

GOVERNMENT ARTS COLLEGE (AUTONOMOUS), KUMBAKONAM - 612 002

(Affiliated to Bharathidasan University, Tiruchirappalli)

M. Phil., BIOCHEMISTRY PROGRAMME

(For the candidates admitted from the academic year 2020-2021 onwards)

Semester I	Subject Code	Title of the course	Marks			Credits
			IA	UE	Total	
Course-1	1MBO1	Research Methodology	25	75	100	4
Course-2	1MBO2	Advanced Techniques in Biochemistry	25	75	100	4
Course -3	1MBO3	Teaching and Learning Skills (Common Paper)	25	75	100	4
Course -4	1MBO4	Biochemical Pharmacology Paper on Topic of Research (Guide will prepare the syllabus and it will be sent to the COE)	25	75	100	4
Semester -II	2MBO5	Dissertation and Viva Voce Dissertation - 150 marks Viva Voce - 50 marks	–	–	200	8

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DEPARTMENT OF BIOCHEMISTRY
M.PHIL SYLLABUS (2020 - 21 ONWARDS)
COURSE-I: RESEARCH METHODOLOGY

Objectives

- To develop research skill and writing manuscript and thesis.
- To provide knowledge to apply statistics and bioinformatics for research.

Course Outcomes

At the end of the course, the student will be able to

- Obtain necessary knowledge to perform the research and methodology
- Explain the collection, arrangement and analysis of statistical data.
- Exhibit a knowledge base in handling different Statistical applications.
- Apply practically the knowledge acquired on Computer applications and Bioinformatics related to the Bio molecular structure predictions.

Unit I

Research – Definition, importance and meaning of research, characteristics of research, types of research, steps in research - identification, selection and formulation of research problem, research questions, research design, formulation of hypothesis, review of literature. Research report: Types of reports - contents - styles of reporting - steps in drafting reports - editing the final draft - evaluating the final draft. Definition and kinds of scientific documents - research paper, review paper, book reviews, theses, conference and project reports for the scientific community. Components of a research paper - title, author and addresses, abstract, acknowledgements, references, tables and illustrations. Dealing with publisher - submission of manuscript and ordering reprints. Oral and poster presentation - Presentation of research papers in conferences/symposia.

Unit II

Sampling techniques: sampling theory, types of sampling, steps in sampling - sampling and non-sampling error - sample size – advantages and limitations of sampling. Collection of data: primary data – meaning – data collection methods - secondary data – meaning - relevance, limitations and cautions. Principles of experimental design, collection, assembly, analysis and interpretation of experimental data. Data presentation: tabular, graphical and diagrammatic representation of data. Use of simple, semilog and double graph paper in data representation. Presentation tools using computer: Introduction, features and functions, presentation - power point presentation, customizing presentation and showing presentation. Tools - power point or similar.

Unit III

Statistical applications in research: averages, standard deviation, standard error, analysis of variance, regression and correlation, coefficient of variation. Levels of significance, Chi-square test, students test (t), ANOVA and Duncan's multiple range test (DMRT). Applications of statistics in Biosciences.

Unit IV

Computer applications: Web Search - introduction to internet, Use of internet and WWW. Use of search engines. Biological databases and data retrieval: nucleotide (Gene bank- EMBL- DDBJ) - sequence submission methods and tools (sequin, Sakura, Bankit) - sequence retrieval systems (Entrez & SRS) - sequence file formats and conversion tools- Protein (Swiss - port, PIR, Expasy) - structural databanks (PDB and NDB)- protein structure classification (SCOP, CATH - and FSSP) - metabolic pathway db (KEGG) – specialized db (IMGT, rebase, COG).

Unit V

Phylogenetic analysis: Constructions of phylogenetic trees - distance methods - maximum parsimony method - maximum likelihood method. Molecular modelling and drug designing: introduction to protein structure prediction - rational drug discovery - recent advances in drug design methodologies - structure based drug design - drug receptor N interactions - structure - activity relationships.

References

1. Anderson, Durston, Polle (1970). Thesis and assignment writing Wiley Eastern Limited .
 2. Research Methodology: Methods and Statistical Techniques – Santosh Gupta.
 3. Biostatistical analysis. J.H.Zar, 4th edition. Pearson Education, Inc. India.
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 5. Dan E. Krane, Michael L. Raymer. Fundamental concepts in Bioinformatics. 1st ed. Pearson Education. 2006.
 6. Des Higgins. Bioinformatics Sequence, Structure databanks. Willie Taylor.
 7. Behrouz A. Forouzan. Foundations of Computer Science: From Data Manipulation to Theory of Computation: From Data Manipulation to Theory of Computation: 1st Edition, Cengage Learning Publisher, 2002.
 8. Nell Dale. Computer Science Illuminated: 5th Edition, Jones & Bartlett Learning Publisher. 2012.
 9. Kothari, CR., IInd edn, 2006. Research methodology, methods and techniques, New Age International Publishers, New Delhi.
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COURSE-II: ADVANCED TECHNIQUES IN BIOCHEMISTRY

Objectives

- To understand and learn the principles, methods and instrumentation of advanced techniques in biochemistry.

