



M.Phil. BIOCHEMISTRY (FT / PT) PROGRAMME

(For the candidates to be admitted from the academic year 2018-19 onwards)

Eligibility : Any life science at post graduate level.

PROGRAMME OBJECTIVES :

- The main aim of the course is to provide the student exposure on research field and train the students to perform any kind of experiments self.
- The course is highly able to provide the student all the basic and sophisticated molecular level techniques.
- The student will gain knowledge about publications and will be motivated to publish their project works in good journals.
- The course also provokes the students to come up with many research ideas and thus they can make a proposal for a project out of it.
- Students will have leadership quality. Students will learn how to teach any topic by using various methods of teaching.
- The most important objective of the course is to make “students with depth knowledge in the subject (Biochemistry).

PROGRAMME STRUCTURE

| Sem-ester | Course | Title of the Course | Exam. Hours | Credits | Marks | | |
|--------------|--------------|--|-------------|-----------|-------|----|------------|
| | | | | | IA | UE | Total |
| I | Course - I | Research Methodology | 3 | 4 | 25 | 75 | 100 |
| | Course - II | Biochemistry of Signal Transduction and Regulation | 3 | 4 | 25 | 75 | 100 |
| | Course – III | Teaching and Learning skills (Common Paper) | 3 | 4 | 25 | 75 | 100 |
| | Course - IV | Paper on Topic of Research (The syllabus will be prepared by the Guide and the examination will be conducted by the COE) | 3 | 4 | 25 | 75 | 100 |
| II | --- | Dissertation and Viva-Voce Viva Voce 50 marks Dissertation 150 marks | -- | 8 | -- | -- | 200 |
| Total | | | | 24 | -- | -- | 600 |

PROGRAMME OUTCOMES :

- Discuss basic knowledge of biochemistry as an evolving science.
- Apply concepts of chemistry to explain the properties of biological molecules.
- Demonstrate an understanding of basic concepts and design of metabolism.
- To understand how the metabolic activities of the cell is coordinately functioning inside the cell to provide energy for its survival.
- To understand the enzymes and how they catalyze reactions as well as enzyme kinetics.

- To understand the overall aspects of the integration of metabolic processes.
- The course is an in-depth examination of the structure and function of biomolecules: chemical and physical properties of proteins, carbohydrates, and lipids; enzyme kinetics and mechanisms; metabolism of carbohydrates, lipids, and amino acids and the metabolic relationships of organ systems.
- At the end of the course, students will understand how the chemical and physical properties of biological molecules influence their function.

COURSE I

RESEARCH METHODOLOGY

Course Objectives :

- Helps understand basic concepts of research and its methodologies
- To identify appropriate research topics and define appropriate research problem.
- Will learn to prepare a project proposal (to undertake a project) and research proposal (grants)
- To familiarise writing research report and thesis.
- To learn working principle on basic techniques.

UNIT I : RESEARCH

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. **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. **Research Report**: Types of reports - contents - styles of reporting - Steps in drafting reports- Editing the final draft evaluating the final draft.

UNIT II : DATA PRESENTATION AND STATISTICAL APPLICATIONS

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 & double graph paper in data representation. **Statistical applications in research** averages, standard deviation, standard error, analysis of variance, regression, coefficient of variation. levels of significance, Chisquare test, students test (t), ANOVA and Duncan's multiple range test.

UNIT III : BIOINFORMATICS

Biological Databases and Data Retrieval: Nucleotide (Genbank- EMBL- DDBJ)-Sequence submission Methods and tools (Sequin, Sakura, Bankit)- Sequence retrieval systems (Entrez & SRS)- Sequence File Formats and Conversion tools- Protein (Swiss-prot, PIR, Expasy)- Structural Databanks (PDB and NDB)- Protein Structure Classification (SCOP, CATH and FSSP)- Metabolic Pathway db (KEGG)- Specialized db (IMG, Rebase, COG). **Molecular Sequence Alignment**- Pair wise Alignment- Global Alignment- Local Alignment- Visual Alignment- Dynamic Programming- Heuristic approach- Scoring Matrices and Affine Gap costs- Database Search methods- Multiple Sequence Alignment methods. **Gene Prediction and Phylogenetic Analysis**: Gene structure in

Prokaryotes and Eukaryotes- Gene Prediction methods- Construction of Phylogenetic trees - Distance Methods- Maximum Parsimony Method- Maximum likelihood method. **Molecular Modeling 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. Molecular Dynamics.

