



संयुक्त विश्वविद्यालय

SYMBIOSIS

INTERNATIONAL UNIVERSITY

Ph.D. Entrance Test 2017

Faculty of Health & Biomedical Sciences

Syllabus & Questions for Entrance Test

❖ BIOTECHNOLOGY

Unit 1: Biochemistry and Biophysics

Composition, structure, conformation and function of biomolecules- carbohydrates, lipids, proteins, nucleic acids and vitamins. Principles of biophysical chemistry (pH, buffer, reaction kinetics). Bioenergetics, glycolysis, oxidative phosphorylation, coupled reaction, group transfer, biological energy transducers. Principles of catalysis and enzymes, enzyme kinetics, enzyme regulation, inhibition, isozymes. Conformation of proteins (Ramachandran plot, secondary structure, domains, motif and folds).

Unit 2: Methods in Biology

Centrifugation techniques, Chromatographic techniques- General principles, TLC, column chromatography, HPLC, Adsorption chromatography, Partition chromatography, Ion exchange chromatography, Exclusion chromatography, GLC, Affinity chromatography.

Electrophoretic Techniques- General principles, Native gels, SDS-PAGE, IEF, 2D gel electrophoresis, Agarose gel electrophoresis, Pulse field gel electrophoresis, Capillary electrophoresis. Spectroscopic techniques- UV/visible, fluorescence, circular dichroism, NMR, ESR spectroscopy, X-ray diffraction, mass spectrometry.

Radiolabeling techniques- Detection and measurement of radioisotopes, molecular imaging of radioactive material, safety guidelines.

Microscopic techniques- Light microscopy, scanning and transmission electron microscopy, fluorescent and confocal microscopy.

Unit 3: Cell Biology

Membrane structure and function- Structure of fluid mosaic model of membrane, lipid bilayer, transport across membrane, mechanism of sorting and regulation of intracellular transport.

Structural organization and function of intracellular organelles.

Organization of chromosomes- Structure of chromatin and nucleosome, heterochromatin, euchromatin.

Cell division and cell cycle- Mitosis and meiosis, cell cycle and regulation.

Cell signaling- Peptide and steroid hormones and their receptors, signal transduction pathways, secondary messengers, regulation of signaling pathways.

Cellular communication- Cytoskeletal elements, cell adhesion molecules, extracellular matrix, neurotransmission and its regulation.

Cancer- Oncogenes, tumor suppressor genes, cancer and cell cycle, virus-induced cancer, metastasis, interaction of cancer cells with normal cells, apoptosis, chemotherapy.



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Unit 4: Molecular Biology and Genetics

DNA replication, repair and recombination in prokaryotes and eukaryotes- Mechanism of replications, enzymes, fidelity of replication, DNA damage and repair mechanisms, homologous and site-specific recombination.

RNA synthesis and processing in prokaryotes and eukaryotes- Transcription factors and machinery, formation of initiation complex, transcription activator and repressor, RNA polymerases, capping, elongation, and termination, RNA processing, RNA editing, splicing and polyadenylation.

Protein synthesis and processing in prokaryotes and eukaryotes: Ribosome, formation of initiation complex, initiation factors, elongation, termination, genetic code, aminoacylation of tRNA, translational inhibitors, Post-translational modification of proteins.

Control of gene expression at transcription and translation level- regulating the expression of prokaryotic and eukaryotic genes, role of chromatin in gene expression, DNA methylation, gene silencing.

Gene mapping methods- Linkage maps, tetrad analysis, mapping with molecular markers, mapping by using somatic cell hybrids, development of mapping population in plants.

Microbial genetics- transformation, conjugation, transduction, fine structure analysis of genes.

Human genetics- Pedigree analysis, karyotypes, genetic disorders.

