**CENTRE FOR MEDICAL BIOTECHNOLOGY**
**M. D. UNIVERSITY, ROHTAK**

## PROGRAM ARCHITECTURE, DURATION, SCHEME OF EXAMINATION, WORKLOAD/WEEK AND CREDITS

### Ph.D. Course-Work in Medical Biotechnology

**Duration:** One Semester (Six Months)

**Total Credit requirement:** 14 Credits

**Program Structure: Ph.D. in Medical Biotechnology**

**Program Specific Outcomes (PSO): The students upon completion of Ph.D. coursework in Medical Biotechnology will be able to:**

**PSO1:** Disseminate their ideas scholarly to the audiences.
**PSO2:** Learn about latest techniques related to their research work and plan quality innovative research in Medical Biotechnology
**PSO3:** Identify valid approaches to scientific problem solving and reporting.
**PSO4:** Enhance their analytical ability and data interpretation skills that will make them fit for various sectors of Medical Biotechnology.

| Course code | Nomenclature of Course | Theory marks (end semester examination) | Internal assessment Marks | Maximum Marks | Hours /week | Credits |
|---|---|---|---|---|---|---|
| 20MBTPH11C1 (Compulsory for all Ph.D. Course work) | Research Methodology | 80 | 20* | 100 | 4 | 4 |
| **20MPCC1** (Compulsory for all Ph.D. Course work) | Research and Publication Ethics | 40 | 10** | 50 | 2 | 2 |
| 20MBTPH11C3 | Techniques in Medical Biotechnology | 80 | 20* | 100 | 4 | 4 |
| 20MBTPH11C4 | Trends in Medical Biotechnology | 80 | 20* | 100 | 4 | 4 |
| **Total Marks/Credit** | | | | **350** | | **14** |

**Note: The compulsory course on "Research and Publication Ethics" shall be offered by Ch. Ranbir Singh Institute of Social and Economic Change for all UTDs/Centres/Institutes passed vide Resolution No. 27of the 271st meeting of EC held on 29.07.2020.**

***Internal Assessment:**
Two assignments of 5 marks each,
Two presentations of 5 marks each
****Internal Assessment:**
One assignment of 5 marks,
One presentation of 5 marks

## Ph.D. Course-Work Syllabus

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| **Name of the Program** | Ph.D. Course-Work in Medical Biotechnology | **Program Code** | MBTPH |
| **Name of the Course** | Research Methodology | **Course Code** | 20MBTPH11C1 |
| **Hours/Week** | 4 | **Credits** | 4 |
| **Max. Marks.** | 80 | **Time** | 3 Hours |

**Note:** The examiner has to set a total of nine questions (two from each unit and one compulsory question consisting of short answer from all units. The candidate has to attempt one question each from each unit along the compulsory question (5 x 16 = 80 marks).

**Course Objectives:**

1. Students will be able to understand some basic concepts of research and its methodologies.
2. Students will learn about how to design an experiment and research hypothesis.
3. Students will learn about how to identify appropriate research topics pertaining to need of Medical Biotechnology sector.
4. Students will learn about how to conduct research in appropriate and effective manner so that they can get recognition globally.
5. After completion of course student will learn about various evaluation parameters of a good research.

**Course Outcomes:**

1. Students will be able to identify the research problem so that they can design their experiments independently.
2. Students will be able to formulate and test their research hypothesis.
3. Students will be able to use various statistical tools for data analysis and interpretation.
4. Students will be able to write their research articles, reports, thesis and research grant proposal.
5. Students will be able to present their research achievements at various platforms.

**Unit - I**

Meaning of Research, Objectives of Research, and Characteristics of Research, Types of Research, Types of research approaches, and Criteria of Good Research. Methods of Research process and Difficulties in Biological research; Identification of Research problem, defining and delimiting Research problem. Research hypothesis: Null and alternate hypothesis Characteristics of good Hypothesis. Objective of hypothesis, formulation of hypotheses-directional and non-directional hypotheses.

**Unit - II**

Experimental design: Meaning, concept need and characteristics of good experimental design, Basic principles of Experimental Design, types of experimental design. Qualitative and Quantitative Research – Concept of measurement, causality, generalization, replication.

