

Syllabus for M. Phil., Biotechnology



PG & Research Department of Biotechnology
THANTHAI HANS ROEVER COLLEGE
Autonomous and affiliated to Bharathidasan University, Trichy
Nationally accredited by NAAC
Perambalur – 621 212



THANTHAI HANS ROEVER COLLEGE (Autonomous)

Perambalur – 621 212

M. Phil. Biotechnology – Course Structure under CBCS

(applicable to the candidates admitted from the academic year 2022-2023 onwards)



	Course and Subject code	Title of the course	Marks			Credit
			IA	UE	Total	
Semester I	Course I (22MPBT1CC1)	Research methodology	40	60	100	4
	Course II (22MPBT1CC2)	Advances in Biotechnology	40	60	100	4
	Course III (22MPBT1CC3)	Teaching and Learning skills	40	60	100	4
	Course IV (22MPBT1CC4)	Paper on topic of research (Guide will prepare the syllabus and it will be sent to the COE)	40	60	100	4
Semester II	22MPBTPW	Dissertation and Viva-Voce (Viva-Voce – 50 and 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)
---------------------	---	---

CIA components

Tests (2x10)	=	20 Marks
Term Paper	=	10 Marks
Seminar & Assignment	=	10 Marks

Semester: I
Hours: 4

Course Code: 22MPBT1CC1
Credit: 4

COURSE –I: Research Methodology

Objectives

- To enable the research scholars understand the basic concepts of research methods.
- To expose the research scholars have thorough knowledge on Research.

UNIT - I

Introduction to research methodology-What is research? -Basic and applied research-Essential steps in research- Defining the research problem- Research/Experimental design- Literature collection- Literature citation- Research report: components Format of thesis and dissertation - Manuscript/research article-Review monographs -Bibliography and Reference -Significance of research.-Ethical issues of research

UNIT - II

Biophysical Methods- Scope of biophysics-Analysis of biomolecules using UV/Visible-Fluorescence - IR spectroscopy-IR scopy- uses-Circular dichroism - NMR and ESR spectroscopy -Structure determination using x-ray diffraction and NMR -Analysis using light scattering -GCMS-GCMS application-Different type of mass spectrometry and surface plasma resonance methods -Radiolabeling techniques Properties of different types of radioisotopes normally used in biology their detection and measurement - Incorporation of radioisotopes in biological tissues and cells - Molecular imaging of radioactive material safety guidelines.

UNIT - III

Microscopic Techniques -Visualization cells and subcellular components by light microscopy, Resolving powers of different microscopes -Microscopy of living cells -Electron microscope-Flourescence microscope-Scanning and transmission microscopes -Different fixation and staining techniques for EM - Freeze-etch and freeze-fracture methods for EM -Image processing methods in microscopy -Histochemical and Immunotechniques Antibody generation - Detection of molecules using ELISA, RIA, western blot –Immunoprecipitation – Monoclonal antibody-Hybridoma technology-Flowcytometry-immunofluorescence microscopy -Detection of molecules in living cells -In situ localization such as FISH and GISH.

UNIT - IV

Electrophysiological Methods -Single neuron recording - Patch clamp recording -ECG-Brain activity recording -Lesion and stimulation of brain -Pharmacological testing PET MRI -fMRI CAT -Computational methods- Nucleic acid and protein sequence database- data mining methods for sequence analysis- web based tools for sequence searches motif analysis and presentation.

UNIT - V

Statistical Methods -Applications of statistical methods-Measures of central tendency and dispersal -Probability distributions (Binomial, Poisson and normal)- Sampling distribution -Difference between parametric and non-parametric statistics -Confidence interval -Errors Levels of significance-Regression and correlation; T test; analysis of variance -X² test -Basic introduction to Multivariate statistics, etc.,

References

1. C.R. Kothari, IInd edition (2004) Research methodology, Methods and techniques, New Age International (P) Ltd, Publishers, New Delhi.
2. Jerrod H. Zar (1999) Biostatistical analysis by, Prentice Hall International, Inc. Press, London.
3. Attwood. T.K and Parry-Smith D.J. (2002) Introduction to Bioinformatics, Pearson education Singapore.
4. Sharma.BK.Instrumental methods of chemical analysis.
5. Upadhyay, Upadhyay and Nath, Biophysical chemistry.
6. KhandpurR.S. Handbook of biomedical instrumentation, Tata Mc GrawHill.
7. Brigal.L.Williams,A biologist guide to principle and techniques of practical biochemistry.