Multifactorial pattern of inheritance- Criteria for multifactorial inheritance, Teratology, Structure of gene, Molecular Screening, Cancer Genetics- Haematological malignancies, Cancer Genetics, Pharmacogenetics Multifactorial pattern of inheritance- Criteria for multifactorial inheritance, Teratology, Structure of gene, Molecular Screening, Cancer Genetics – Haematological malignancies, Cancer Genetics, Pharmacogenetics

Quantitative genetics- Polygenic inheritance, heritability and its measurements, QTL mapping. Mutation- Types, causes and detection, mutant types– lethal, conditional, biochemical, loss of function, gain of function, germinal versus somatic mutants, insertional mutagenesis.

Structural and numerical alterations of chromosomes- Deletion, duplication, inversion, translocation, ploidy and their genetic implications.

Unit 5: Gene Technology and Bioinformatics

Isolation, purification, analysis of RNA and DNA (genomic and plasmid). Molecular cloning of DNA and RNA fragments in cloning vectors and expression. Construction of genomic and cDNA libraries and screening. DNA sequencing methods, strategies for genome sequencing.

Methods for analysis of gene expression at RNA and protein level, micro array, DNA chips. PCR, RFLP, Southern and Northern blotting, AFLP techniques, Real-time PCR. *In situ* localization, FISH and GISH.

Bioinformatics

Biological Databases- Types, importance and management.

Sequence Database- Nucleotide and Protein.



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Bioinformatics Softwares- Clustal V Multiple Sequence Alignments, ClustalW Version 1.7, RasMol, Oligo, MolScript, TREEVIEW, ALSCRIPT, Genetic Analysis Software, Phylip. Computational Biology- Data mining and Sequence Analysis, Database Similarities Searches, Multiple Sequence Alignment, Phylogenetic Analysis, Predictive methods using Nucleic acid and Protein Sequences, Submitting DNA Sequences to the Databases.

Unit 6: Immunology and Immunotechnology

Innate and adaptive immune system- Cells and molecules involved in innate and adaptive immunity, antigens, antigenicity and immunogenicity. B and T cell epitopes, structure and function of antibody molecules. Generation of antibody diversity, monoclonal antibodies, antibody engineering, antigen-antibody interactions, MHC molecules, antigen processing and presentation, activation and differentiation of B and T cells, B and T cell receptors, humoral and cell-mediated immune responses, primary and secondary immune modulation, the complement system, cell-mediated effector functions, inflammation, hypersensitivity and autoimmunity.

Immunological techniques- ODD, immunoelectrophoresis, RIA, ELISA, Immunofluorescence, Western blot.

Tumor immunology- Neoplasms, tumor-associated antigens, immune response to tumor antigens, immunologic factors favouring tumor growth, immunotherapy.

Unit 7: Bioprocess and Microbial Technology

Primary and secondary metabolites, Batch culture, the growth cycle, effect of nutrients, energetics of growth.

Design of bioreactors- Biosensors, scale up of bioreactors

Transport phenomena in bioprocess- Mass transfer resistance, oxygen transfer coefficients, biological heat transfer, heat transfer coefficients.

Downstream processing of biologicals- Separation of cells, foam separation, flocculation, filtration, plate filters, rotary vacuum filter, centrifugation, Stokes law, basket centrifuge, bowl centrifuge, disintegration of microorganisms, mechanical and non-mechanical methods, membrane filtration, ultra filtration and reverse osmosis, chromatographic techniques, absorption, spray drier, drum dryers, freeze dryers.

Microbial products- Microbial production of vitamins, enzymes, organic acids, amino acids, antibiotics, ethanol.

Microbes for sustainable agriculture- Biological nitrogen fixation, Biofertilizers, Biological control, Biopesticides.

Unit 8: Plant Biotechnology

Cell and Tissue Culture Technology

Role of hormones in Callus Induction, Organogenesis, Somatic embryogenesis and synthetic seeds. Micropropagation- Stages and applications.



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Germplasm preservation- Short and long-term storages, gene banks, applications. Haploid Technology- Methods of haploid culture and applications.

Protoplast Technology- Isolation, purification and culture of protoplasts, protoplast fusion and somatic hybridization, applications of somatic hybrids.

