# MGM INSTITUTE OF HEALTH SCIENCES

(Deemed to be University u/s 3 of UGC Act, 1956)
**Grade 'A' Accredited by NAAC**
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CHOICE BASED CREDIT SYSTEM

**(CBCS)**

**(with effect from 2025-26 Batches)**

# Curriculum for

# M.Sc. Molecular Biology

Amended as per AC-52/2025, Dated 28/11/2025

## Amended History

1. Amended as per AC-51/2025, [Resolution No.3.1(Annexure-3.6)], [Resolution No.3.5, (Annexure-7)]; Dated 29/04/2025.
2. Amended as per AC-52/2025, [Resolution No.5.1(Annexure-17F)]; [Resolution No.5.8, (Annexure-24E)]; Dated 28/11/2025.

**Resolution No. 3.1 of Academic Council (AC-51/2025):**

Resolved to approve the CBCS syllabus, including Program Outcomes (POs), Course Outcomes (COs), and PO-CO Mapping for 15 two-year postgraduate programs under MGMSBS for Semesters I and II. These include: M.Sc. Medical Biotechnology, M.Sc. Medical Genetics, M.Sc. Clinical Embryology, M.Sc. Clinical Nutrition, M.Sc. Medical Dialysis Technology , **M.Sc. Molecular Biology**, M.Sc. Medical Radiology & Imaging Technology , M.Sc. Cardiac Care Technology, M.Sc. Operation Theatre and Anaesthesia Technology, M.Sc. Emergency and Trauma Care, M. Optometry , Master in Hospital Administration , Master of Public Health, M.Sc. Health Informatics & M.Sc. Clinical Research to be effective from batch admitted in Academic Year 2025-26 onwards [ANNEXURE-3.1 to 3.30].

**Annexure-3.6 of AC-51/2025**

# MGM SCHOOL OF BIOMEDICAL SCIENCES

**(A constituent unit of MGM INSTITUTE OF HEALTH SCIENCES)**
(Deemed to be University u/s 3 of UGC Act 1956)
Grade "A$^{++}$" Accredited by NAAC
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## CHOICE BASED CREDIT SYSTEM (CBCS)

## (Academic Year 2025-26)

## Curriculum for

## M.Sc. Allied Health Sciences

## M.Sc. Molecular Biology

## DIRECTOR'S MESSAGE

### Welcome Message from the Director

Dear Postgraduate Students,

Welcome to **MGM School of Biomedical Sciences (MGMSBS), MGMIHS**, a premier institution dedicated to advancing allied and health sciences education. As you embark on this transformative academic journey, you are joining a community that fosters excellence in research, clinical expertise, and innovation**.**

MGMIHS, accredited with **NAAC 'A$^{++}$' Grade (CGPA 3.55, 2022)** and recognized as a **Category I Institution by UGC**, offers an ecosystem that nurtures both academic and professional growth. With **NIRF (151-200 rank band) recognition, NABH-accredited hospitals, NABL-accredited diagnostic labs, and JCI accreditation for MGM New Bombay Hospital**, we uphold global benchmarks in education and healthcare.

At MGMSBS, our **15 postgraduate programs** are meticulously designed to align with the National Commission for Allied and Healthcare Professionals **(NCAHP)** standards**,** National Education Policy **(NEP)** 2020**,** and the National Credit Framework **(NCrF).** We have implemented the **Choice-Based Credit System (CBCS)** to provide academic flexibility while ensuring rigorous training in clinical and technical skills**.** Our state-of-the-art research laboratories, digital classrooms, and the Central Research Laboratory (CRL) foster an environment that encourages innovation and evidence-based learning**.**

Postgraduate education at MGMSBS goes beyond theoretical learning—our curriculum integrates **hands-on clinical training, interdisciplinary collaboration, and exposure to real-world healthcare challenges**. We emphasize **research-driven education**, encouraging students to actively participate in **scientific discoveries, publications, and international collaborations**.

Beyond academics, we believe in **holistic development**, with initiatives such as the **AARAMBH Science and Wellness Club**, which promotes **mental well-being, leadership, and professional networking**.

As you step into this **next phase of academic and professional growth**, we encourage you to explore new ideas, engage in impactful research, and contribute meaningfully to the **healthcare ecosystem**. We are confident that your journey at MGMSBS will shape you into **skilled, compassionate, and visionary professionals**, ready to lead in the ever-evolving healthcare landscape.

We look forward to witnessing your achievements and contributions!

**Dr.Mansee Thakur**
Director, MGM School of Biomedical Sciences
MGM Institute of Health Sciences, Navi Mumbai

## ABOUT MGM SCHOOL OF BIOMEDICAL SCIENCES

### Mission

To improve the quality of life, both at individual and community levels by imparting quality medical education to tomorrow's doctors and medical scientists and by advancing knowledge in all fields of health sciences though meaningful and ethical research.

### Vision

By the year 2020, MGM Institute of Health Sciences aims to be top-ranking Centre of Excellence in Medical Education and Research. Students graduating from the Institute will have the required skills to deliver quality health care to all sections of society with compassion and benevolence, without prejudice or discrimination, at an affordable cost. As a research Centre, it shall focus on finding better, safer and affordable ways of diagnosing, treating and preventing diseases. In doing so, it will maintain the highest ethical standards.

### About – School of Biomedical Sciences

MGM School of Biomedical Sciences is formed under the aegis of MGMIHS with the vision of offering basic Allied Science and Medical courses for students who aspire to pursue their career in the Allied Health Sciences, teaching as well as research.

School of Biomedical Sciences is dedicated to the providing the highest quality education in basic medical sciences by offering a dynamic study environment with well-equipped labs. The school encompasses 23 courses each with its own distinct, specialized body of knowledge and skill. This includes 8 UG courses and 15 PG courses. The college at its growing years started with mere 100 students has recorded exponential growth and is now a full-fledged educational and research institution with the student strength reaching approximately **800** at present.

Our consistent theme throughout is to encourage students to become engaged, be active learners and to promote medical research so that ultimately they acquire knowledge, skills, and understanding so as to provide well qualified and trained professionals in Allied Health Sciences to improve the quality of life.
As there is increased need to deliver high quality, timely and easily accessible patient care system the collaborative efforts among physicians, nurses and allied health providers become ever more essential for an effective patient care. Thus the role of allied health professionals in ever-evolving medical system is very important in providing high-quality patient care.

Last but by no means least, the School of Biomedical Sciences envisions continuously grow and reform. Reformations are essential to any growing institution as they fulfill our bold aspirations of providing the best for the students, for us to serve long into the future and to get ourselves updated to changing and evolving trends in the health care systems

## INTRODUCTION

To keep pace with the worldwide education and research scenario in the field of biological science, MGM Institute of Health Sciences has started M.Sc. Molecular Biology course which is designed to enrich the students with wide knowledge and understanding of the advance techniques in molecular biology and its applications. The primary objective of this program is to provide job oriented and research driven education.

## VISION

- Academic excellence & development of an excellent intellectual system for rich technology talent pool
- Research & development driven education
- Student involvement in research projects
- Advance education and training

## MISSION

- Generation of research& technology talent pool in the area of molecular biology

## SALIENT FEATURES

- Very strong infrastructure e.g. classroom, conference and seminar room well equipped library, computer and internet facility, hostel, hospital, hygienic canteen etc.
- Excellent teaching staff - highly experienced faculty, expert and professionals from various organizations.
- Support from state-of-the-art MGMIHS OMICS Research Center: A highly equipped laboratory for advanced life sciences - proteomics, genomics computational biology etc. (This centers providing unique and exploratory platform for discovery research).
- Frequent guest lecturers (by externalfaculty)/seminar/symposium/ workshops.
- Opportunity for students for their involvement in major research projects of institute.
- Provision of project work on applied aspects of molecular biology and opportunity to implement their novel ideas in research.

## NAME OF THE DEGREE

Master of Science in Molecular Biology: M.Sc. (Molecular Biology)

## OBJECTIVES

The students of M.Sc. Molecular Biology course (2 years) should be able to

- Deep knowledge and understanding of molecular biology and its applications
- Understand key implications of proteomics, Genomics and related aspects.
- Research driven education
- Read and analyze the primary research literature, critically assess scientific experiments and evaluate the impact of a scientific discovery.
- Be primed and able to conduct quality research in latest molecular biology based research topics.

## ADMISSION REQUIREMENTS

- Citizenship: Indian nationals can apply under the General category. Foreign nationals or NRI or Indian nationals supported by NRI relatives can apply under the Foreign/NRI category.

- Qualification: Candidates with 50% marks in B.Sc. Molecular Biology/ Biotechnology/ Microbiology/ / Biochemistry/Genetics /Botany/Zoology /B.Sc. Nursing/MBBS/BDS) or any equivalent degree in life sciences of any recognized university.

- Total Seats=10

## DURATION OF STUDY

The duration of the study for M.Sc. Molecular Biology will be of four semesters spread over two years.