Semester: I
Hours: 4

Course Code: 22MPBT1CC2
Credit: 4

COURSE –II: Advances in Biotechnology

Objectives

- To enable the research scholars to understand current advances in Biotechnology.
- To expose the research scholars have thorough knowledge on genetic engineering, animal, plant, Microbial and Nano Biotechnology applications.

UNIT- I

Plant Biotechnology-Applications of plant biotechnology-Production of transgenic plants tolerant to biotic stresses-Genetically improved crops(Golden rice)-Bt and Terminator - Technology Protecting Systems (GURTs)-Clean GeneTechnology-Gene silencing Anti Sense RNA technology (FlavrSavr)-RNAinterference-Production technology for Plantigens-Plantibodies-Food vaccines-Bioplastics.

UNIT- II

Animal Biotechnology-Scope of animal biotechnology-Animal cell cultures-Primary & Continuous cell lines-Animal Virus derived vectors SV-40&Baculovirus-Expression vectors - GST and pET-based vectors-Protein purification -Histag GSTtag MBPtag-Inclusion bodies-Transgenic mice, fish and sheep-Hybridomatechnology-Recombinant vaccines production-Gene therapy-Stem cell technology -Somatic cell-Nuclear transfer-Xeno transplantation.

UNIT- III

Microbial Biotechnology-Scope and techniques-Importance of microbial technology-Selection and improvement of strains for biomass production-Production of recombinant proteins-Enzymes and vaccines in microbes-Bioprospecting ofMicrobial diversity- Bioweapons and Bioshields-Direct Mutagenesis-Protein engineering-Principle of microbial reaction engineering and novel metabolites-Uses of GeneticallyEngineered Microbes in Agriculture, Industries and Medicine.

UNIT- IV

Nanobiotechnology-Carriers for Drug Delivery-Overview of nano technology-Nano carriers-Liposomes-Cubosomes-Hexosomes-Virosomes-ViruslikeNanoparticles-Microbial Nanoparticles Magnetosomes and Bacteriorhodopsins-Nanoparticles for Biomedical Imaging-Immuno fluorescent -

biomarker Immunogoldlabeling-Iron oxide nanoparticles for Magnetic Resonance Imaging (MRI)-Nanosphere-Nanocapsule-Applications of Nanobiotechnology – Biochips, Nucleic acid nanoparticles-Nanobods-Nanowire-Nanotubes and Nanorods-Fullerenes for Drug Delivery.

UNIT- V

Ethical Issues in Biotechnology-Biosafety -Biosafety cabinet-Biosafety cabinet types-Biosafety for human health and environment. Social and ethical issues of biosafety-Use of genetically modified organisms (BT cotton and BT brinjal) and their release into the environment-Special procedures for r DNA based products-Intellectual property rights, -patenting (Process and Product)-Bioethics - Ethical issues of Synthetic biology-Nanobiotechnology.

References

1. Glick BR and Pasternak JJ. 2010. Molecular Biotechnology: Principles and applications of recombinant DNA, 4thEd. ASM Press, Washington, USA.
2. Watson JD *et al.*, 2007. Recombinant DNA: Genes and Genomes- a short course. 3rdEd. Cold Spring Harbor Laboratory Press, CSHL, New York, USA.
3. Brown TA. 2010. Gene cloning and DNA Analysis- An Introduction, 6thEd. Blackwell Science Ltd. Oxford, UK.
4. Satish MK. 2008. Bioethics and Biosafety. I K International Publishing House Pvt Ltd, India.
5. Deepa Goel and Shomini Parashar. 2013. IPR, Biosafety and Bioethics. 1st Ed. Pearson Education, India

Semester I
Hours:4

Course Code: 22MPB1CC4
Credit: 4

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.
- 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 communication process through the web

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 Online journals, ebooks, 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.