UNIT IV : SEPARATION TECHNIQUES:

Chromatography: adsorption, partition, paper, thin layer, paper, cellulose derivatives affinity. **Electrophoresis:** Moving boundary, zone, starch gel, paper, cellulose derivatives Isotachopheresis, Isoelectro focusing, high voltage electrophoresis. PAGE: Preparation of native & denaturing polyacrylamide gels and separation of proteins. Preparation of PAGE gels for DNA sequencing. 2-D gel. Preparation of DNA fragments. Maxam and Gilbert and Sangers DNA sequencing methods. Generation of DNA sequence.

UNIT V : RECOMBINANT DNA TECHNOLOGY:

Generation of DNA fragment; Restriction and modification enzymes and their in generation DNA fragment. Restriction fragment polymorphism (RFLP); DNA finger printing; PCR Amplification; Chemical synthesis of DNA and c DNA synthesis. **Vectors:** Plasmids and Cosmid vectors. Promotor probe vectors; expression vector and vectors for cloning plants and Eukaryotes. **Cloning strategies:** Cloning of blunted and DNA fragments, use of DNA linkers; Homopolymer tailing. Cloning DNA fragments with cohesive end; Use of alkaline phosphatase. Introduction of cloned genes. Transformation, Transduction, Electroporation. Detection of recombination. Hybridization, Immunochemical techniques.

REFERENCE

1. Anderson, Durston, Polle (1970) Thesis and assignment writing Wil Eastern Limited
2. Research Methodology Methods and Statistical Techniques - Santosh Gupta
3. Biostatistical analysis. J.H.Zar, 4th edition. Pearson Education, Inc. India.
4. Braun, R.P. Introduction to instrumental analysis, McGrawHill.
5. Wilson & Walker, Principles and Techniques of Biochemistry and Molecular Biology .6th Edn, Cambridge Univ. Press.
6. Molecular cloning: Laboratory Manual – Maniatis, E.F. Fritsch and J. Sambrook
7. Genes V (1994) Benjamin Lewin
8. Molecular Biology of the Gene 4 th by Watson, Hopkins, Roberts, Steitz and Weiner
9. Biochemistry. Donald Voet and Judith Voet
10. Claverie. J. M, Notredame. C. Bioinformatics For, Wiley Publishing, Inc. 2003
11. Dan. E. Krane, Michael L. Raymer 1st ed. Fundamental concepts in Bioinformatics. Pearson Education. 2006.
12. Des Higgins. Bioinformatics Sequence, Structure databanks. Willie Taylor.

Course Outcomes :

- Understand and apply research approaches, techniques and strategies in the appropriate manner for managerial decision making.
- Demonstrate knowledge and understanding of data analysis and interpretation in relation to the research process.
- Develop necessary critical thinking skills in order to evaluate different research approaches utilised in the service industries.
- Students will be able to describe basic approaches to qualitative research.
- Students will be able to identify and critique articles based on different research methods.
- Students will be able to Write a research proposal suitable for submission to a research funding body.
- Students will be able to Choose appropriate quantitative or qualitative method to collect data.
- Design an appropriate mixed-method research study to answer a health-related research question.

COURSE II

BIOCHEMISTRY OF SIGNAL TRANSDUCTION AND REGULATION

Course Objectives :

- Helps to distinguish the key principles of biochemical metabolic concepts
- Students will learn the signalling pathways that will help them in further studies.
- Students grasp the basic need of the signalling molecules and the consequence on their absence.
- Students will be exposed to most of the actions of the biological system, which they will study in depth with signalling molecules.

Unit I

Regulation of transcription and translation in prokaryotes - Positive and negative control, repressor and inducer, concept of operon, lac-, gal-, ara-, trp operons, attenuation, regulons, regulation of translation - stringent response of rRNA synthesis. Regulation in eukaryotes- gene families, regulatory strategies in eukaryotes, gene alteration, regulation of synthesis of primary transcripts, hormonal control, transcription factors, transcription factors: targets of signaling pathways, DNA binding motifs in pro- and eukaryotes Helix turn, helix, zinc fingers, leucine zippers/ b zip, helix loop helix motifs. Regulation at the level of translation in eukaryotes.