**Program pattern**

- First Semester: July
- Second Semester: January
- Third Semester: July
- Fourth Semester: January

*(a) **Dissertation / Project Course** commences in III Semester

(b) **Educational Tours / Field Works/Hospital Visit/Industrial Visit** Course may be carried out in any Semester or all Semestersbutevaluated and Grade Points are to be added in 4th Semester.
**(Elective): Any one subject is to be chosen from the following** (Subjects offered may change from time o time depending on the availability of expertise)
**Elective courses may or may not have practical and/or field work.
Multidisciplinary / Interdisciplinary

**EDUCATIONAL/INDUSTRIAL TOUR:**

Industrial visit has its own importance in building a career of a student which is pursuing a professional degree. Objectives of industrial visit are to provide students with an insight regarding internal working of reputed hospitals and labs. Industrial visits providestudents with an opportunity to learn practically thought interactions, working methods and employment practices as theoretical knowledge is not enough for making competent and skillful professionals

# M.Sc. MOLECULAR BIOLOGY

## PROGRAM OUTCOME

| Program Code | Program Objective |
|---|---|
| PO1 | Nurture the scientific and/or clinical knowledge and skills for development of industrial application, health care practices and entrepreneurship. |
| PO2 | Develop the ability of critical thinking to analyze, interpret problems and to find out systematic approach for solution. |
| PO3 | Impart decision making capability of handling various circumstances in their respective areas. |
| PO4 | Demonstrate research skills for planning, designing, implementation and effective utilization of research findings for the community. |
| PO5 | Develop an ability to function as an efficient individual and team player in multidisciplinary sectors for effective outcomes. |
| PO6 | Demonstrate effective written and oral communication skills to communicate effectively in the health care sector, industries, academia and research. |
| PO7 | Inculcate code of ethics in professional and social circumstances to execute them in daily practices and research in respective areas of specialization |
| PO8 | Develop lifelong learning attitude and values for enhancement professional and social skills for an overall development |

# Course Outcomes
# Semester I

| MMB 101 T & MMB 104 P | Cell Biology | Mapped PO | Teaching-Learning Methodology | Assessment Tools |
|---|---|---|---|---|
| CO1 | Students will gain an understanding of cell origin. | PO1, PO2 | Lecture, Practical, Assignment, Seminar, group discussion | Theory exam, Practical exam, Viva-voce, Seminar, Internal Assessment |
| CO2 | Basic understanding of cell structure and its components. | PO1, PO2 | Lecture, Practical, Assignment, Seminar, group discussion | Theory exam, Practical exam, Viva-voce, Seminar, Internal Assessment |
| CO3 | Students will understand the cell function. | PO1, PO2 | Lecture, Practical, Assignment, Seminar, group discussion | Theory exam, Practical exam, Viva-voce, Seminar, Internal Assessment |
| CO4 | Understanding of cell regulations and physiology. | PO1, PO2 | Lecture, Practical, Assignment, Seminar, group discussion | Theory exam, Practical exam, Viva-voce, Seminar, Internal Assessment |
| **MMB 102 T & MMB 105 P** | **Molecular Immunology** | **Mapped PO** | **Teaching-Learning Methodology** | **Assessment Tools** |
| CO1 | Students will gain understanding of the immune system and immunity. | PO1, PO2 | Lecture, Practical, Assignment, Seminar, group discussion | Theory exam, Practical exam, Viva-voce, Seminar, Internal Assessment |
| CO2 | It highlights understanding of the molecular structure of immune cells. | PO1, PO2 | Lecture, Practical, Assignment, Seminar, group discussion | Theory exam, Practical exam, Viva-voce, Seminar, Internal Assessment |
| CO3 | Understanding of role and expression of immune system during infection and immunity | PO1, PO2 | Lecture, Practical, Quiz, Assignment, Seminar, group discussion | Theory exam, Practical exam, Viva-voce, Seminar, Internal Assessment |
| CO4 | Understanding of the status of the immune system during disease system | PO1, PO2 | Lecture, Practical, Assignment, Seminar, group discussion | Theory exam, Practical exam, Viva-voce, Seminar, Internal Assessment |
| CO5 | Exploration of immune system concepts into design and development of new therapeutics. | PO1, PO2 | Lecture, Practical, Assignment, Seminar, group discussion | Theory exam, Practical exam, Viva-voce, Seminar, Internal Assessment |
| **MMB 103 T & MMB 106 P** | **Molecular Enzymology** | **Mapped PO** | **Teaching-Learning Methodology** | **Assessment Tools** |
| CO1 | Post graduate students will understand the basics of enzymes and their function | PO1, PO2 | Lecture, Practical, Assignment, Seminar, group discussion | Theory exam, Practical exam, Viva-voce, Seminar, Internal Assessment |

| | | | | |
|---|---|---|---|---|
| | in biological systems. | | | |
| **CO2** | They will understand the enzyme modulation during specific situations. | **PO1, PO2** | Lecture, Practical, Assignment, Seminar, group discussion | Theory exam, Practical exam, Viva-voce, Seminar, Internal Assessment |
| **CO3** | Basic understanding of the applications of the enzyme in various industries. | **PO1, PO2** | Lecture, Practical, Assignment, Seminar, group discussion | Theory exam, Practical exam, Viva-voce, Seminar, Internal Assessment |
| **CO4** | Students will learn the basics techniques of enzymology. | **PO1, PO2** | Lecture, Practical, Assignment, Seminar, group discussion | Theory exam, Practical exam, Viva-voce, Seminar, Internal Assessment |
| **CC 001 T CC 001 P** | **Research Methodology & Biostatistics (Core Course)** | **Mapped PO** | **Teaching-Learning Methodology** | **Assessment Tools** |
| **CO1** | Student will be able to understand develop statistical models, research designs with the understating of background theory of various commonly used statistical techniques as well as analysis, interpretation & reporting of results and use of statistical software. | **PO1, PO2, PO3** | Lecture, Practical, Assignment, Seminar, group discussion | Theory exam, Practical exam, Viva-voce, Seminar, Internal Assessment |
| **MMB 107 CP** | **MMB Directed Clinical Education-I** | **Mapped PO** | **Teaching-Learning Methodology** | **Assessment Tools** |
| **CO1** | Demonstrate proficiency in diagnostic and therapeutic techniques used in hospital laboratories. | PO1 | Pre-Clinical Orientation, Laboratory Hands-on Training, Problem-Based Learning. | Daily log book, Direct observation and feedback by mentors |
| **CO2** | Effectively communicate and collaborate with healthcare professionals and patients. | PO6 | Pre-Clinical Orientation, Laboratory Hands-on Training, Problem-Based Learning. | Daily log book, Direct observation and feedback by mentors |
| **CO3** | Develop decision-making skills for effective healthcare management and administration. | PO2, PO3 | Pre-Clinical Orientation, Laboratory Hands-on Training, Problem-Based Learning. | Daily log book, Direct observation and feedback by mentors |

# Semester II

| MMB 108 T & MMB 112 P | Gene and Protein Science | Mapped PO | Teaching-Learning Methodology | Assessment Tools |
|---|---|---|---|---|
| CO1 | Students will be able to understand the basis of inheritance, gene organization and structure of DNA. | PO1, PO2 | Lecture, Practical, Assignment, Seminar, group discussion | Theory exam, Practical exam, Viva-voce, Seminar, Internal Assessment |
| CO2 | They will be also understanding gene function and linkages with protein. Understanding of genome and proteome will be important learning outcome. | PO1, PO2 | Lecture, Practical, Assignment, Seminar, group discussion | Theory exam, Practical exam, Viva-voce, Seminar, Internal Assessment |
| CO3 | Understanding of basics of protein structure, purification and characterization will be major outcome of the section. | PO1, PO2 | Lecture, Practical, Assignment, Seminar, group discussion | Theory exam, Practical exam, Viva-voce, Seminar, Internal Assessment |
| **MMB 109 T& MMB 113 P** | **Bioinformatics & Computational Biology** | **Mapped PO** | **Teaching-Learning Methodology** | **Assessment Tools** |
| CO1 | The major outcome in this section will be basic knowledge of various data banks and datasets mainly for protein sequence and nucleic acid sequence. | PO1, PO5 | Lecture, Practical, Assignment, Seminar, group discussion, e-learning | Theory exam, Practical exam, Viva-voce, Seminar, Journal club, skill assessment |
| CO2 | Students will understand the basic skill data analysis including cluster analysis and sequence analysis. | PO1, PO5 | Lecture, Practical, Assignment, Seminar, group discussion, e-learning | Theory exam, Practical exam, Viva-voce, Seminar, Journal club, skill assessment |
| **MMB 110 T&MMB 114 P** | **DNA Recombinant Technology** | **Mapped PO** | **Teaching-Learning Methodology** | **Assessment Tools** |
| CO1 | Student will be able to understand concept and process of DNA recombinant technology. It will also provide strategy and designs of experiment for product development. Course will also generate and teach as skills in molecular biology. | PO1, PO2, PO5 | Lecture, Practical, Assignment, Seminar, group discussion | Theory exam, Practical exam, Viva-voce, Seminar, Internal Assessment |
| **MMB 111 T& MMB 115 P** | **Metabolic Engineering** | **Mapped PO** | **Teaching-Learning Methodology** | **Assessment Tools** |
| CO1 | Students will understand the basics of metabolic pathways and network in cellular system. | PO1, PO2, PO5 | Lecture, Practical, Assignment, Seminar, group discussion | Theory exam, Practical exam, Viva-voce, Seminar, Internal Assessment |
| CO2 | Understanding different models of cellular reactions. | PO1, PO2, PO5 | Lecture, Practical, Assignment, | Theory exam, Practical exam, |