Semester:I

Course Code: 22MPBT1CC4

Hours: 6

Credit: 4

CORE COURSE-I: BIOMOLECULES

Objectives

- To know about Bio-molecules
- To understand the metabolic pathway of bio molecules.
- To know about structure, properties and functions of bio molecules.

UNIT - I

Carbohydrates - Properties and biological importance of ribose, deoxyribose, glucose, fructose, galactose, lactose, maltose, sucrose, starch, glycogen, cellulose and chitin - Biomolecule metabolism concepts-Carbohydrate metabolism-glycolysis, gluconeogenesis, HMP Shunt, TCA Cycle. ETC(Mitochondria) -arrangement of electron carriers in the electron transport chain, Oxidative phosphorylation (Chemiosmotic theory)-Fate of pyruvate in aerobic and anaerobic condition.

UNIT - II

Lipids -Definition and classification of lipids -Lipid metabolism concepts-Fatty acids-classification, structure and properties-Structure and biological functions of phospholipids, sphingolipids, glycolipids. Steroids. Structure, properties, functions of cholesterol, sex hormones, bile acids, phytosterols and cytosterol-Membrane composition and structure, Fatty acid oxidation. -Regulation of fatty acid metabolism, Ketone bodies.

UNIT - III

Proteins and Aminoacids - Biological significance-Structure of Proteins-primary,secondary, tertiary and quaternary -Ramachandran plot. -Classification of protein-based on solubility, shape, composition function. Globular proteins. - Hemoglobin and myoglobin-Fibrous proteins- keratin and collagen-Properties of proteins in aqueous solutions: Isoelectric pH, electrophoretic mobility, hydrolysis of proteins, denaturation and renaturation of proteins, protein stability and protein

folding.-Biosynthesis of amino acids-Amino acid deamination-transamination, oxidative deamination; urea cycle & its regulation.

UNIT - IV

Nucleic acid and Vitamins - Structure of Purines, Pyrimidines, nucleosides and nucleotides -DNA double helical structure. A,B and Z forms of DNA-Structure of RNA. RNA- types and biological role -Vitamins classification and Functions.

UNIT - V

Inborn error metabolism -Disorders of carbohydrate metabolism-Glycogen storage disease -Disorders of amino acid metabolism- Phenylketonuria-maple syrup urine disease -Albinism and Alkaptonuria-Disorders of fatty acid oxidation and mitochondrial metabolism-Medium chain acyl coenzyme A -dehydrogenase deficiency -Disorders of purine and pyrimidine metabolism-Lesch-Nyhan syndrome -Lysosomal storage disorders-Gaucher's disease, Niemann Pick disease.

Text Books

1. Nelson, D.L., Cox, M.M. 2008. Lehninger Principles of Biochemistry, 5th Edition. W.H.Freeman and Company, USA.
2. Stryer, L. 2000. Biochemistry, 4th Edition. W.H. Freeman and Company, New York.
3. Voet, D and Voet, J.G. 2012. Biochemistry, 4th Edition. John Wiley&Sons Publishers

References

1. A.L. Lehninger- D.L. Nelson and M.M Cox (2003) - Principles of Biochemistry - Worthpublishers- New York.
2. L. Stryer- (2002) - Biochemistry- W.H. Freeman and Co. New York.
3. C. Branden J.Tooze. (1999)- Introduction to protein structure – Publishing Inc.
4. Thomas Devlin (2002) - Textbook of Biochemistry by John publishers.
5. Voet and Voet - Principles of Biochemistry
6. Van Holde and Mathew- Principles of Biochemistry.