
SYLLABUS
FOR
MEDICAL AND DENTAL
COLLEGES ADMISSION TEST
(MDCAT)
2019



**UNIVERSITY OF HEALTH
SCIENCES LAHORE, PAKISTAN**

Structure of the Question Paper for
Medical and Dental Colleges Admission Test (MDCAT)
2018

Sr. No.	Subject	No. of Questions
1.	Biology	88
2.	Chemistry	58
3.	Physics	44
4.	English	30
Total		220

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BIOLOGY

STRUCTURE OF THE SYLLABUS (2018)

For F.Sc. and Non-F.Sc.

TABLE OF CONTENTS

1. Cell Biology
2. Biological Molecules
3. Microbiology
5. Human Physiology
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9. Evolution
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1. CELL BIOLOGY

Content

Animal and plant cell

Prokaryotic and eukaryotic cell

Structure and function of cellular organelles

Learning outcomes:

Students should be able to:

- a) Compare and contrast the structure of typical animal and plant cell.
- b) Compare and contrast the structure of Prokaryotic cell with Eukaryotic cell.
- c) Define the terms diffusion, facilitated diffusion, active transport, passive transport, endocytosis and exocytosis and explain the basics of Fluid Mosaic Model of Cell Membrane.
- d) Outline the structure and function of the following organelles:
Nucleus, Endoplasmic reticulum, Golgi apparatus, Mitochondria, Centrioles, Ribosomes, Peroxisomes, Glyoxisomes, Cytoskeleton, Lysosomes.

2. BIOLOGICAL MOLECULES:

Content

Carbohydrates

Proteins

Lipids

Nucleic acids (DNA and RNA)

Enzymes

Learning outcomes:

Students should be able to:

- a) Define the terms: monomer, polymer, macromolecules, discuss Carbohydrates: Monosaccharides, Oligosaccharides, Polysaccharides (starch, glycogen, and cellulose).
- b) Explain the structure of amino acids and peptide bond formation.
- c) Explain the structure of primary, secondary, tertiary, quaternary proteins and their importance.

- d) Describe Lipids: Acylglycerols, Waxes, Phospholipids, Terpenoids and their functions.
- e) Describe the structure of DNA as hereditary material along its composition and functions.
- f) Give the structure and types of RNA (mRNA, rRNA, tRNA) and their function in the cell.
- g) Define enzyme and describe its characteristics.
- h) Define the following terms:
Coenzyme, Co-factor, Activator, Prosthetic group, Apoenzyme and Holoenzyme.
- i) Explain the mode / mechanism of enzyme action.
- j) Explain the effects of temperature, pH, enzyme concentration and substrate concentration on the rate of enzyme catalyzed reaction.
- k) Explain the effects of reversible and irreversible, competitive and non-competitive inhibitors on the rate of enzyme activity.

3. MICROBIOLOGY:

Content

Virus

Bacteria

Fungi

Learning Outcomes:

Students should be able to:

- a) Have the knowledge of discovery and structure of Viruses.
- b) Discuss viral diseases in humans with signs, symptoms and cure (hepatitis, measles and mumps, polio, herpes).
- c) Explain the mechanism of action of Retroviruses and describe Acquired Immunodeficiency Syndrome (AIDS).
- d) Describe the life cycle of Bacteriophage
including: Lytic cycle
Lysogenic cycle

- e) Explain the structure and types of bacteria (cocci, bacilli and spiral).
- f) Discuss in detail:
 - Gram +ve bacteria
 - Gram -ve bacteria
 - Nutrition in bacteria
 - Reproduction in bacteria
- g) Discuss the control of bacteria by physical and chemical methods.
- h) Define fungi.
- i) Describe the life cycle of fungus (*Rhizopus*).
- j) Discuss useful and harmful fungi to mankind.
- k) Describe structure and reproduction in fungi.

4. KINGDOM ANIMALIA:

Content

- Basic terminology
- Medically important phyla

Learning outcomes:

Students should be able to:

- a) Define the following terms:
 - Coelomates, Acoelomates, Pseudocoelomates, Radiata, Bilateria
- b) Describe the medical importance of following phyla:
 - i. Platyhelminthes (*Taenia solium*, *Fasciola hepatica*)
 - ii. Aschelminthes (*Ascaris lumbricoides*, *Enterobius vermicularis*, *Ancylostoma duodenale*)
 - iii. Annelida (*Hirudinea medicinalis*)
 - iv. Arthropoda (mosquito, lice, Tse-tse fly, common housefly)
 - v. Mollusca (snail)

5. HUMAN

PHYSIOLOGY: Content

- a) Digestive system
- b) Gas exchange
- c) Transportation
- d) Homeostasis
- e) Nervous system
- f) Reproduction
- g) Support and Movement
- h) Hormonal control
- i) Immunity