Course Outcomes

At the end of the course, the student will be able to

- Obtain necessary knowledge to perform techniques to biochemistry
- Explain the instrument components, principles of operation and applications of spectroscopy, radioisotope technique and microscopy.
- Exhibit a knowledge base in handling different chromatographic techniques and to make an appropriate choice based on nature of the sample.
- Differentiate the principles of paper, ion exchange, gel and affinity chromatography.
- Apply practically the knowledge acquired on centrifugation for separation of biological samples and isolation of cell organelles.
- Gain knowledge on principles of electrophoresis and learn the procedure for electrophoresis, blotting and hybridisation techniques.

Unit I

Microscopy - Basic principles, instrumentation and application of phase, ultraviolet and interference microscope and fluorescence microscopy. Electron microscope - scanning emission microscopy, transmission emission microscopy. Confocal microscopy and Atomic force microscopy. Principle, methods and applications of polarimetry, flow cytometry.

Unit II

Spectroscopic techniques - Basics of light spectrum. Instrumentation, working principle and application of atomic absorption spectroscopy (AAS), atomic emission spectroscopy- flame photometry, plasma emission spectroscopy, fluorimetry and spectrofluorimetry. Fourier transform infrared spectroscopy (FTIR). Ultra violet and visible spectrometry, infra-red spectroscopy, molecular luminescence spectroscopy, nuclear magnetic resonance spectroscopy (NMR), mass spectroscopy. Methods for studying the structure of macromolecules - CD, ORD and X-Ray - spectroscopy.

Unit III

Radioisotope techniques - nature of radioactivity and its detection, measurement of radioactivity, GM counter, scintillation counter, autoradiography, applications of radioisotopes in biological science. Safety measures in handling isotopes. Radioimmunoassay and tracer studies. Molecular biology techniques - southern, northern and western blotting. DNA sequencing - Maxam and Gilbert and Sanger's methods. PCR, RAPD, RFLP, AFLP. DNA finger printing and DNA foot printing. Protein sequencing.

Unit IV

Principles, types and uses of chromatographic techniques - Basic concepts and instrumentation - Ion exchange chromatography, affinity chromatography, partition chromatography, paper and thin layer chromatography, gel permeation chromatography, gas chromatography. High performance liquid chromatography (HPLC), high performance thin layer chromatography (HPTLC). GC-MS, LC-MS.

Unit V

Electrophoresis - Principle, instrumentation, methods and applications of zone electrophoresis - capillary electrophoresis, paper electrophoresis, gel electrophoresis – native and SDS PAGE, agarose gel electrophoresis, isotachopheresis, isoelectric focusing and pulse field gel electrophoresis. Gel Doc system.

References

1. Nelson DL and Cox MM. Lehninger Principles of Biochemistry, 5th Edition, Freeman (2004).
 2. Wilson K and Walker J (Eds). Principles and Techniques of Biochemistry and Molecular Biology, 6th Edition, Cambridge University Press (2005).
 3. Voet D and Voet J. Biochemistry. 3rd Edition, Wiley International Edition (2004).
 4. Stryer L. Biochemistry, 4th Edition, W.H. Freeman Company, New York (1995).
 5. Plummer DT. An Introduction to Practical Biochemistry, 3rd Edition, Tata McGraw Hill (1988).
 6. Skoog DA, Holler FJ and Nieman TA. Principles of Instrumental Analysis, 5th Edition, Thomson Books/Cole (2005).
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COURSE-III: TEACHING AND LEARNING SKILLS

Objectives

- To develop skill for teaching and learning process.

Course Outcomes

At the end of the course, the student will be able to

- Obtain necessary knowledge of Computer system.
- Exhibit a knowledge base in **Communication skills**
- Differentiate the **Communication skills and Communication technology**.
- Explain the **Pedagogy** with teaching and learning techniques.
- Apply practically the knowledge acquired on definition, meaning and nature, types of teaching skills

Unit I: Computer application skills

Computer system: Characteristics, Parts and their functions - Different generations of computers, Operation of computers: Switching on/ off/ restart. Mouse control - Use of key board and some functions of key. Information and Communication Technology(ICT): Definition, Meaning, Features, Trends, Integration of ICT in teaching and learning - ICT applications using word processors, Spread sheets, Power point slides in the classroom - ICT for Research - Online journals, E-books, Courseware, Tutorials, Technical reports, Theses and Dissertations.

Unit II: Communication skills

Communication skills: Communications definitions - elements of communications, Sender, Message, Channels, Receiver, Feedback and Noise. Types of communication: Spoken and written, non-verbal communication, Intrapersonal, Interpersonal, Group and Mass Communication. Barriers to communication, mechanical, physical, linguistic and cultural. Skills of communication, listening, speaking, reading and writing - Methods of developing fluency in oral and written communication - style, diction, vocabulary. Class room communication and dynamics.