| | | | | |
|---|---|---|---|---|
| | | | Seminar, group discussion | Viva-voce, Seminar, Internal Assessment |
| **CO3** | Students will understand the concept of metabolic flux analysis and metabolic control analysis. | **PO1, PO2, PO5** | Lecture, Practical, Assignment, Seminar, group discussion | Theory exam, Practical exam, Viva-voce, Seminar, Internal Assessment |
| **CO4** | Understanding of the concept of metabolic design in strain development | **PO1, PO2, PO5** | Lecture, Practical, Assignment, Seminar, group discussion | Theory exam, Practical exam, Viva-voce, Seminar, Internal Assessment |
| **CO5** | It will provide the understanding of the potential of metabolic engineering in industrial applications. | **PO1, PO2, PO5** | Lecture, Practical, Assignment, Seminar, group discussion | Theory exam, Practical exam, Viva-voce, Seminar, Internal Assessment |
| **MMB 116 CP** | **MMB Directed Clinical Education-II** | **Mapped PO** | **Teaching-Learning Methodology** | **Assessment Tools** |
| **CO1** | Demonstrate proficiency in diagnostic and therapeutic techniques used in Hospital laboratories. | PO1 | Pre-Clinical Orientation, Laboratory Hands-on Training, Problem-Based Learning. | Daily log book, Direct observation and feedback by mentors |
| **CO2** | Effectively communicate and collaborate with healthcare Professionals and patients. | PO6 | Pre-Clinical Orientation, Laboratory Hands-on Training, Problem-Based Learning. | Daily log book, Direct observation and feedback by mentors |
| **CO3** | Develop decision-making skills for effective healthcare management and Administration. | PO2, PO3 | Pre-Clinical Orientation, Laboratory Hands-on Training, Problem-Based Learning. | Daily log book, Direct observation and feedback by mentors |
| **SEC 001 T** | **Innovation and Entrepreneurship** | **Mapped PO** | **Teaching-Learning Methodology** | **Assessment Tools** |
| **CO1** | Students will grasp the concepts of innovation, its ecosystem, and the role of various stakeholders such as government policies, startups, and innovation hubs. | **PO1, PO3, PO4** | Lecture, Practical, Quiz, Assignment, Seminar, group discussion | Theory exam, Practical exam, Seminar, Journal club, case study presentation, station exercise |
| **CO2** | Cultivating an entrepreneurial mindset and leadership qualities necessary for driving innovation and leading ventures. | **PO1, PO3, PO4** | Lecture, Practical, Quiz, Assignment, Seminar, group discussion | Theory exam, Practical exam, Seminar, Journal club, case study presentation, station exercise |
| **CO3** | Understanding the intersection of technology and innovation and leveraging emerging technologies for entrepreneurial ventures | **PO1, PO3, PO4** | Lecture, Practical, Quiz, Assignment, Seminar, group discussion | Theory exam, Practical exam, Seminar, Journal club, case study presentation, station exercise |

## OUTLINE OF COURSE CURRICULUM

## M.Sc. MOLECULAR BIOLOGY

### Semester I

| Code No. | Core Course | Credits/Week | | | | | Hrs/Semester | | | | | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Lecture (L) | Tutorial (T) | Practical (P) | Clinical Posting/ Rotation (CP) | Total Credits (C) | Lecture (L) | Tutorial (T) | Practical (P) | Clinical Posting/ Rotation (CP) | Total (hrs.) | Internal Assement (IA) | Semester End Exam (SEE) | Total |
| **Discipline Specific Core Theory** | | | | | | | | | | | | | | |
| MMB 101 T | Cell Biology | 3 | - | - | - | **3** | 45 | - | - | - | **45** | **20** | **80** | **100** |
| MMB 102 T | Molecular Immunology | 3 | - | - | - | **3** | 45 | - | - | - | **45** | **20** | **80** | **100** |
| MMB 103 T | Molecular Enzymology | 3 | - | - | - | **3** | 45 | - | - | - | **45** | **20** | **80** | **100** |
| CC 001 T | Research Methodology & Biostatistics (Core Course) | 3 | - | - | - | **3** | 45 | - | - | - | **45** | - | **50** | **50** |
| **Discipline Specific Core Practical** | | | | | | | | | | | | | | |
| MMB 104 P | Cell Biology | - | - | 2 | - | **1** | - | - | 30 | - | **30** | **10** | **40** | **50** |
| MMB 105 P | Molecular Immunology | | | 2 | | **1** | | | 30 | | **30** | **10** | **40** | **50** |
| MMB 106 P | Molecular Enzymology | - | - | 2 | - | **1** | - | - | 30 | - | **30** | **10** | **40** | **50** |
| MMB 107 CP | MMB Directed Clinical Education - I | - | - | - | 12 | **4** | - | - | - | 180 | **180** | - | **50** | **50** |
| CC 001 P | Research Methodology & Biostatistics (Core Course) | - | - | 4 | - | **2** | - | - | 60 | - | **60** | - | **50** | **50** |
| **Total** | | **12** | **0** | **10** | **12** | **21** | **180** | **0** | **150** | **180** | **510** | **90** | **510** | **600** |

Resolution No. 5.8 of Academic Council (AC-52/2025):

The Academic Council resolved to approve the continuation of SWAYAM/NPTEL elective courses for postgraduate students, wherever applicable to their respective programmes. Accordingly, students admitted from the Academic Year 2025–26 onwards shall be permitted to choose any one approved elective course. The Council further approved the inclusion of 2 and 3 credit courses in the index. This approach is in alignment with the current NCAHP curriculum guidelines, which recommend flexibility for open electives through recognized national platforms.

Accordingly, the names of individual elective courses shall be removed from the existing syllabi. The links of SWAYAM /NPTEL courses (https://swayam.gov.in/nc_details/NPTEL) shall be incorporated in the syllabus index under the existing course code SEC-002 T, titled: "NPTEL/SWAYAM (Name of the Course Chosen by the Student)"

In alignment with Resolution No. 3.1 of the Academic Council (AC-51/2025), the detailed syllabi of individual courses shall be removed and replaced with the approved links of SWAYAM/NPTEL or common reference pool courses. The complete course content shall remain accessible on the official SWAYAM/NPTEL portals. Students may select any one course from the provided links, in alignment with the credit requirements mentioned in their respective syllabi, as per Annexures 24A, 24B, 24C, 24D, 24E, 24F, 24G, 24H, 24I, 24J, 24K, 24L, 24M, 24N, and 24O.

# OUTLINE OF COURSE CURRICULUM

## M.Sc. MOLECULAR BIOLOGY

### Semester II

| Code No. | Core Course | Credits/Week | | | | | Hrs/Semester | | | | | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Lecture (L) | Tutorial (T) | Practical (P) | Clinical Posing/ Rotation (CP) | Total Credits (C) | Lecture (L) | Tutorial (T) | Practical (P) | Clinical Posing/ Rotation (CP) | Total (hrs.) | Internal Assement (IA) | Semester End Exam (SEE) | Total |
| **Discipline Specific Core Theory** | | | | | | | | | | | | | | |
| MMB 108 T | Gene and Protien Science | 3 | - | - | - | **3** | 45 | - | - | - | **45** | **20** | **80** | **100** |
| MMB 109 T | Bioinformatics and Computational Biology | 3 | - | - | - | **3** | 45 | - | - | - | **45** | **20** | **80** | **100** |
| MMB 110 T | DNA Recombinant Technology | 3 | - | - | - | **3** | 45 | - | - | - | **45** | **20** | **80** | **100** |
| MMB 111 T | Metabolic Engineering | 3 | - | - | - | **3** | 45 | - | - | - | **45** | **20** | **80** | **100** |
| **Discipline Specific Core Practical** | | | | | | | | | | | | | | |
| MMB 112 P | Gene and Protien Science | - | - | 2 | - | **1** | - | - | 30 | - | **30** | **10** | **40** | **50** |
| MMB 113 P | Bioinformatics and Computational Biology | - | - | 2 | - | **1** | - | - | 30 | - | **30** | **10** | **40** | **50** |
| MMB 114 P | DNA Recombinant Technology | - | - | 2 | - | **1** | - | - | 30 | - | **30** | **10** | **40** | **50** |
| MMB 115 P | Metabolic Engineering | - | - | 2 | - | **1** | - | - | 30 | - | **30** | **10** | **40** | **50** |
| MMB 116 CP | MMB Directed Clinical Education - II | - | - | - | 12 | **4** | - | - | - | 180 | **180** | - | **50** | **50** |
| **Skill Ehancement Course** | | | | | | | | | | | | | | |
| SEC 001 T | Innovation and Enterpreneurship | 3 | - | - | - | **3** | 45 | - | - | - | **45** | - | **100** | **100** |
| SEC 002 T | NPTEL Swayam (Course Selected as per Below List) | | | | | | | | | | | | | |
| **Total** | | **15** | **0** | **8** | **12** | **23** | **225** | **0** | **120** | **180** | **525** | **120** | **630** | **750** |