Components of a Research Paper/report: Abstract, Introduction, Review of literature, Methodology, Discussion, Conclusion and references. Reference styles and formatting; Significance of writing research papers and review articles; Major scientific publishers and criteria to choose publisher.

**Unit - III**

Sampling: Concepts of Statistical Population, Sample, Sampling Frame, Sampling Error, Sample Size, Non Response. Characteristics of a good sample. Probability Sample – Simple Random Sample, Systematic Sample, Stratified Random Sample & Multi-stage sampling. Determining size of the sample; Analysis of research data: Mean, Mode and Median Standard deviation, Standard error, Co-efficient of variation, probability distributions, 't' and 'z' test; level of significance; Chi-square tests, Analysis of Variance, Correlation and Regression analysis. Statistical software for analysis of research data.

**Unit - IV**

I

PR- intellectual property rights and patent law, commercialization, copy right, royalty, trade related aspects of intellectual property rights (TRIPS); Introduction to ethics and ethical committee, function and responsibility of ethical committee. Social and ethical issues related to biological experiments; Biosafety containment facilities, biohazards, Biosafety for human health, designing and management of laboratory and culture room as per the norm of GLP, GMP and FDA.

**References:**


1. Garg, B.L., Karadia, R., Agarwal, F. and Agarwal, U.K. (2002). An introduction to Research Methodology. RBSA Publishers.
2. Kothari, C.R. (1990). Research Methodology: Methods and Techniques. New Age International.
3. Sinha, S.C. & Dhiman, A.K. (2002). Research Methodology, Ess Ess Publications.
4. Wadehra, B.L. (2000). Law relating to patents, trade marks, copyright designs and geographical indications. Universal Law Publishing.
5. Sateesh, M.K. (2008). Bioethics & Biosafety. I K International Publishing House Pvt. Ltd.
6. Cox, P; Scott, B. Rae. (1999). Bioethics: Christian Approach In A Pluralistic World (Critical Issues In Bioethics). Eerdmans Publishing Co.

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| **Name of the Program** | Ph.D. Course-Work in Medical Biotechnology | **Program Code** | MBTPH |
| **Name of the Course** | Research and Publication Ethics | **Course Code** | 20MPCC1 |
| **Hours/Week** | 2 | **Credits** | 2 |
| **Max. Marks.** | 40 | **Time** | 2 Hours |

**Note:** The examiner has to set a total of five questions (two from each unit and one compulsory question consisting of short answer from all units. The candidate has to attempt any three questions out of four along with compulsory question.

**Course Objectives:**

1. To sensitize the students about concept of philosophy.
2. To aware students about ethics related to scientific research.
3. To sensitize student about publication misconduct and plagiarism.
4. To aware students about various index parameter to access quality of journal/publisher.
5. To create awareness about various practices and guidelines to be followed during publications.

**Course Outcomes:**

1. Students will be able to learn about ethics in research and publication.
2. Students will be able to identify research misconduct and predatory journals.
3. Students will be able to use plagiarism software's and open access publications.
4. Students will be able to learn the use of databases and calculation of research metrics.
5. Student will be able to learn concept of copyright, authorship and contributor ship.

**Unit - I**

Introduction to philosophy: definition, nature and scope, concept, branches; Ethics: definition, moral philosophy, nature of moral judgments and reactions; Ethics with respect to science and research; Intellectual honest and research integrity; Scientific misconducts: falsification, fabrication, and plagiarism; Redundant publications: duplicate and overlapping publications, salami slicing; Selective reporting and misrepresentation of data; Violation of publication ethics, copyright, authorship and contributor ship; Identification of publication misconduct, complaints and appeals.

**Unit - II**

Publication ethics: definition, introduction and importance; Best practices/standards setting initiatives and guidelines: COPE, WAME, etc.; Publication misconduct: definition, concept, problems that lead to unethical behavior and vice-versa, types; Conflicts of interest; Predatory publishers and journals; Use of plagiarism software's; Open access publications and initiatives; Indexing databases; Citation databases: Web of Science, Scopus; Research Metrics: Impact Factor of journal as per journal citation report, SNIP, SJR, IPP, Cite Score; h-index, g index, i10 index, altmetrics.