Unit III: Communication technology

Communication technology - Bases, trends and development skills of using communication technology - Computer Methods of teaching - Multimedia, E-content, satellite based communication - EDUSAT and ETV channels, Communication through web. Audio and Video applications on the Internet. Interpersonal communication through the web.

Unit IV: Pedagogy

Instructional technology: Definition, objectives and types. Difference between teaching and instruction. Lecture technique, steps, planning of a lecture, delivery of a lecture, narration in tune with the nature of different disciplines - Lecture with power point presentation, versatility of lecture technique, demonstration, characteristics, principles, planning, implementation and evaluation - Teaching and learning techniques - Team teaching, group discussion, seminar, workshop, symposium and panel discussion - Models of teaching: CAT, CMI and WBI.

Unit V: Teaching skills

Teaching skills - definition, meaning and nature, types of teaching skills. Skill of set induction, Skill of stimulus variation, Skill of explaining, Skill of probing questions, Skill of black board writing and Skill of closure, Integration of teaching skill and evaluation of teaching skill.

References

1. Bela Rani Sharma (2007), Curriculum Reforms and Teaching Methods, Sarup and sons, New Delhi.
2. Don Skinner (2005), Teacher Training, Edinburgh University Press Ltd., Edinburgh.
3. Information and Communication Technology in Education: A Curriculum for Schools and Programme of Teacher Development, Jonathan Anderson and Tom Van Weart, UNESCO, 2002.
4. Kumar K.I (2008) Educational Technology, New Age International Publisher, New Delhi.
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6. Michel D and William (2000) Integrating Technology into Teaching and Learning: Concepts and Applications, Prentice Hall, New York.
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COURSE-IV: BIOCHEMICAL PHARMACOLOGY

Objectives

- To understand and learn the concepts and methods for biopharmacological research.

Course Outcomes

At the end of the course, the student will be able to

- Learn the drug metabolic pathway, drug discovery and development process.
- Acquire knowledge in the anti-inflammatory drugs.
- Understand the pharmacotherapy, vitamins, vaccines and hypoglycemic drugs.
- Understand the anticancer drugs, antibiotics, antiviral and antimalarial substances.
- Acquire knowledge on drug resistance and drug addiction.

Unit I

Experimental approaches to the study of metabolism – Techniques for studying metabolic processes from whole organisms to cultured cells and organelles isolated by ultracentrifugation. Integration of metabolic pathways. Metabolism of xenobiotics – Fate of xenobiotics in organism, distribution of xenobiotics and biotransforming enzymes. Pharmacological and toxicological aspects of drug metabolism – Activation and deactivation of drugs, Contribution of drug metabolizing enzymes to mutagenesis, Carcinogenesis, Teratogenesis. Gene Therapy – Overview, Possibilities of viral vectors mediated gene therapy.

Unit II

Pharmacology - Types of drug transport in organism, Drug absorption, Distribution, Metabolism and elimination - General principles. Theories of the mechanism of drug action, Drug resistance and other factors affecting drug efficacy. Vasoactive drugs. Diabetes mellitus-treatment with oral hypoglycaemic agents. Antibacterial drugs, Antimycobacterial agents, Antiviral agents, Antifungal drugs, Antiparasitic drugs, Antimalarial drugs, Principles of chemotherapy, chemotherapeutic agents. Anticancer drugs. Drugs for pain and allergy.

Unit III

Toxicology – Mechanism of toxic effect, Chemical carcinogens and teratogens, Treatment of intoxication. Toxic agents - Toxic effects of metals, Toxic effects of solvents and Toxic effects of environmental pollutants, Responses of the liver and kidney to toxic agents. Bioassays for toxicity, Pathological and Histopathological examinations for toxicity. Preclinical toxicological studies. Calculation of LD₅₀ & ED₅₀. Acute, subacute and chronic toxicity studies.

Unit IV

Medicinal plants and phytochemicals - Bioactive principles in medicinal plants- Identification, Methods of extraction, Isolation, Separation and Screening. Chemical composition of plant body, Secondary metabolism and secondary metabolites, Biological and pharmacological activities of simple phenols and phenolic acids, flavonoids, tannins, terpenoids, steroids and alkaloids. Plant therapeutics: Plant antioxidants, Plants with Hepatoprotective, Nephroprotective, Hypoglycemic, Anticancer, Antibacterial, Antifungal, Antiviral and Antimalarial, Anti-inflammatory properties.

Unit V

Free radicals – Types, sources, importance and production, Disease caused by radicals, Reactive oxygen species. Antioxidant defence system. Enzymic antioxidants – Chemistry and Mechanism, antioxidant effects of superoxide dismutase, catalase, glutathione peroxidase. Non enzymic antioxidants – Sources and chemistry, Antioxidant effects of Vitamin A, C, and E, Glutathione and Selenium.

References

1. Methods of plant analysis and phytochemical analysis by J. B. Harborne, Chapman & Hall Ltd. 1973.
2. Kee, JL, Hayes ER and McCuiston LE. Study guide for pharmacology: A nursing process approach, Saunders, 5th edition, 2006.
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