# Common Pool of Swayam/NPTEL Coureses offered as elective option (SEC 002)

| Course ID | Discipline | Course Name | Institute | Duration | Start date | End date | Exam date | Enrollment End date | Exam Registration End date | UG/PG | Click here to Join the course | NPTEL URL | NPTEL ID |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| noc25-bt06 | Biotechnology and Bioengineering | BioInformatics: Algorithms and Applications | IIT Madras | 12 Weeks | 20-01-2025 | 11-04-2025 | 26-04-2025 | 27-01-2025 | 28-02-2025 | UG/PG | https://onlinecourses.nptel.ac.in/noc25_bt06/preview | https://nptel.ac.in/courses/102106065 | https://nptel.ac.in/courses/102106065 |
| noc25-bt13 | Biotechnology and Bioengineering | Computational Genomics | IISER Bhopal | 12 Weeks | 20-01-2025 | 11-04-2025 | 27-04-2025 | 27-01-2025 | 28-02-2025 | PG | https://onlinecourses.nptel.ac.in/noc25_bt13/preview | https://nptel.ac.in/courses/102106339 | https://nptel.ac.in/courses/102106339 |
| noc25-bt29 | Biotechnology and Bioengineering | Maternal Infant Young Child Nutrition | IIT Bombay | 12 Weeks | 20-01-2025 | 11-04-2025 | 26-04-2025 | 27-01-2025 | 28-02-2025 | UG/PG | https://onlinecourses.nptel.ac.in/noc25_bt29/preview | https://nptel.ac.in/courses/102101091 | https://nptel.ac.in/courses/102101091 |
| noc25-ge05 | Multidisciplinary | Biophotonics | IIT Kharagpur | 12 Weeks | 20-01-2025 | 11-04-2025 | 03-05-2025 | 27-01-2025 | 28-02-2025 | PG | https://onlinecourses.nptel.ac.in/noc25_ge05/preview | https://nptel.ac.in/courses/127105225 | https://nptel.ac.in/courses/127105225 |
| noc25-ge07 | Multidisciplinary | Comprehensive Molecular Diagnostics and Advanced Gene Expression Analysis | IIT Kharagpur | 12 Weeks | 20-01-2025 | 11-04-2025 | 03-05-2025 | 27-01-2025 | 28-02-2025 | UG/PG | https://onlinecourses.nptel.ac.in/noc25_ge07/preview | https://nptel.ac.in/courses/127105391 | https://nptel.ac.in/courses/127105391 |
| noc25-ge25 | Multidisciplinary | One Health | ICMR - Regional Medical Research Centre, Bhubaneswar | 12 Weeks | 20-01-2025 | 11-04-2025 | 03-05-2025 | 27-01-2025 | 28-02-2025 | PG | https://onlinecourses.nptel.ac.in/noc25_ge25/preview | https://nptel.ac.in/courses/127106233 | https://nptel.ac.in/courses/127106233 |
| noc25-ge27 | Multidisciplinary | Qualitative Research Methods and Research Writing | IIT Kharagpur | 12 Weeks | 20-01-2025 | 11-04-2025 | 27-04-2025 | 27-01-2025 | 28-02-2025 | PG | https://onlinecourses.nptel.ac.in/noc25_ge27/preview | https://nptel.ac.in/courses/109105115 | https://nptel.ac.in/courses/109105115 |
| noc25-bt21 | Biotechnology and Bioengineering | Host-Pathogen Interaction (Immunology) | IISER Bhopal | 12 Weeks | 20-01-2025 | 11-04-2025 | 04-05-2025 | 27-01-2025 | 28-02-2025 | PG | https://onlinecourses.nptel.ac.in/noc25_bt21/preview | https://onlinecourses.nptel.ac.in/noc24_bt24/preview | https://onlinecourses.nptel.ac.in/noc24_bt24/preview |
| noc25-bt22 | Biotechnology and Bioengineering | Human Physiology | IISER Pune | 12 Weeks | 20-01-2025 | 11-04-2025 | 26-04-2025 | 27-01-2025 | 28-02-2025 | PG | https://onlinecourses.nptel.ac.in/noc25_bt22/preview | https://onlinecourses.nptel.ac.in/noc24_bt05/preview | https://onlinecourses.nptel.ac.in/noc24_bt05/preview |
| noc25-hs61 | Humanities and Social Sciences | Patent Law for Engineers and Scientists | IIT Madras | 12 Weeks | 20-01-2025 | 11-04-2025 | 03-05-2025 | 27-01-2025 | 28-02-2025 | UG/PG | https://onlinecourses.nptel.ac.in/noc25_hs61/preview | https://onlinecourses.nptel.ac.in/noc24_hs155/preview | https://onlinecourses.nptel.ac.in/noc24_hs155/preview |
| noc25-mg05 | Management | AI in Human Resource Management | IIT Guwahati | 12 Weeks | 20-01-2025 | 11-04-2025 | 04-05-2025 | 27-01-2025 | 28-02-2025 | PG | https://onlinecourses.nptel.ac.in/noc25_mg05/preview | https://nptel.ac.in/courses/110103626 | https://nptel.ac.in/courses/110103626 |
| noc25-hs70 | Humanities and Social Sciences | Science Communication: Research Productivity and Data Analytics using Open Source Software | IIT Delhi | 12 Weeks | 20-01-2025 | 11-04-2025 | 03-05-2025 | 27-01-2025 | 28-02-2025 | PG | https://onlinecourses.nptel.ac.in/noc25_hs70/preview | https://nptel.ac.in/courses/109102392 | https://nptel.ac.in/courses/109102392 |
| noc25-ag04 | Agricultural and Food | Food Science and | IIT Kharagpur | 12 Weeks | 20-01-2025 | 11-04-2025 | 26-04-2025 | 27-01-2025 | 28-02-2025 | UG/PG | https://onlinecourses.nptel.a | | |

# FIRST YEAR

## M.Sc. MOLECULAR BIOLOGY

## SEMESTER I

| CODE NO | CORE SUBJECT |
|---|---|
| **Discipline Specific Core Theory** | |
| MMB 101 T | Cell Biology |
| MMB 102 T | Molecular Immunology |
| MMB 103 T | Molecular Enzymology |
| CC 001 T | Research Methodology & Biostatistics (Core Course) |
| **Discipline Specific Core Practical** | |
| MMB 104 P | Cell Biology |
| MMB 105 P | Molecular Immunology |
| MMB 106 P | Molecular Enzymology |
| MMB 107 CP | MMB Directed Clinical Education - I |
| CC 001 P | Research Methodology & Biostatistics (Core Course) |

| | |
|---|---|
| **Name of the Programme** | **Molecular Biology** |
| **Semester** | **Semester I** |
| **Name of the Subject** | **Cell Biology** |
| **Subject Code** | **MMB 101T** |

| | |
|---|---|
| **Teaching Objective** | • To get post graduate students understand the basics of cell biology.<br>• To know the basic cell structures and their components with function.<br>• To understand the cell cycle.<br>• Understanding of the core function of cellsignaling and cell regulationduring maintenance of cell physiology. |
| **Course Outcomes** | • Students will gain an understanding of cell origin.<br>• Basic understanding of cell structure and its components.<br>• Students will understand thecell function.<br>• Understanding ofcell regulations and physiology. |

| Sr. No. | Topic | No. of Hrs. |
|---|---|---|
| 1 | Overview of Cell biology ,Universal features of cells, Diversity of genomesVisualization of cell, its fine structure and molecules | **6** |
| 2 | The cell membrane and its structure, Transport across membrane, Ion channels, Receptor mediated endocytosis | **6** |
| 3 | Cellular components and function, protein sorting, Vesicular traffic inside the cells Mitochondria and chloroplast and its genetic system | **7** |
| 4 | Cell signaling, receptor, ligands, signaling pathways, Signal transduction mechanismsCytoskeleton of cells, cytoskeleton filaments, molecular motors | **7** |
| 5 | Cell cycle, regulation of cell division, cell cycle checkpoints. Cell division-Mitosis,meiosis and the mechanism of cell division | **7** |
| 6 | Germ cells, Stem cells, Cancer cells | **6** |
| 7 | Apoptosis: Mechanism, Pathways, Markers | **6** |
| **Total** | | **45hrs** |

# MMB 104 P: CELL BIOLOGY

| Sr. No. | Topic | No. of Hrs. |
|---|---|---|
| 1 | Microscopy:<br>**i.** Simple, Compound, inverted and fluorescence<br>**ii.** Cell count using haemocytometer<br>**iii.** WBC- Differential counting<br>**iv.** RBC- Osmotic fragility<br>**v.** Preparation of microbial, animal and plant cells for microscopic examination & staining by Giemsa | **8** |
| 2 | Genetic apparatus:<br>i. Cell viability assay<br>ii. Mitosis & meiosis | **7** |
| 3 | Buccal smear of exfoliated epithelial cells | 4 |
| 4 | Osmosis, exosmosis and endosmosis | 4 |
| 5 | Fixation of cells & different fixatives | 4 |
| 6 | Preparation of mononuclear cells | 3 |
| **Total** | | **30 hrs** |

**Reference Books:**


1. Cell and Molecular biology, Gerald Karp, John Wiley and sons Inc.
2. Cell Biology by C.B. Powar.
3. Cell and Molecular Biology; DeRobertis; Lippincott Williams & Wilkins 8tEdition (2001).
4. Molecular Biology of the Cell and the Hypercell with CDROM; Alberts, Bray; Garland Publishing 1st Edition (1999).
5. Molecular Biology of the Cell with CDROM Alberts, Bruce; Johnson, Alexander; Lewis,Julian 4th Edition (2005).
6. Molecular Cell Biology, H. Lodish, A. Berk, S. L. Zipursky, W. H. Preeman andCompany.

| | |
|---|---|
| **Name of the Programme** | **Molecular Biology** |
| **Semester** | **Semester I** |
| **Name of the Subject** | **Molecular Immunology** |
| **Subject Code** | **MMB 102 T** |

| | |
|---|---|
| **Teaching Objective** | • To get post graduate students understand the basics of immunology and its importance in immunity and infection**.**<br>• To understand the immune response and tolerance during specific situations.<br>• To highlight the basic applications of the subject. |
| **Course Outcomes** | • Students will gain understanding of the immune system and immunity.<br>• It highlights understanding of the molecularstructure of immune cells.<br>• Understanding of role and expression of immune system during infection and immunity<br>• Understandingofthe status of the immune system during disease system<br>• Exploration of immune system concepts into design and development of new therapeutics. |

| Sr. No. | TOPIC | No. of Hrs. |
|---|---|---|
| 1 | The origin of immunology: Innate and acquired immunity; humoral and cell mediated immunity. Primary and secondary lymphoid organ: antigen, B cell, T cell subsets and macrophages. | **7** |
| 2 | Molecular basis of Immunology: Structure of antibody, Molecular basis of antibody diversity, polyclonal and monoclonal antibody, complement, antigen-antibody reactions. | **6** |
| 3 | Major Histocompatibility complex (MHC): Class I & II antigens their functions | **5** |
| 4 | Immune response and tolerance: Regulation of immune response, immune tolerance; hyper sensitivity, autoimmunity; | **6** |
| 5 | Immunity to Infection : Bacteria, viral, fungal and parasitic infections (with examples from each group); Hypersensitivity Type I-IV; Autoimmunity; Types of autoimmune diseases; Mechanism and role of CD4+ T cells; MHC and TCR in autoimmunity; | **6** |
| 6 | Immunological basis of graft rejection; Clinical transplantation and immunosuppressive therapy; Tumor immunology | **5** |
| 7 | Primary immunodeficiency, Acquired or secondary immune deficiencies, immune modulators and immune enhancers | **5** |
| 8 | Antibody engineering | **5** |
| **Total** | | **45hrs** |

