- (b) Discuss the importance of ADMET prediction using machine learning models. (CO3, K4)

14. (a) Describe the use of AI techniques in early disease detection and prognosis. (CO4, K2)

Or

- (b) Explain the role of clinical decision support systems in modern healthcare. (CO4, K4)

15. (a) Explain the importance of ethical AI practices in healthcare applications. (CO5, K4)

Or

- (b) Discuss the role of regulatory bodies in approving AI-based life science technologies. (CO5, K5)

Part C (5 × 8 = 40)

Answer **all** questions not more than 1000 words each.

16. (a) Explain the fundamental principles of Artificial Intelligence and discuss their significance in life sciences. (CO1, K2)

Or

- (b) Discuss the contribution of machine learning models in transforming biological data analysis. (CO1, K2)

17. (a) Analyze the application of artificial intelligence in transcriptomics and functional genomics. (CO2, K4)

Or

- (b) Examine the use of machine learning approaches for identifying genetic markers associated with diseases. (CO2, K4)

18. (a) Discuss the application of artificial intelligence in optimizing drug candidates during preclinical development. (CO3, K4)

Or

- (b) Explain the role of AI in structure-based drug design and molecular docking studies. (CO3, K4)

19. (a) Explain the contribution of artificial intelligence in smart healthcare systems and patient monitoring. (CO4, K2)

Or

- (b) Discuss how predictive models enhance clinical decision-making and patient care. (CO4, K2)
20. (a) Critically evaluate the challenges related to ethics, accountability, and governance of AI in life sciences. (CO5, K5)

Or

- (b) Analyze future developments and emerging AI-driven innovations in healthcare and biomedical research. (CO5, K4)
-