**References:**


1. MacIntyre, A.(1967). A Short History of Ethics. London.
2. Chaddah, P. (2018). Ethics in Competitive Research: Do not get scooped; do not get plagiarized.

3. Resnik, D.B. (2011). What is ethics in research and why is it important. National Institute of Environmental Health Sciences.
4. Beall, J. (2012). Predatory publishers are corrupting open access. Nature.
5. Indian National Science Academy (INSA). (2019). Ethics in Science Education, Research and Governance

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| **Name of the Program** | Ph.D. Course-Work in Medical Biotechnology | **Program Code** | MBTPH |
| **Name of the Course** | Techniques in Medical Biotechnology | **Course Code** | 20MBTPH11C3 |
| **Hours/Week** | 4 | **Credits** | 4 |
| **Max. Marks.** | 80 | **Time** | 3 Hours |

**Note:** The examiner has to set a total of nine questions (two from each unit and one compulsory question consisting of short answer from all units. The candidate has to attempt one question each from each unit along the compulsory question (5 x 16 = 80 marks).

**Course Objectives:**

1. Students will be able to learn about concept of various bio-analytical techniques in Medical Biotechnology research.
2. Students will be able to handle various bio-analytical techniques pertaining to need of Medical Biotechnology sector.
3. To train students so that they can handle and optimize the experimental conditions of various bio-analytical techniques.
4. To prepare students for high quality research in the field of Medical Biotechnology & related field
5. Students will be able to sharpen their bio-analytical skills that will help them come up with innovative diagnostic ideas.

**Course Outcomes:**

1. Students will be able to explain the general principle and the uses of molecular biology techniques such Gel electrophoresis, PCR and blotting in protein and nucleic acid analysis.
2. Students will be able to explain the different types of Immunological and cytogenetic methods and their diagnostic applications.
3. Students will be able to explain the different types of chromatography, centrifugation techniques and their applications.
4. Students will be able to explain how we can analyze biological systems using underlying principles of various spectroscopic and radioisotopes techniques.
5. After completion of course, students will be able to prepare themselves for research and development sector of Medical Biotechnology.

**Unit - I**

Electrophoresis; AGE, PAGE, 2-D gel electrophoresis, Capillary electrophoresis, Blotting techniques (Northern, Southern and western blotting), Nucleic acid amplification methods and types of PCR: Reverse Transcriptase-PCR, Real- Time PCR, Inverse PCR, Multiplex PCR, Nested PCR, Touchdown PCR, Hot-start, *In- situ* PCR, Colony PCR Assembly-PCR; SNP

Genotyping methods.

**Unit - II**

Hybridoma Technology, Chromosome banding: Karyotyping, spectral karyotyping (SKY); FISH, and comparative genomic hybridization (CGH); Histochemical and immunotechniques: Antibody generation, detection of molecules using ELISA, RIA, Immunoprecipitation, Immunofluorescence microscopy, Immunoelectrophoresis, Flow Cytometery.

**Unit - III**

Chromatography Thin layer, Gel-filtration, ion-exchange, Affinity chromatography, Gas liquid chromatography, High pressure liquid chromatography (HPLC); Reversed Phase chromatography, Hydrophobic interaction chromatography; Microscopy: Electron microscopes, Scanning probe microscope, Fluorescent microscope, Stereo microscope, Confocal microscope, Atomic Force microscope.

**Unit - IV**

Introduction to principles and applications of (a)Spectroscopic methods (UV, Vis, IR, Fluorescence, ORD, CD, & PAS) (b)NMR, ESR & Mass spectrometry, Use of radioactive and stable isotopes and their detection in biological systems. Different types of centrifugation and their applications.

**References:**


1. Richard, E. Venn. (Eds.). (2003). Principal and Practice of Bio analysis. Taylor and Francis.
2. Walker, J. & Wilson, K. (2000), Principles and Techniques-Practical Biochemistry, 5th edition. (Eds.), Cambridge University Press, London.
3. Freifelder, D. (1982). Physical Biochemistry – Application to Biochemistry and Molecular Biology, 2nd Edition. W.H. Freeman and Company, San Fransisco.
4. Slater, R.J. (1990). Radioisotopes in Biology-A Practical Approach. Oxford University Press, New York.
5. Upadhayaye, A; Upadhyaye, K. & Nath N. (2002). Biophysical Chemistry: Principles & Techniques. Himalaya Publication House, New Delhi.