# MMB 105 P: MOLECULAR IMMUNOLOGY

| Sr. No. | Topic | No. of Hrs. |
|---|---|---|
| 1 | Practical based on antigen – antibody interactions - Widal,VDRL,Blood grouping,CRP,Titre determination. | **10** |
| 2 | Radial Immunodiffusion, double diffusion | **10** |
| 3 | Immuno electrophoresis. | **10** |
| **Total** | | **30 hrs** |

**Reference Books:**


1. Immunology, An introduction by Ian R Tzard, Thomson publisher.
2. Immunology, Gordan Reeve and Ian Todd.
3. Essential Immunology: Ivan Roitt.
4. Kuby, Immunology: Gold by, Kindt and Osborne.
5. Immunology: Roitt, Brostoff, Mole.
6. Introductory Immunology : Huw Davies

| | |
|---|---|
| **Name of Programme** | **Molecular Biology** |
| **Semester** | **Semester I** |
| **Name of the Subject** | **Molecular Enzymology** |
| **Subject Code** | **MMB 103 T** |

| | |
|---|---|
| **Teaching Objective** | • To have a thorough understanding of the origin and different class of enzymes.<br>• To have a thorough understanding of the molecular structure and function of enzyme.<br>• To have a thorough understanding of purification and molecular characterization of enzymes including kinetics.<br>• To understand the role of modulator in enzyme function and its effect.<br>• To understand the industrial and clinical applications of enzyme. |
| **Course Outcomes** | • Post graduate students will understand the basics of enzymes and their function in biological systems.<br>• They will understand the enzyme modulation during specific situations.<br>• Basic understanding of the applications of the enzyme in various industries.<br>• Students will learn the basics techniques of enzymology. |

| Sr. No. | Topic | No. of Hrs. |
|---|---|---|
| 1 | Classification and nomenclature of enzyme, Extracellular and intracellular enzyme, Inducible and constitutive enzyme, properties of enzymes as catalytic power, enzyme specificity, cofactors, isoenzymes, multi enzyme complex and multifunctional enzyme. | **6** |
| 2 | Enzyme techniques- enzyme assays, analysis of enzyme assays, Expression of the enzyme activity (International Unit), specific activity of enzyme, Coupled reaction, Isolation and purification of enzyme, concept of fold purification and yield, Importance of pure enzymes, chemical modification of enzyme, molecular techniques in enzymes, immobilization of enzymes. | **7** |
| 3 | Factors affecting the rate of enzymes catalyzed reactions, Study of enzyme kinetics, Plots for enzyme kinetics: Michaelis-Menten, Lineweaver-Burke plot and Eddie Hofstee plot. Use of initial velocity, Determination of rate constant for enzyme catalyzed reactions, inhibition and exchange studies to differentiate between multi substrate reaction mechanisms. Methods of examining enzyme-complex, Use of substrate analogs, kinetics of various types of inhibitionand kinetics of enzyme inhibition. | **7** |
| 4 | Allosteric enzymes, sigmodial kinetics (Cooperativity phenomenon. Hill and Scatchard plots) and their physiological significance. Symmetric and sequential modes for action of allosteric enzymes and their significance. K class and V class allosteric enzymes. | **7** |
| 5 | Active site of enzymes: Basic concept, conformation of active site, mapping of active site by different methods. Lysozyme and chyrnotrypsin as models. | **6** |
| 6 | Enzyme engineering: Basic concept for designing a new enzyme in reference to therapeutic enzyme, Immobilization of enzymes, designer enzymes, biosensor enzymes, enzyme crystallization and X-ray crystallography,Flexibility& conformational mobility of enzymes. | **6** |
| 7 | Clinical Enzymology: End point and kinetic methods for determination of enzyme activity, SI units. Application of $K_m$ to Diagnostic enzymology serum enzymes in health and disease, | **6** |

| | | |
|---|---|---|
| | Isoenzymes. | |
| **Total** | | **45hrs** |

## MMB 106 P: MOLECULAR ENZYMOLOGY

| Sr. No. | Topic | No. of Hrs. |
|---|---|---|
| 1 | $K_m$ and $V_{max}$value of Transaminase and Amylase. | **5** |
| 2 | Determination of K cat | **5** |
| 3 | Determination of specific activity | **5** |
| 4 | Enzyme purification by gel chromatography | **5** |
| 5 | Enzyme immobilization | **5** |
| 6 | Rapid zymogram of enzyme. | **5** |
| **Total** | | **30 hrs** |

**Reference Books:**

1. Biochemistry- Stryer, Berg, 6thEdition, W.H.Freeman and Co., 2007.
2. Lehninger' Principles of biochemistry-Nelson, Cox, 4thEdn.W. H Freeman and Co., 2005.
3. Harper's Principles of Biochemistry-Murray, Gardener, Mayes, Rodwell, 27th N Edn. McGraw Hill Education, 2006.
4. Biochemistry-Zubay; G, 3rdEdn. Pearson Education Pvt.Ltd, 2003.
5.Fundamentals of Enzymology by Nicholas Price, Oxford University Press.
6.Enzyme Structure and Mechanism by Alan Fersht,W. H. Freeman.
7.Enzymes: Biochemistry, Biotechnology, Clinical Chemistry by Trevor Palmer, Horwood Publishing.
8.Enzyme Assays: A Practical Approach by Michael J. Danson, Oxford University Press

| | |
|---|---|
| **Name of the Program** | **M.Sc. Molecular Biology** |
| **Semester** | **Semester - I** |
| **Name of the Course** | **Research Methodology & Biostatistics (Core Course)** |
| **Course Code** | **CC 001 T** |

| | |
|---|---|
| **Teaching Objective** | • The course is intended to give an overview of research and statistical models commonly used in medical and bio-medical sciences. The goal is to impart an intuitive, understanding and working knowledge of research designs and statistical analysis. The strategy would be to simplify, analyze the treatment of statistical inference and to focus primarily on how to specify and interpret the outcome of research. |
| **Learning Outcomes** | • Student will be able to understand develop statistical models, research designs with the understating of background theory of various commonly used statistical techniques as well as analysis, interpretation & reporting of results and use of statistical software. |

| Sr. No. | Topic | No. of Hrs. |
|---|---|---|
| **A** | **Research Methodology:** | **23** |
| 1 | **Scientific Methods of Research**: Definition of Research, Assumptions, Operations and Aims of Scientific Research. Research Process, Significance and Criteria of Good Research, Research Methods versus Methodology | 4 |
| 2 | **Research Designs**: Observational Studies: Descriptive, explanatory, and exploratory, Experimental Studies: Pre-test design, post-test design, Follow-up or longitudinal design, Cohort Studies, Case – Control Studies, Cross-sectional studies, Intervention studies. | 5 |
| 3 | **Sampling Designs**: Census and Sample Survey, Need and importance for Sampling, Implications of a Sample Design, Different Types of Sample Designs (Probability sampling and non-probability sampling),Systematic sampling, Stratified sampling, Cluster sampling, Multi-stage sampling, Sampling with probability proportional to size, Sequential sampling. | 5 |
| 4 | **Measurement in research**: Measurement Scales, Sources of Error in Measurement, | 3 |
| 5 | **Methods of Data Collection**: Types of data, Collection of Primary Data, Observation Method, Interview Method | 4 |
| 6 | Research Ethics and plagiarism | 2 |
| **B** | **Biostatistics** | **22** |
| 7 | **Data Presentation**: Types of numerical data: Nominal, Ordinal, Ranked, Discrete and continuous. Tables: Frequency distributions, Relative frequency, Graph: Bar charts, Histograms, Frequency polygons, scatter plots, line graphs | 3 |
| 8 | **Measures of Central Tendency and Dispersion**: Mean, Median, Mode, Range, Inter quartile range, variance and Standard Deviation, Coefficient of variation, grouped mean and grouped standard deviation (including merits and demerits). | 3 |
| 9 | **Testing of Hypotheses**: Definition, Basic Concepts, Procedure for Hypothesis Testing, power of test, Normal distribution, Parametric Tests including Z-test, t-test, and ANOVA | 4 |

| | | |
|---|---|---|
| 10 | **Chi-square Test**: Chi-square as a Non-parametric Test,Applications. | 2 |
| 11 | **Measures of Relationship**: Correlation and Simple Regression Analysis | 3 |
| 12 | **Non-parametric test**: Sign test, Wilcoxon signed-Rank Test, Wilcoxon Rank Sum Test: Mann-Whitney U test, KruskalWalli's test, Friedman's test, and Spearman Rank correlation test. | 3 |
| 13 | **Vital Health Statistics**: rate, crude rate, age specific rate, Measurement of fertility, Rate, Measures of mortality. | 4 |
| **Total** | | **45 hrs** |