Secondary metabolite production- Induction of secondary metabolites by plant cell culture; Bioreactor systems for mass cultivation of plant cells.

Seed Biotechnology- Seed development and structure, Hybrid seed production technology: Genetic determinants of flowering, seed development and germination, male sterility and apomixes.

Transgenic plant transformation techniques- Methods of gene transfer in plants, *Agrobacterium*-mediated gene transfer, and direct gene transfer methods- electroporation, microinjection, particle bombardment, selection of transformants.

Transgenic plants- Herbicide resistance, resistance against biotic stress- bacterial, viral, fungal and insect resistance, abiotic stress, improved crop productivity, improved nutritional quality. Molecular pharming.

Intellectual Property Rights (IPR)- IPRs and agricultural technology- implications for India, WTO, WIPO, GATT, TRIPS. Plant Breeder's Rights, legal implications. Ethical issues associated with consumption of GM food, labelling of GM crops and foods.

Unit 9: Animal Biotechnology

Culture of animal cells- Primary culture: Isolation of mouse and chick embryos, human biopsies, methods for primary culture, nomenclature of cell lines, sub culture and propagation and routine maintenance.

Cell characterization- cytotoxicity assays, cell quantitation, cell culture contamination-monitoring and eradication, cryopreservation, confocal microscopy. Stem cell culture and its applications.

Cell and Tissue engineering- Growth factors for *in situ* tissue regeneration, biomaterials in tissue engineering, approaches for tissue engineering of skin, bone grafts, nerve grafts. Haemoglobin-based blood substitutes, bio artificial or biohybrid organs. Limitations and possibilities of tissue engineering. *In vitro* fertilization and Embryo transfer- *In vitro* fertilization in Humans, Embryo transfer in Humans, Super ovulation and embryo transfer in farm animals e.g: Cow.

Cloning of Animals- Methods and uses. Introduction, nuclear transfer for cloning, cloning from-embryonic cells, adult and fetal cells. Cloning from short-term and long-term cultured cells: cloning of sheep, Cloning of cows from aged animals. human cloning- ethical issues and risks.

Transgenic animals- Transgenic animals and applications: mice and other animals,

Biosafety regulations- guidelines for research in transgenic animals, public awareness of the processes of producing transgenic organisms.



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Unit 10: Research Methodology and Biostatistics:

Research Methodology- Types of research, Types of research designs, Qualitative and quantitative research, applied research, Sampling methods, and Preparation of research proposal.

Basic statistics- Measures of central tendencies, dispersion, Uses of graphs and tables, Software in statistical analysis, Probability, Types of errors in statistics, Tests of significance, and Sample Size.

Sample Questions:

1. Cell membrane consists of :
 - a. Lipids and proteins
 - b. Lipids only
 - c. Protein only
 - d. None of the above

2. Which of the organelles contain DNA:
 - a. Nucleus
 - b. Nucleolus
 - c. Golgi apparatus
 - d. Ribosomes

3. To keep blood P^H at 7.4 the $HCO_3:H_2CO_3$ ratio should be:
 - a. 20:1
 - b. 30:1
 - c. 15:1
 - d. 1:1



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❖ **NUTRITION AND DIETETICS**

Unit 1: Principles of Nutrition and Nutritional Biochemistry

Nutrients- Carbohydrates, proteins, lipids and functions, Energy, Macro and micro elements and functions, fat and water soluble vitamins and functions, Fiber, Water, Digestion and absorption of nutrients, bioavailability.

Carbohydrate metabolism, Protein metabolism, Lipid metabolism, micronutrient metabolism, Drug nutrient interactions, Enzymes and hormones, and Xenobiotics.

Unit 2: Medical Nutrition Therapy/Clinical Nutrition/Dietetics/Nutrition in Health and Disease:

Principles of diet therapy, Modifications of diets in febrile conditions, Oral and dental conditions, Gastrointestinal and hepato-biliary disorders, Disorders of energy metabolism- obesity, underweight, Non-communicable diseases such as cardiovascular disorders, diabetes mellitus, hypertension and renal diseases, pulmonary disorders, Nutrition in critical care, cancer and allergies and food intolerances.