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| **Name of the Program** | Ph.D. Course-Work in Medical Biotechnology | **Program Code** | MBTPH |
| **Name of the Course** | Trends in Medical Biotechnology | **Course Code** | 20MBTPH11C4 |
| **Hours/Week** | 4 | **Credits** | 4 |
| **Max. Marks.** | 80 | **Time** | 3 Hours |

**Note:** The examiner has to set a total of nine questions (two from each unit and one compulsory question consisting of short answer from all units. The candidate has to attempt one question each from each unit along the compulsory question (5 x 16 = 80 marks).

**Course Objectives**

1. To make student aware about various essential areas of Medical Biotechnology.
2. Students will be able to learn about concept of virology and its significance concerning to health sector.
3. Students will be able to learn about various cell culturing methods and their applications in therapeutics.
4. Students will be able to learn about human genome organization & that will help them to discover underlying mysteries of the genome.
5. Students will be able to learn about various Bioinformatics resources and their applications in Medical Biotechnology.

**Course Outcomes:**

1. Students will be able to understand basic differences between different forms of viruses and their mode of pathogenesis
2. Students will be able to understand different types of stem cells and their applications in the field of medical biotechnology
3. Student will be able to learn about how we can make use computational tools for the prediction about various putative target for genetic disorders.
4. Better understanding of human genome will allow students to come up with innovative diagnostic ideas.
5. After completion of course students will be able to apply their knowledge in identifying potential research problems and their solutions.

**Unit - I**

Maintenance and handling of laboratory animals and requirements of virological laboratory; Cultivation and purification of viruses; estimation of yields, methods for purification. Virus Group Clinical features, epidemiology, diagnosis and treatment of following viral group: Viral Haemorrhagic Fevers (Dengue & Chikungunya), Viral Encephalitis (JEV & WNV), Viral Enteric Diseases (Rota virus & Norovirus). antiretrovirals - mechanism of action and drug resistance. Modern approaches of virus control.

**Unit - II**

Animal cell culture: Primary and established cell line cultures; Basic biology of stem cells; Types & sources of stem cells, Blood cell formation from Bone marrow stem cells, Isolation & characterizations of stem cells, Cancer stem cells, Induced pluripotent stem cells: Molecular basis Pluripotentency and its applications,, Stem cell banking, Stem cell niches, Stem cell

renewal, Cell cycles regulators in stem cells. Therapeutic application of stem cells. . Ethical and Legal issues of human stem cell research.

**Unit - III**

Organization of human genome, Molecular markers - RFLPs, SSLPs, SNPs; STSs, ESTs , Genetic and Physical mapping - Restriction mapping, Somatic cell hybrid mapping, Radiation hybrid mapping, Cytogenetic map. Disorders of genome: Chromosomal anomalies, Single gene and Multifactorial disorders. Pedigree analysis: Pedigree construction & family study Complications in pedigree analysis. Genome wide associations Studies.

**Unit - IV**

Overview of Bioinformatics databases: Sequences databases- GenBank, EMBL, DDBJ, TrEMBL, UniProt, Swiss Prot, PIR; Structure databases: PDB , SCOP, CATH, Data submission tools: Bankit, Sequin and Webin, Substitution matrices: PAM and BLOSUM; Pairwise and multiple sequence alignments: BLAST, FASTA Dot Plot, Needle-wunsch and Smith-waterman algorithm; Phylogenetic analysis: Overview of character and distance based methods; Gene prediction methods.

**References:**


1. Xiong, J. (2012). Essential Bioinformatics. Cambridge University Press.
2. Ghosh, Z & Mallick, B. (2008). Bionformatics: Principles and Applications. Oxford University Press.
3. Brown, T. A. (2006). Genome 3, 3rd edition. Garland Science
4. Strachan, T. and Read, A. (2010). Human Molecular Genetics. Garland Publishers, London. 4th ed.
5. Freshney, R.I. (2010). Culture of Animal Cells- A Manual of Basic Technique and Specialized Applications, 6th edition. Willey-Blackwell.
6. Rovozzo, G. C. & Burke, N. C. (1974). A manual of basic virological techniques. Prentice Hall