## CC 001 P–Research Methodology & Biostatistics

| Sr. No. | Topics | No. of Hrs. |
|---|---|---|
| **A** | **Research Methodology** | |
| 1 | Research Article Presentation (Seminar) | 5 |
| **B** | **Biostatistics** | |
| 2 | Data Presentation | 4 |
| 3 | Measures of Central Tendency and Dispersion | 6 |
| 4 | Testing of Hypotheses | 16 |
| 5 | Chi-square Test | 4 |
| 6 | Measures of Relationship | 6 |
| 7 | Analysis of Variance | 5 |
| 8 | Non parametricor Distribution-free Tests | 8 |
| 9 | Computer Application Using Statistical Software including SPSS | 6 |
| **Total** | | **60 hrs** |

**Reference Books:**


1. Daniel WW. Biostatistics: A foundation for analysis in the health sciences. 10th ed. Wiley; 2013.
2. Gupta SC, Kapoor VK. Fundamentals of mathematical statistics. Sultan Chand & Sons; 2020 Sep.
3. Kothari CR, Garg G. Research methodology: Methods and techniques.2019.
4. Mahajan BK. Methods in biostatistics for medical students and research workers. 7th ed. Jaypee Brothers Medical Publishers; 2010.
5. Murthy MN. Sampling theory and methods. Statistical Publishing Society; 1967.
6. Singh YK. Fundamental of research methodology and statistics. New Age International; 2006.

**Resolution No. 3.5 of Academic Council (AC-51/2025):**

Resolved to approve the submitted list of recommended books for M.Sc. Clinical Nutrition and the course on **Biostatistics and Research Methodology** [ANNEXURE-7].

Annexure-7 of AC-51/2025

Biostatistics & Research Methodology Books List

| Subject | Book Name | Author |
|---|---|---|
| **Biostatistics & Research Methodology** | Biostatistics: A Foundation for Analysis in the Health Sciences (10th ed.) | Daniel WW. |
| | Biostatistical Analysis (5th ed.) | Zar JH. |
| | Research Methodology: Methods and Techniques | Kothari CR, Garg G. |
| | Methods in Biostatistics for Medical Students and Research Workers (7th ed.) | Mahajan BK. |
| | Sampling Theory and Methods | Murthy MN. |
| | Fundamentals of Research Methodology and Statistics | Singh YK. |
| | Fundamentals of Biostatistics (8th ed.) | Rosner B. |
| | An Introduction to Medical Statistics (4th ed.) | Bland M. |

## Course code- MMB 107 CP: MMB Directed Clinical Education – I

Community orientation and; clinical visit (Including related Practical to the Parent course) Molecular Biology students will gain extensive clinical exposure in a hospital setting, allowing them to refine their skills in various diagnostic and therapeutic procedures. Under the supervision of experienced professionals, they will progressively interact with patients and healthcare personnel, enhancing their understanding in molecular biology applications in real-world scenarios. Their training will encompass quality assurance (QA) and quality control (QC) in NABH and NABL-accredited laboratories, ensuring they are well-versed in regulatory standards and best practices. Additionally, students will develop problem-solving skills and learn to address complications in healthcare management. This hands-on experience will also prepare them for administrative roles in hospital settings, equipping them with the knowledge, skills, and aptitude required for effective healthcare delivery. Through this structured clinical education, students will be immersed in a dynamic hospital environment, strengthening their competency in molecular biology. **(Total - 180 hrs.)**

# FIRST YEAR

## M.Sc. MOLECULAR BIOLOGY

## SEMESTER II

| CODE NO | CORE SUBJECT |
|---|---|
| **Discipline Specific Core Theory** | |
| MMB 108T | Gene and Protein Science |
| MMB 109 T | Bioinformatics and Computational Biology |
| MMB 110 T | DNA Recombinant Technology |
| MMB 111 T | Metabolic Engineering |
| **Discipline Specific Core Practical** | |
| MMB 112 P | Gene and Protein Science |
| MMB 113 P | Bioinformatics and Computational Biology |
| MMB 114 P | DNA Recombinant Technology |
| MMB 115 P | Metabolic Engineering |
| MMB 116 CP | MMB Directed Clinical Education - II |
| **Skill Enhancement Course** | |
| SEC 001 T | Innovation and Entrepreneurship |
| SEC 002 T | NPTEL Swayam |

| | |
|---|---|
| **Name of the Program** | **Molecular Biology** |
| **Semester** | **Semester II** |
| **Name of the Subject** | **Gene and Protein Science** |
| **Subject Code** | **MMB 108 T** |

| | |
|---|---|
| **Teaching Objective** | • To understand an overview of the basics of gene and protein science,this is the most common biomolecule in biological science.<br>• To impart an intuitive, understanding and deep knowledge ofgenes and protein and their structure, organization and functions.<br>• To know the basic techniques of estimation nucleic acid and protein |
| **Course Outcomes** | • Students will be able to understand the basis of inheritance, gene organization and structure of DNA.<br>• They will be also understanding gene function and linkages with protein. Understanding of genome and proteome will be important learning outcome.<br>• Understanding of basics of protein structure, purification and characterization will be major outcome of the section. |

| Sr. No. | Topics | No. of Hrs. |
|---|---|---|
| 1 | The biochemical basis of inheritance, DNA as the genetic material,concept of gene organization,diversity of genomes. | **6** |
| 2 | Denaturation and renaturation of DNA, $T_m$, and complexity of DNA& Cot curves. | **5** |
| 3 | Centraldogma, Genetic code, Gene expression – concept of operon and related elements in the unit, regulatory and structural gene. | **6** |
| 4 | Extra chromosomal DNA and its functions, DNA isolation and estimation. | **5** |
| 5 | Protein chemistry, amino acid composition, solubility of proteins, Isoelectric pH and proteomes. | **5** |
| 6 | Protein Structure, Overview: Primary,Secondary, Tertiary and Quarternary structure, Primary structure Peptide bond conformation – Ramchandran Plot, Secondary Structure-Importance of alpha helix in protein structure & stability. Beta sheet structures in different proteins,Bonds& forces involved in tertiary and quarternary structure Contribution of tertiary and quarternary structures to protein architecture (Fibrous & Globular proteins, silk fibroin, Myoglobin, lysozyme), Protein motifs and their contribution to Protein architecture | **7** |
| 7 | Protein denaturation and folding, Role of molecular chaperones | **5** |
| 8 | Basic of protein estimation, isolation, purification special reference to various chromatographic methods and characterization | **6** |
| **Total** | | **45hrs** |

# MMB 112 P: GENE AND PROTEIN SCIENCE

| Sr. No. | Topic | No. of Hrs. |
|---|---|---|
| 1 | DNA isolation, Spectrophotometric assessment of purity (260 : 280 ratio) | **5** |
| 2 | Tm of DNA, | **5** |
| 3 | Electrophoresis of DNA, DNA damage study | **5** |
| 4 | Protein isolation, estimation and preservation | **5** |
| 5 | Dialysis of protein, Molecular weight determination of proteins by SDS PAGE | **5** |
| 6 | Protein characterization | **5** |
| **Total** | | **30 hrs** |

**Reference Books:**


1. Molecular Biology; David Freifelder, Narosa Publishing House, 2nd edition (2004).
2. Principles of Gene Manipulations; S. B. Primrose, R. M. Twyman, R. W. old, BlackwellScience, 6th Edition (2003).
3. Gene IX; Benjamin Lewin;Oxford Univ. Press, 8th edition (2004).
4. Advanced Molecular Biology; R. M. Twyman, 1st Edition, (2003).
5. Instant Notes on Molecular Biology; P.C. Turner, A. G. Mclennan, A. D. Bates & M. R. H. White, 2nd Edition (2002)
6. Structure and Mechanism in Protein Science: A Guide to Enzyme Catalysis and ProteinFolding by Alan Fersht.
7. Lehninger' Principles of biochemistry-Nelson,Cox, 4th Edn.,W.H.Freeman and Co., 2005.
8. Harper's Principles of Biochemistry-Murray, Gardener, Mayes, Rodwell, 27th N Edn.McGraw Hill Education, 2006.
9. Biochemistry-Zubay; G, 3rdEdn. Pearson Education P.Ltd, 2003.