Unit 3: Food Science and Food Microbiology

Food groups, Food preparation methods, Food preservation techniques, Food analysis – proximate composition, Sensory analysis and Food processing techniques, Food safety, Food security, and Food hygiene.

Food borne illnesses, hazard analysis and critical control points and good manufacturing practices, Role of microorganisms in food processing, Food additives, Food fortification and Food packaging.

Unit 4: Nutritional Epidemiology

Nutrition research methods- observational, case-control, cohort, randomized control trials, Nutrition surveys and surveillance in India, Nutritional assessments-anthropometry, biochemical, clinical and dietary surveys, Monitoring and evaluation of nutrition programmes, and nutrition education.

Unit 5: Public Health Nutrition

Nutrition security, Nutritional status, Malnutrition, under- and over nutrition, trends in nutritional status in India, Strategies to overcome nutritional challenges- under-nutrition, anaemia, obesity, non-communicable diseases, Nutrition intervention programmes in India, Sustainable development goals, World Health Assembly targets, Trends in breast feeding practices in India, Role of national and international agencies to combat malnutrition, Nutrition education, Maternal and child nutrition programmes in India.



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Unit 6: Nutrition through Lifecycle

Balanced diet, Meal planning, Nutrition during pregnancy, lactation, infancy, toddlerhood, preschool stage, school going children, and adolescence. Growth and development during different stages of lifecycle, nutrition for adults, older adults and old populations.

Unit 7: Human Physiology

Human body systems – Cardiovascular system, Digestive system, Urinary system, Blood, Lymphatic system, Respiratory system, Musculoskeletal system, Endocrine and Reproductive system.

Unit 8: Food Service Management

Meal planning, Portion sizing, Food service institutions, Types of food service, Food service equipment, lay outs, designs, Principles of meal service and planning, Catering service management and Institutional food service.

Unit 9: Research Methodology and Biostatistics:

Research Methodology- Types of research, Types of research designs, Qualitative and quantitative research, applied research, Sampling methods, and Preparation of research proposal.

Basic statistics- Measures of central tendencies, dispersion, Uses of graphs and tables, Software in statistical analysis, Probability, Types of errors in statistics, Tests of significance, and Sample Size.

Sample Questions:

1. The conversion factor for estimating crude protein content of food from its nitrogen content is
 - (A) 6.25
 - (B) 16.0
 - (C) 5.5
 - (D) 4.0
2. The most sophisticated and extremely formal style of service is
 - (A) Waiter service
 - (B) Self service
 - (C) Room service
 - (D) Banquet service
3. Following are the methods of conducting dietary survey:
 - I. Bioimpedance analysis
 - II. 24 hour recall



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III. FFQ

IV. Diet record

Codes

(A) II, III and IV

(B) I, II and IV

(C) I, III and IV

(D) I, II and III



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❖ HEALTHCARE MANAGEMENT

Unit 1: Introduction to Public Health

Evolution of Public Health. Important Public Health Acts, Health problems of developed and developing countries, Health problems in India, Environment and Health.

Unit 2: Basic Epidemiology

Definition and Concepts of Epidemiology, Concepts of Health and Disease.

Role of Genetics in Health and Disease, Levels of Prevention, Types of Epidemiology, Uses of Epidemiology.

Unit 3: Health Systems in India

Health planning in India including various committees and National Health Policy and Health Goals set from time to time. Organised sector with reference to Centre, State, District and Block level structures and local bodies and Panchayati Raj Organisation and functions of community health centres and Primary Health Centres (PHCs).

Health Manpower, Primary Health care and concept, Alternative systems of medicine, like Ayurveda, Homeopathy, etc. Holistic Approach

Non-Governmental Organisations (NGOs) and Private Voluntary Organisations (PVOs). Unorganized Sector.