Learning outcomes:

a) Digestive System:

Students should be able to:

- I. Describe the anatomy of digestive system and specify the digestion in:
 - i. Oral cavity (role of saliva and enzymes)
 - ii. Pharynx (swallowing)
 - iii. Oesophagus (peristalsis, anti-peristalsis)
 - iv. Stomach (chemical and mechanical digestion)
 - v. Small intestine (Duodenum, Jejunum, Ileum)
 - vi. Large intestine (Caecum, Colon, Rectum)
- II. Discuss disorders related to nutrition (Obesity, Anorexia Nervosa).

b) Gas Exchange:

Students should be able to:

- I. Understand the anatomy of respiratory system (Nostrils, Trachea and
- II. Explain the mechanism of breathing (Inspiration and Expiration).
- III. Know how blood carries oxygen and carbon dioxide between lungs and body tissues.

- IV. Discuss structure and role of respiratory pigments e.g.; (Haemoglobin, Myoglobin).
- V. Discuss the respiratory disorders with causes and symptoms (Tuberculosis, Emphysema and Lung Cancer).

c) Transport

Students should be able to:

- I. Describe the structure of Heart (external and internal structure), difference in left and right chamber of heart, SA node and AV node.
- II. Describe the Cardiac Cycle, ECG and Blood pressure (systolic and diastolic).
- III. Explain structure of blood vessels (Arteries, Veins, Capillaries) and arterial disorder (atherosclerosis).
- IV. Describe Blood and its composition; plasma and blood cells (red blood cells, white blood cells and platelets)
- V. Discuss the following circulatory disorders with symptoms and causes: Thrombosis, Embolism, Myocardial infarction, Cerebral Infarction.
- VI. Understand components of lymphatic System: Lymph, Lymph Vessels, Lymph Nodes

d) Homeostasis:

Students should be able to:

- I. Understand the terms homeostasis, internal and external stimuli, receptors, central control, coordination system, effectors and negative feedback.
- II. Describe the structure of kidney and its functions, structure of nephron with associated blood vessels, ultrafiltration, reabsorption and formation of urine.
- III. Explain the terms osmoregulation and thermoregulation.
- IV. Explain types of kidney problems (Kidney stones and Renal failure) and cures (Lithotripsy, Kidney transplant and Dialysis-peritoneal and hemodialysis).

e) Nervous System:

Students should be able to:

- I. Describe Nervous System and its types.
- II. Explain Central Nervous System including forebrain, mid brain, hind brain and spinal cord.
- III. Explain Peripheral Nervous System and its types (Autonomic and Sympathetic).
- IV. Describe neurons (Associative, Motor and Sensory Neurons).
- V. Describe nerve impulse and how it propagates.
- VI. Understand the concept of synapse and passage of nerve impulse, role of neurotransmitters.
- VII. Discuss the nervous disorders (Parkinson's disease, Epilepsy and Alzheimer's disease).
- VIII. Understand the Biological Clock and Circadian Rhythms.

f) Reproduction:

Students should be able to:

- I. Explain the structure and function of reproductive system in male.
- II. Explain the structure and function of reproductive system in female.
- III. Describe menstrual cycle with its stages.
- IV. Explain the stages of gametogenesis (Spermatogenesis and Oogenesis).
- V. Discuss the following Sexually Transmitted Diseases (STD's) with their causative agents, symptoms and cure: Gonorrhoea, Syphilis, AIDS.

g) Support & Movement:

Students should be able to:

I. Human skeleton:

- i. Define and explain terminologies: Bone, Cartilage, Tendon, and Ligament.
- ii. Describe Axial & Appendicular Skeleton.
- iii. Describe Joints and their types (fibrous, cartilaginous, synovial, pivot and multistage).

II. Muscular system:

- i. Compare the types of muscles (smooth, cardiac and skeletal).
- ii. Explain structure and function of skeletal muscle.
- iii. Explain the concept and working of sarcomere, ultrastructure of myofilaments, sliding filament model.
- iv. Understand the sources of energy for muscle contraction.
- v. Describe Muscle Fatigue, Tetany, and Cramp with their causes.

h) Hormonal control:

Students should be able to:

- I. Describe hormones and their composition.
- II. Discuss the effect of hypothalamus on the pituitary gland.
- III. Describe the knowledge of pituitary gland and its hormones.
 - i. Anterior lobe: Somatotrophin, Thyroid Stimulating Hormone, Adrenocorticotrophic Hormone, Gonadotrophins (Follicle Stimulating Hormone (FSH), Luteinizing Hormone (LH), Luteotropic Hormone (LTH), Prolactin).
 - ii. Posterior lobe: Vasopressin, Oxytocin.
- IV. Explain the hormones of thyroid and parathyroid: Thyroxin (T₃, T₄), Calcitonin, Parathormone.
- V. Discuss the adrenal gland in detail:
 - i. Adrenal cortex (cortisol, corticosterone, aldosterone, androgens).
 - ii. Adrenal medulla (adrenaline and nor adrenaline).
- VI. Explain hormones of Islets of Langerhans i.e. Insulin, Glucagon.
- VII. Describe the hormones of alimentary canal (Gastrin, Secretin).
- VIII. Discuss the hormones of ovaries and testes (oestrogen, progesterone, testosterone).
- IX. Explain the disorders of endocrine gland i.e. diabetes mellitus, diabetes insipidus, goiter, dwarfism, gigantism.

i) Immunity:

Students should be able to:

- I. Define immune system and describe its components:
 - Antigen.
 - Antibody (structure of antibody).
 - Lymphocytes (B and T cells).
- II. Describe cell mediated response and humoral immune response.
- III. Discuss the types of immunity:
 - Active immunity.
 - Passive immunity.
- IV. Explain vaccination.

6. BIOENERGETICS:

Content

Photosynthesis and cellular respiration

Learning outcomes:

Students should be able to:

- a) Describe photosynthetic pigments (chlorophyll and carotenoids).
- b) Understand the concept of absorption and action spectra.
- c) Discuss light dependent stage (cyclic and non-cyclic phosphorylation).
- d) Discuss light independent stage (Calvin cycle).
- e) Describe the respiration at cellular level including:
 - Glycolysis (with preparatory and oxidative phase), Krebs's cycle (with reference to production of NADH, FADH and ATP), Electron Transport Chain with its carriers.
 - Anaerobic Respiration and its types (alcoholic and lactic acid fermentation).

7. BIOTECHNOLOGY:

Content

DNA technology
Gene therapy
Tissue culture
Cloning

Learning outcomes:

Students should be able to:

- a) Describe Recombinant DNA Technology and its application (e.g. Insulin production).
- b) Describe the principle and steps of Polymerase Chain Reaction (PCR).
- c) Understand the following terms:
 - DNA Analysis (Finger Printing, Gene Sequencing).
- d) Explain Gene therapy with reference to how genetic diseases (i.e. cystic fibrosis, severe combined immunodeficiency syndrome, hypercholesterolemia) can be treated with gene therapy.
- e) Describe the detail of Transgenic Organisms (Bacteria, Plants and Animals), Tissue Culture, Cloning and their applications.

8. ECOSYSTEM:

Content

Biological succession
Impacts of Human activity on ecosystem
Energy flow in ecosystem

Explain learning outcomes:

Students should be able to:

- a) Define succession and describe various stages of xerosere.
- b) Describe the significance of human activity on ecosystem such as Population, Deforestation, Ozone Depletion, Greenhouse Effect, Acid rain, Eutrophication and Pesticides.
- c) Describe Nitrogen cycle (ammonification, nitrification, assimilation, depletion).

- d) Define and explain Energy Flow, Trophic Levels (producers, consumers, decomposers), Productivity, Food chain, Food web.

9. EVOLUTION:

Content

Darwin's theory
Lamarck's theory
Evidences of evolution

Learning outcomes:

Students should be able to:

- a) Compare the theory of Darwin and Lamarck.
- b) Discuss evidences of evolution from Paleontology, Comparative anatomy, Molecular biology and Biogeography.
- c) Explain Hardy-Weinberg Theorem and factors affecting gene / allele frequency

10. Genetics

Content

Mendelian Inheritance
Genetic linkage
Gene control & expression
Sex Determination
Cell Division
Genetic disorders

Learning outcomes:

Students should be able to:

- a) Explain the terms: Gene, locus, allele, dominant, recessive, co-dominant, linkage, F1 and F2, phenotype, genotype, homozygous, heterozygous, mutation, epistasis, multiple allele, Rh factor, dominance relations, polygenic inheritance.
- b) Explain law of segregation and law of independent assortment through Punnet square, solve problems related to monohybrid, dihybrid crosses and testcross.

- c) Discuss gene linkage and sex linkage in human (haemophilia and colour blindness).
- d) Discuss hypothesis about DNA Replication, Meselson and Stahl experiment and mechanism of replication.
- e) Explain mechanism of gene expression: Transcription and Translation.
- f) Describe Genetic code and its properties.
- g) Explain sex chromosomes and discuss different systems of sex determination (XO-XX, XY-XX, ZZ-ZW).
- h) Know cell cycle and its phases.
- i) Describe events of mitosis and meiosis along with their significance.
- j) Discuss meiotic errors (Down's syndrome, Klinefelter's syndrome, Turner's syndrome).