| | |
|---|---|
| **Name of the Program** | **Molecular Biology** |
| **Semester** | **Semester II** |
| **Name of the Subject** | **Bioinformatics & Computational Biology** |
| **Subject Code** | **MMB 109T** |

| | |
|---|---|
| **Teaching Objective** | • The course is intended to give an overview of bioinformatics and computational biology in reference to its future applications.<br>• The objective is to impart an intuitive, understanding and knowledge of protein sequenceand nucleic acid data bank. The strategy would be to simplifysequence analysis and prediction.<br>• To understand the basic concept of prediction and probabilistic model in reference to biomolecules. |
| **Course Outcomes** | • The major outcome in this section will be basic knowledge of various data banks and datasets mainly for protein sequence and nucleic acid sequence.<br>• Students will understand the basic skill data analysis including cluster analysis and sequence analysis. |

| Sr. No. | Topic | No. of Hrs. |
|---|---|---|
| 1 | Introduction to Genomic data and Data Organization: Sequence Data Banks – Introduction to sequence date banks –Protein sequence data bank. NBFR-PIR, SWISSPROT, Signal peptide data bank, Nucleic acid sequence data bank –GenBank, EMBL nucleotide sequence data bank, AIDS virus sequence data bank, Structural databanks – protein Data Bank (PDB), The Cambridge Structural Database (CSD): Genome data bank – Metabolic pathway data: Microbial and Cellular Data Banks. | **8** |
| 2 | Sequence analysis: Analysis Tools for Sequence Data Banks; Pair wise alignment - NEEDLEMAN and Wunsch algorithm, Smith Waterman, BLAST, FASTA algorithms to analyze sequence data: Sequence patterns motifs and profiles. | **4** |
| 3 | Secondary Structure prediction (Proteins)s; prediction algorithms; Chao-Fasman algorithm, Hidden-Markov model, Neural Networking. Tertiary Structure predictions; prediction algorithms; Chao-Fasman algorithm, Hidden-Markov model, Neural Networking | **4** |
| 4 | Cluster analysis; Phylogenetic clustering by simple matching coefficients; Sequence Comparison; Sequencepattern; Regular expressionbased pattern; Theory of profiles and their use in sequence analysis; Markovmodels; Concept of HMMS; Baum-Welch algorithm; Use of profile HMM for protein family classification;Pattern recognition methods, Neighbor Joining | **5** |
| 5 | Applications in Biotechnology: Primer Designing, Phylogenetic Tree Analysis with Mammalian and Bacterial 9-10 specific genes, development of specific case studies | **4** |
| 6 | Protein classifications, Fold libraries, Protein structure prediction: Fold recognition (threading), Protein structure predictions: Comparative modeling (Homology), Advanced topics: Protein folding, Protein ligand interactions, Molecular Modeling & Dynamics, Drug Designing | **5** |

| | | |
|---|---|---|
| 7 | Goals of a Microarray experiment; Normalization of Microarray data; Detecting differential gene expression;Principal component analysis; Clustering of microarray data; Structure determination by X-raycrystallography; NMR spectroscopy; PDB (Protein Data Bank) and NDB (Nucleic Acid Data Bank); Fileformats for storage and dissemination of molecular structure | **7** |
| 8 | Probabilistic models and machine learning: Gene annotation and evolution | **4** |
| 9 | Horizons-The Future: Protein Structure, The Future: Haplotype Mapping | **4** |
| **Total** | | **45hrs** |

## MMB 113 P: BIOINFORMATICS &COMPUTATIONAL BIOLOGY

| Sr. No. | Topic | No. of Hrs. |
|---|---|---|
| 1 | Study of structure of proteins using PDB, PROSITE, CATH, SCOP | 4 |
| 2 | Multiple alignment and Phylogenetic tree | 4 |
| 3 | Compare DNA/ Protein sequences using BLAST<br>- Orthologs<br>- Paralogs/ Homologs | 6 |
| 4 | Find the motifs in DNA sequences | 4 |
| 5 | Understanding structure function using of KEGG database | 4 |
| 6 | Docking studies using Argus Lab. | 4 |
| 7 | Programmes related to graphics and animation, RASMOL, MOLMOL, MX VRML etc. | 4 |
| **Total** | | **30 hrs** |

**Note: Any 5 Practical from each subject is mandatory.**

**Reference Books:**

1. Introduction to Bioinformatics – Teresa Atwood and David J.Parry, Pearson smith publication (2003).
2. Sequence structure and Database – Des Higgins, Willice Taylor, Oxford press (2003).
3. Bioinformatics: Sequence and Genome analysis by David W. Mount CBS Publishers & Distributors, 2004 reprint.
4. Discovering Genomics, Proteomics and Bioinformatics, Campbell, ISBN: 788131715598, Pearson Education.
5. Bioinformatics: Databases, Tools, and Algorithms, OrpitaBosu, Simminder Kaur, Thukral , ISBN: 9780195676839, Oxford University Press.

| | |
|---|---|
| **Name of the Program** | **Molecular Biology** |
| **Semester** | **Semester II** |
| **Name of the Subject** | **DNA Recombinant Technology** |
| **Subject Code** | **MMB 110T** |

| | |
|---|---|
| **Teaching Objective** | • The course is intended to give an overview of recombinant DNA technology and their wide applications. The goal is to impart an intuitive, understanding and working knowledge of the processinvolved DNA recombinant technology and various strategies and systems. |
| **Course Outcomes** | • Student will be able to understand concept and process of DNA recombinant technology. It will also provide strategy and designs of experiment for product development. Course will also generate and teach as skills in molecular biology. |

| Sr. No. | TOPIC | No. of Hrs. |
|---|---|---|
| 1 | Introduction to recombinant DNA technology: Past, Present and future | **5** |
| 2 | Vectors in DNA recombinant technology, Bacteriophage derived vectors in recombinant DNA, Lambda vectors, cosmids, Phagemids/M13 vectors, Yeast vectors. | **5** |
| 3 | Enzymes used in DNA recombinant Technology, RE, DNA polymerases, Reverse Transcriptase, Polynucleotide Kinase, Terminal Transferase, Alkaline Phosphatase, S1-Nuclease, Bal-31, DNA Ligase. | **6** |
| 4 | Introduction to cloning, Overview of Cloning, Purification and Separation of Nucleic Acids – cutting and joining DNA and vectors<br>Design of Cloning and expression vectors, the construction of cDNA and genomic libraries, The labeling of DNA with radionucleotides, The screening of libraries: Oligonucleotide, cDNA and antibody probes | **8** |
| 5 | Transformation and Transfect ion Membrane Fusion, Electroporation Gene-Gun and Micro-injection | **5** |
| 6 | Restriction mapping; Chromosome walking and chromosomal localization of genes,RFLP and other uses of cloned sequences, micro cloning; DNA fingerprinting | **5** |
| 7 | Restriction modification systems in Bacteria; F factor and conjugation, transformation; Viruses: Generalized and Specialized transduction | **6** |
| 8 | Recombinant DNA products applications: Insulin, antigen vaccine, growth hormones | **5** |
| **Total** | | **45hrs** |

# MMB114 P: DNA RECOMBINANT TECHNOLOGY

| Sr. No. | Topic | No of Hrs. |
|---|---|---|
| 1 | Extraction of genomic DNA | **6** |
| 2 | Restriction digestion | **6** |
| 3 | DNA Ligation | **6** |
| 4 | Bacterial transformation<br>- Plasmid extraction & electrophoresis | **6** |
| 5 | Bacterial conjugation | **6** |
| **Total** | | **30 hrs** |

**Reference Books:**


1. Essential molecular biology by T. A. Brown, Oxford university press.
2. Recombinant DNA: Watson et. al.
3. Molecular Biology Lab fax I & II: T. A. Brown.
4. Gene Cloning and DNA analysis: An introduction, (2006) 5/e. T. A. Brown,Black Well Publishing Company.
5. Principles of Gene Manipulation; S. B. Primrose, R. M. Twyman& R. W. old;Blackwell Science, 6thEdition (2001).
6. Molecular Cloning lab manual; Joseph Sambrook, David W. Russell, cold SpringHarbor Laboratory Press, 3rdEdition (2001).

| | |
|---|---|
| **Name of the Programme** | **M.Sc. Molecular Biology** |
| **Semester** | **Semester I** |
| **Name of the Subject** | **Metabolic Engineering** |
| **Subject Code** | **MMB 111 T** |

| | |
|---|---|
| **Teaching Objective** | • To get post graduate students understand the basics of metabolic engineering and their function in biological system.<br>• Students understand the cellular reaction and metabolic pathway.<br>• To understand the applications of metabolic engineering. |
| **Course Outcomes** | • Students will understand the basics of metabolic pathways and network in cellular system.<br>• Understanding different models of cellular reactions.<br>• Students will understand the concept of metabolic flux analysis and metabolic control analysis.<br>• Understanding of the concept of metabolic design in strain development<br>• It will provide the understanding of the potential of metabolic engineering in industrial applications. |

| Sr. No. | Topics | No. of Hrs. |
|---|---|---|
| 1 | Introduction to metabolic engineering, Coordination of metabolic reactions: Feedback inhibition, Multigene networks, methods for metabolic characterization: Genome, Transcriptome, Proteome, Metabolome, Fluxome. | **8** |
| 2 | Different model of cellular reaction, Stochiometry of cellular reactions, Reaction rates, Dynamic mass balance. | **7** |
| | Regulation of metabolic pathways: Regulation of Enzymatic Activity, Regulation of Enzyme concentration, metabolic pathway manipulation. | **7** |
| 3 | Metabolic flux analysis: Over determined and undetermined systems, Sensitivity analysis, Metabolite Balancing, Tracer Experiments, MS and NMR in labelling measurement, Applications of metabolic flux analysis. | **8** |
| 4 | Metabolic control analysis (MCA): Determination of Flux control coefficients, MCA of Linear and Branched pathways. | **8** |
| 5 | Metabolic design: Gene amplification, Gene-disruption, Randomized and targeted strain development. | **7** |
| 6 | Metabolic Engineering in Practice: Actual examples from research and industrial biotechnology | **7** |
| **Total** | | **45hrs** |

# MMB 115 P: METABOLIC ENGINEERING

| Sr. No. | Topic | No. of Hrs. |
|---|---|---|
| 1 | Modulation of metabolic enzyme | 8 |
| 2 | Statin inhibition of HMG CoA reductase& its interpretation | 7 |
| 3 | Modification of metabolic network | 8 |
| 4 | Demonstration of cell signaling | 7 |
| **Total** | | **30 hrs** |

**Reference Books:**

1.Metabolic Engineering: Principles and Methodologies byGregory N. Stephanopoulos, Aristos Aristidou , Jens C. O. Nielsen.
2.Pathway Analysis and Optimization in Metabolic Engineering byByNéstor V. Torres
By Eberhard O. Voit,Cambridge University Press.