Unit II

Signal transduction – definition, signals, ligands and receptors. Endocrine, paracrine and autocrine signaling. Sensory Transduction : Nerve impulse transmission – Nerve cells, synapses, reflex arc structure, Resting membrane potential, Nernst equation, action potential, voltage gated ion-channels, impulse transmission, neurotransmitters, neurotransmitter receptors, Synaptosomes, synaptogamin. Rod and cone cells in the retina, biochemical changes in the visual cycle, photochemical reaction and regulation of rhodopsin. Odor receptors. Chemistry of muscle contraction – actin and myosin filaments, theories involved in muscle contraction, mechanism of muscle contraction, energy sources for muscle contraction.

Unit III

Receptors and signaling pathways- cell signaling, cell surface receptors. G Protein coupled receptors- structure, mechanism of signal transmission, regulatory GTPases, heterotrimeric G proteins and effector molecules of G Proteins. Signaling molecules- cAMP, cGMP, metabolic pathways for the formation of inositol triphosphate from phosphatidyl inositol diphosphate, Ca²⁺, DAG and NO as signaling molecules, ryanodine and other Ca²⁺ receptors, phosphoregulation of inositol and the calcium channel activation. Ser/Thr-specific protein kinases and phosphatases. Receptor tyrosine kinases, Role of phosphotyrosine in SH2 domain binding. Signal transmission via Ras proteins and MAP kinase pathways.

Unit IV

Signaling by nuclear receptors- ligands, structure and functions of nuclear receptors, nuclear functions for hormones/metabolites - orphan receptors; cytoplasmic functions and crosstalk with signaling molecules, signaling pathway of the steroid hormone

receptors. Cytokine receptors- structure and activation of cytokine receptors, Jak-Stat path way, Janus kinases, Stat proteins.

Unit V

Regulation of the cell cycle- Overview of the cell cycle, cell cycle control mechanisms, Cyclin-dependent protein kinases (CDKs), regulation of cell cycle by proteolysis, G₁/S Phase transition, G₂/M Phase transition, cell cycle control of DNA replication, DNA damage check points.

Cancer, types of cancer, factors causing cancer-physical, chemical and biological agents. Errors in function of signal proteins and tumorigenesis. Oncogenes, proto-oncogenes and tumor suppressor genes. Tumor suppressor protein p53 and its role in tumor suppression. Tumor suppressor APC and Wnt/ β -Catenin signaling.

Recommended Books:

1. Molecular biology- David Freifelder, Narosa Publishing House Pvt. Limited, 2005.
2. Biochemistry of Signal Transduction and Regulation. 3rd Edition. Gerhard Krauss, 2003 WILEY-VCH Verlag GmbH & Co. KGaA, Weinheim ISBN: 3-527-30591-2.
3. Molecular Biology of the Cell, 4th edition, Bruce Alberts. New York: Garland Science; 2002. ISBN-10: 0-8153-3218-1 ISBN-10: 0-8153-4072-9.
4. Molecular Cell Biology, 4th edition, Harvey Lodish. New York: W. H. Freeman; 2000. ISBN-10: 0-7167-3136-3.
5. Principles of cell and molecular biology- Lewis Kleinsmith, 2nd edition, illustrated, HarperCollins, 1995.

Course Outcomes :

- Students can able to understand the function of specific anabolic and catabolic pathways and how these pathways are controlled and interrelated.
- Helps to distinguish the key principles of biochemical metabolic concepts.
- Students will learn the signaling pathways that will help them in further studies.
- Students grasp the basic need of the signaling molecules and the consequence on their absence.
- Students will be exposed to most of the actions of the biological system, which they will study in depth with signalling molecules.
- Students can able to understand the function of specific anabolic and catabolic pathways and how these pathways are controlled and interrelated.
- How current research has provided us with an understanding of the molecular basis of the control of metabolism.
- How to communicate scientific information effectively in writing Hypothesis-based experimental design.
- The course aims to give participants a basic knowledge of mechanisms of signal transduction and the significance of signal transduction in physiology and pathophysiology.

COURSE III

Teaching and Learning Skills

Course Objectives :

- Acquaint different parts of computer system and their functions.
- Understand the operations and use of computers and common Accessories.
- Develop skills of ICT and apply them in teaching learning context and Research.
- Appreciate the role of ICT in teaching, learning and Research.
- Acquire the knowledge of communication skill with special reference to its elements, types, development and styles.
- Understand the terms communication Technology and Computer mediated teaching and develop multimedia /e- content in their respective subject.
- Understand the communication process through the web.
- Acquire the knowledge of Instructional Technology and its Applications.
- Develop different teaching skills for putting the content across to targeted audience.