Unit 4: Population Indicators

Definition, scope and evolution. Problems of Population growth, Birthrates, death rates, fertility rates, age-specific mortality rates, MMR, CPR, etc. Approaches and methods of contraception, Medical Termination of Pregnancy.

Unit 5: Nutrition and Communicable & Non-communicable diseases

Major nutritional problems, etiology, manifestations and prevention.

Family Welfare and Planning, Reproductive and Child health- Components of RCH care, Need and package of services under RCH Programme.

Communicable and Non-communicable diseases- Epidemiology, Etiology, Pathogenesis, Prevention and Control of Communicable Diseases- Malaria, Cholera, Tuberculosis, Leprosy, Diarrhoea, ARI, Poliomyelitis, Viral Hepatitis, Measles, Dengue, Rabies, AIDS, etc.

Non-communicable diseases- coronary heart disease, hypertension, diabetes mellitus, cancers, etc.

Unit 6: Introduction to Management

The evolution of Management, Definition and importance of Management, Different schools of Management thought- classical school, Management Sciences School, Behavioral School,



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Human Relation School, Operational approach, system approach and contingency approach to Management. Hospital Planning, Organizing, Staffing, directing and controlling.

Unit 7: Hospital Operation Management

Epidemiological basis for healthcare management. Management development-towards development of professional management of Indian Hospitals. Management of Indian Hospitals- challenges & strategies. Modern Techniques of hospital management. Operation concept- use of models. Health services research & formalized managerial methods.

Unit 8: Hospital Operational Management

Management of Quality Assured services of professional service units of hospitals. Quality control mechanisms.

Unit 9: Outpatient & In Patient Services in the Following Fields (Basic knowledge only)

Radiotherapy, Nuclear medicine, surgical units, and OT Medical units, G & Obs. units & LR. Pediatric, neonatal units, Critical care units, Physical medicine & Rehabilitation. Skin, Eye, ENT, Neurology, Dental, Gastroenterology, Endoscopy, Pulmonology, Cardiology, Cath lab, Nephrology & Dialysis, Urology, Orthopedics, Transplant units, Burn Unit.

Unit 10: Medical Record Science

Definition and types of medical record, Importance of medical record, Flow chart of function, Statutory requirements of maintenance, coding, indexing and filing, Computerization of record, Report and returns by the record department, Statistical information and ICD.

Unit 11: Inventory Control & Purchase Management

Inventory Control & Purchase Management-meaning & significance. Purchasing & procurement- Principles of sourcing, purchase methods & procedures, legal aspects of purchasing. Reference to Contract Act, Sale of Goods Act, Drug Control Act in respect to purchase activities. Import substitution.

Quality Control & quality management- Principles & methods.

Principles of storage & stores accounting- types of storage care & preservation of materials & equipment in inventory control.

Distribution management (logistics Management) - distribution of materials to various departments & auxiliary services.

Exceptional management needs in Healthcare Units- Management of Blood Bank, Donated Organs, Morgues, and Dispensaries.

Unit-12 Research Methodology and Biostatistics:

Research Methodology- Types of research, Types of research designs, Qualitative and quantitative research, applied research, Sampling methods, and Preparation of research proposal.



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Basic statistics- Measures of central tendencies, dispersion, Uses of graphs and tables, Software in statistical analysis, Probability, Types of errors in statistics, Tests of significance, and Sample Size.

Sample Questions:

1. Free Health Care Delivery At Government expenditure is called:
 - (A) Primary Health Care
 - (B) Comprehensive Health Care
 - (C) Socialised Medicine
 - (D) Social Medicine

2. WHO theme was adopted in following order (to be arranged in chronological order):
 - I. "Smoking or Health– the choice is yours"
 - II. "Safe blood starts with me– blood saves life"
 - III. "Healthy cities – for better living"
 - IV. "Pregnancy is special – let us make it safe"
 - (A) 1, 3, 2, 4
 - (B) 1, 3, 4, 2
 - (C) 1, 2, 4, 3
 - (D) 2, 1, 4, 3