



BHARATHIDASAN UNIVERSITY, TIRUCHIRAPPALLI – 620 024

M.Phil. BIOCHEMISTRY [FT / PT] Programme

(For the candidates to be admitted from the academic year 2009-2010 onwards)

Semester I	Title of the Course	Marks			Credits
		IA	UE	Total	
Course -I	Research Methodology	40	60	100	4
Course - II	Biochemistry of Signal Transduction and Regulation	40	60	100	4
Course- III	Paper on Topic of Research (Guide will prepare the syllabus and it will be sent to the COE)	40	60	100	4
Course – IV	Teaching and Learning skills (Common Paper)	40	60	100	4
Semester II					
	Dissertation and Viva-Voce Viva Voce 50 marks Dissertation 150 marks	--	--	200	8

For each Course other than the Dissertation

Continuous Internal Assessment	– 40 Marks
End Semester Examination	– 60 Marks
Total	– 100 Marks

Question paper pattern for Course I - III

10 questions compulsory	10 x 01 = 10 Marks (2 from each unit)
5 questions	05 x 04 = 20 Marks (either or type, one from each unit)
3 questions from 5	03 x 10 = 30 Marks (one question from each unit)

Total 60 Marks

Question paper pattern for Course IV

5 Questions	05 x 12 = 60 Marks (either or type, one from each unit)
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CIA components

Tests (2x10)-	20 Marks
Term Paper –	10 Marks
Seminar -	10 Marks

COURSE I - RESEARCH METHODOLOGY

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 uncan's new 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 (IMGT, 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- Drugreceptor N interactions- Structure-Activity Relationships.

UNIT-IV

TECHNIQUES 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. 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.

4. Molecular cloning: Laboratory Manual – Maniatis, E.F. Fritsch and J. Sambrook
5. Genes V (1994) Benjamin Lewin
6. Molecular Biology of the Gene 4 th by Watson, Hopkins, Roberts, Steitz and Weiner
7. Biochemistry Donald Voet and Judith Voet
8. Claverie. J. M, Notredame. C. Bioinformatics For, Wiley Publishing, Inc. 2003
9. Dan.E.Krane, Michael L. Raymer 1st ed. Fundamental concepts in Bioinformatics.
Pearson Education. 2006.
10. Des Higgins. Bioinformatics Sequence, Structure databanks. Willie Taylor

COURSE II - BIOCHEMISTRY OF SIGNAL TRANSDUCTION AND REGULATION

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, Ca^{2+} , DAG and NO as signaling molecules, ryanodine and other Ca^{2+} 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
- 2) Biochemistry of signal transduction and regulation – Gerhard Krauss.
- 3) Molecular biology of the cell- Alberts
- 4) Molecular cell biology- Lodish

Principles of cell and molecular

COURSE -IV - TEACHING AND LEARNING SKILLS

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

Computer system: Characteristics, Parts and their functions – Different generations of Computer – Operation of Computer: 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: On-line journals, e-books, Courseware, Tutorials, Technical reports, Theses and Dissertations

Unit II – Communication 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 – Communication Technology

Communication Technology: Bases, Trends and Developments – Skills of using Communication Technology – Computer Mediated 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 – Learning Techniques: Team Teaching, Group discussion, Seminar, Workshop, Symposium and Panel Discussion – Models of teaching: CAI, CMI and WBI

Unit V – Teaching Skills

Teaching skill: 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

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 Publishers, New Delhi
5. Mangal, S.K. (2002) Essential of Teaching – Learning and Information Technology, Tandon Publications, Ludhiana
6. Michael D. and William (2000), Integrating Technology into Teaching and Learning: Concepts and Applications, Prentice Hall, New York
7. Pandey S.K. (2005) Teaching Communication, Commonwealth Publishers, New Delhi
8. Ram Babu A. and Dandapani S (2006) Microteaching (Vol.1&2) Neelakamal Publications, Hyderabad
9. Singh V.K. and Sudarshan K.N. (1996) Computer Education, Discovery Publishing Company, New York
10. Sharma R. A. (2006) Fundamentals of Educational Technology, Surya Publications, Meerut
11. Vanaja. M. and Rajasekar S. (2006) Computer Education, Neelkamal Publications, Hyderabad.