Unit I : Computer Application Skills

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: On-line journals, e-books, Courseware, Tutorials, Technical reports, Theses and Dissertations-- **ICT for Professional Development**: Concept of professional development; institutional efforts for competency building; individual learning for professional development using professional networks, OERs, technology for action research, etc.

Unit II : Communications Skills

Communication: Definitions – Elements of Communication: Sender, Message, Channel, 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 & Cultural – Skills of communication: Listening, Speaking, Reading and Writing – Methods of developing fluency in oral and written communication – Style, Diction and Vocabulary – Classroom communication and dynamics.

Unit III : 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-learning Techniques: Team Teaching, Group discussion, Seminar, Workshop, Symposium and Panel Discussion.

Unit IV : E- Learning, Technology Integration and Academic Resources in India

Concept and types of e-learning (synchronous and asynchronous instructional delivery and means), m-learning (mobile apps); blended learning; flipped learning; E-learning tools (like LMS; software's for word processing, making presentations, online editing, etc.); subject specific tools for e-learning; awareness of e-learning standards- Concept of technology integration in teaching- learning processes; frameworks guiding technology integration (like TPACK; SAMR); Technology Integration Matrix- Academic Resources in India: MOOC, NMEICT; NPTEL; e-pathshala; SWAYAM, SWAYAM Prabha, National academic depository, National Digital Library; e-Sodh Sindhu; virtual labs; eYantra, Talk to a teacher, MOODLE, mobile apps, etc.

Unit V : Skills of Teaching and Technology based assessment

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 Skills – Evaluation of Teaching Skills- **Technology for Assessment:** Concept of assessment and paradigm shift in assessment; role of technology in assessment 'for' learning; tools for self & peer assessment (recording devices; e-rubrics, etc.); online assessment (open source software's; e-portfolio; quiz makers; e- rubrics; survey tools); technology for assessment of collaborative learning like blogs, discussion forums; learning analytics.

References

1. Bela Rani Sharma (2007), Curriculum Reforms and Teaching Methods, Sarup and sons, New Delhi
2. Brandon Hall , E-learning, A research note by Namahn, found in: www.namahn.com/resources/.../note-e-learning.pdf, Retrieved on 05/08/2011
3. Don Skinner (2005), Teacher Training, Edinburgh University Press Ltd., Edinburgh
4. Information and Communication Technology in Education: A Curriculum for schools and programmed of Teacher Development, Jonathan Anderson and Tom Van Weert, UNESCO, 2002.
5. Jereb, E., & Šmitek, B. (2006). Applying multimedia instruction in e-learning. Innovations in Education & Teaching International, 43(1), 15-27.
6. Kumar, K.L. (2008) Educational Technology, New Age International Publishers, New Delhi.
7. Learning Management system : https://en.wikipedia.org/wiki/Learning_management_system , Retrieved on 05/01/2016
8. Mangal, S.K (2002) Essential of Teaching – Learning and Information Technology, Tandon Publications, Ludhiana.
9. Michael, D and William (2000), Integrating Technology into Teaching and Learning: Concepts and Applications, Prentice Hall, New york.

10. Pandey, S.K (2005) Teaching communication, Commonwealth Publishers, New Delhi.
11. Ram Babu, A abd Dandapani, S (2006), Microteaching (Vol.1 & 2), Neelkamal Publications, Hyderabad.
12. Singh, V.K and Sudarshan K.N. (1996), Computer Education, Discovery Publishing Company, New York.
13. Sharma, R.A., (2006) Fundamentals of Educational Technology, Surya Publications, Meerut
14. Vanaja, M and Rajasekar, S (2006), Computer Education, Neelkamal Publications, Hyderabad.

Course Outcomes

After completing the course, the students will:

- Develop skills of ICT and apply them in Teaching Learning context and Research.
- Be able to use ICT for their professional development.
- Leverage OERs for their teaching and research.
- Appreciate the role of ICT in teaching, learning and Research.
- Develop communication skills with special reference to Listening, Speaking, Reading and Writing.
- Learn how to use instructional technology effectively in a classroom.
- Master the preparation and implementation of teaching techniques.
- Develop adequate skills and competencies to organize seminar / conference / workshop / symposium / panel discussion.
- Develop skills in e-learning and technology integration.
- Have the ability to utilize Academic resources in India for their teaching.
- Have the mastery over communication process through the web.
- Develop different teaching skills for putting the content across to targeted audience.
- Have the ability to use technology for assessment in a classroom.