## Course code- MMB 116 CP: MMB Directed Clinical Education – II

Community orientation and; clinical visit (Including related Practical to the Parent course) Molecular Biology students will gain extensive clinical exposure in a hospital setting, allowing them to refine their skills in various diagnostic and therapeutic procedures. Under the supervision of experienced professionals, they will progressively interact with patients and healthcare personnel, enhancing their understanding in molecular biology applications in real-world scenarios. Their training will encompass quality assurance (QA) and quality control (QC) in NABH and NABL-accredited laboratories, ensuring they are well-versed in regulatory standards and best practices. Additionally, students will develop problem-solving skills and learn to address complications in healthcare management. This hands-on experience will also prepare them for administrative roles in hospital settings, equipping them with the knowledge, skills, and aptitude required for effective healthcare delivery. Through this structured clinical education, students will be immersed in a dynamic hospital environment, strengthening their competency in molecular biology. **(Total – 180 hrs.)**

# SKILL ENHANCEMENT COURSE

| | |
|---|---|
| **Name of the Program** | **M.Sc. Molecular Biology** |
| **Semester** | **Semester II** |
| **Name of the Subject** | **Innovation and Entrepreneurship** |
| **Subject Code** | **SEC 001 T** |

| | |
|---|---|
| **Course Outcome** | • Students will grasp the concepts of innovation, its ecosystem, and the role of various stakeholders such as government policies, startups, and innovation hubs.<br>• Cultivating an entrepreneurial mindset and leadership qualities necessary for driving innovation and leading ventures.<br>• Understanding the intersection of technology and innovation and leveraging emerging technologies for entrepreneurial ventures. |

| Sr. No. | Topics | No. of Hrs. |
|---|---|---|
| 1 | Innovation and Innovation Eco-System, The Policy Framework, Startup L and scape and Innovation Hubs, - Digital India and Make in India, - Linking Innovation with Intellectual Property Rights, Raising Finance for Startups in India, Innovation in Indian Context, Writing a business plan | **15** |
| 2 | Creativity and Research, Converting Research to Innovation: Innovation Types and Models, Product Development, IPR and its Commercialization, Support System to Develop Culture of Research and Innovation, commercialization of research and innovation, Fund raising – Research and Innovation, Envisioning Innovation and Scenario Building | **15** |
| 3 | Introduction to Innovation in Entrepreneurship, Idea Generation and Validation, Design Thinking in Entrepreneurship, Business Model Innovation, Technology and Innovation, Funding Innovation, Entrepreneurial Mindset, Leadership & amp; Intellectual Property, Scaling and Growth Strategies, sustainability & amp; Social Innovation | **15** |
| **Total** | | **45 hrs** |

| | |
|---|---|
| **Name of the Program** | **M.Sc. Molecular Biology** |
| **Semester** | **Semester II** |
| **Name of the Course** | **NPTEL Swayam** |
| **Course Code** | **SEC 002 T** |

**Note:** The links of SWAYAM/NPTEL courses (https://swayam.gov.in/nc_details/NPTEL)

# Scheme of University Examination Theory for PG Program:

General structure / patterns for setting up question papers for Theory / Practical courses, their evaluation weightages for PG programs of MGMSBS are given in the following tables

## Marks scheme for the University exam:

Final theory marks will be 100 marks (80 marks University Theory exam + 20 Marks Internal assessment).

| Question | | Marks distribution | Marks allotted per section | Marks |
|---|---|---|---|---|
| Sec: A | MCQ | 10 x 1 M = 10 | 10 | 10 |
| Sec: B | SAQ | 3/4x 5 M = 15 | 15 | 35 |
| Sec: B | LAQ | 2/3 x 10 M = 10 | 20 | |
| Sec: C | SAQ | 3/4x 5 M = 15 | 15 | 35 |
| Sec: C | LAQ | 2/3x 10 M = 10 | 20 | |
| **Total** | | | | **80 Marks** |

**Marks Scheme for the University Examination (50 Marks)**

Final theory marks will be 50 marks University Theory exam pattern Research Methodology & Biostatistics (Core course)

| Question | Question No. | Question Type | Marks Distribution | Marks |
|---|---|---|---|---|
| Sec: A | 1. | LAQ (2 out of 3) | 2 X 10 Marks = 20 | 20 |
| Sec: B | 2. | SAQ (6 out of 8) | 6 X 05 Marks = 30 | 30 |
| **Total** | | | | **50 Marks** |

**Marks Scheme for the University Examination (100 Marks)**

Final theory marks will be 100 marks University Theory exam pattern Elective Course

| Question | Question No. | Question Type | Marks Distribution | Marks |
|---|---|---|---|---|
| Sec: A | 1. | LAQ (10 out of 12) | 10 X 10 Marks = 100 | 100 |
| **Total** | | | | **100 Marks** |

**Practical exam pattern: Total 40 marks with following breakup:**

| Exercise | Description | Marks |
|---|---|---|
| Q No 1 | Practical exercise - 1 | 1 x15=15 M |
| Q No 2 | Station exercise | 2x5M=10 M |
| Q No 3 | VIVA | 10 M |
| Q No 4 | Journal | 5M |
| **Total** | | **40 Marks** |

**Practical exam pattern Research Methodology & Biostatistics (Core course)**

## Total 50-mark distribution:

| Exercise | Description | Marks |
|---|---|---|
| Q No 1 | **Practical/Problem-Solving:** These questions can assess statistical analysis, research design, hypothesis testing, or interpretation of data etc. | 2 × 10 marks each) = **20 marks** |
| Q No 2 | Identification of study designs, Critical appraisal of research papers, Application of biostatistical tools, Sampling techniques etc. | (4 × 5 marks each) = **20 marks** |
| Q No 3 | **Viva Voce (Oral Examination)** Assessing conceptual clarity, application of research methodology, and statistical reasoning. | **10 marks** |
| **Total** | | **50 Marks** |

**Practical to be conducted at respective departments and marks submitted jointly by the parent department to the university.**

**Breakup of theory IA calculation for 20 marks**

| Description | Marks |
|---|---|
| Internal exam (at department) | 15 marks |
| Seminar | 5 marks |
| **Total** | **20 Marks** |

**Breakup of practical IA calculation:**

| Description | Marks |
|---|---|
| Internal exam (at department) | 10 marks |
| Viva | 5 marks |
| Journal | 5 marks |
| **Total** | **20 Marks** |

**Note** –20 marks to be converted to 10 marks weightage for submission to the university.

# Model Checklist for Evaluation of the Clinical Directed Posting (PG)

Name of the student: _____Date:_____
Program: _____
Semester: _____ Name of the internal faculty/Observer: _____
Name of the External Faculty/Observer: _____

| Core Competencies | Marks allotted | Marks obtained |
|---|---|---|
| Students will begin to develop critical thinking abilities utilizing the allied health personnel roles of communicator and caregiver. Students will learn principles of professional allied health personnel practice and provide direct care to individuals within a medical surgical setting while recognizing the diverse uniqueness of individuals with health alterations. | | |
| **Clinical Teaching** | | |
| a. Demonstrate beginning competency in technical skills. | 10 | |
| **Independent Work by Student guided by faculty** | | |
| a. Develop effective communication skills (verbally and through charting) with patients, team members, and family | 2.5 | |
| b. Identify intra and inter-professional team member roles and scopes of practice. Establish appropriate relationships with team members. | 2.5 | |
| **Hands on practical work by students** | | |
| a. Protect confidentiality of electronic/manual health records data, information, and knowledge of technology in an ethical manner | 05 | |
| **Independent work by student** | | |
| a. Demonstrate expected behaviors and complete tasks in a timely manner. Arrive to clinical experiences at assigned times. Maintain professional behavior and appearance. | 05 | |
| **Log book** | 10 | |
| **Viva** | 10 | |
| **Attendance** | 05 | |
| **Total** | **50 Marks** | |

Sign of Internal Examiner: _____
Sign of External Examiner: _____

Resolution No. 5.1 of Academic Council (AC-52/2025):
Resolved to approve the CBCS syllabus, including Program Outcomes (POs) and Course Outcomes (COs), for Postgraduate (PG) 2-year programs under MGMSBS (semester III & IV) for M.Sc. Medical Biotechnology, M.Sc. Medical Genetics, M.Sc. Clinical Embryology, M.Sc. Clinical Nutrition, M.Sc. Medical Dialysis Technology, M.Sc. Molecular Biology, M.Sc. Medical Radiology & Imaging Technology, M.Sc. Cardiac Care Technology, M.Sc. Operation Theatre and Anaesthesia Technology, M.Sc. Emergency and Trauma Care, M. Optometry, Masters in Hospital Administration, Masters of Public Health, M.Sc. Health Informatics, M.Sc. Medical Laboratory Technology, M. Sc. Clinical Research, to be effective from batch admitted in the Academic Year 2025-26 onwards. Guidelines for selected programmes as per National Commission for Allied & Healthcare Professions will be adopted for the given programmes from academic year 2026-27 onwards [ANNEXURE-17A, 17B, 17C, 17D, 17E, 17F, 17G, 17H, 17I, 17J, 17K, 17L, 17M, 17N, 17O & 17P and ANNEXURE-18A, 18B, 18C, 18D, 18E, 18F, 18G, 18H, 18I, 18J, 18K, 18L, 18M, 18N, 18O & 18P].

Annexure-17F of AC-52/2025

# MGM SCHOOL OF BIOMEDICAL SCIENCES

**(A constituent unit of MGM INSTITUTE OF HEALTH SCIENCES)**

(Deemed to be University u/s 3 of UGC Act 1956)

Grade "A$^{++}$" Accredited by NAAC

Sector 1, Kamothe, Navi Mumbai-410209, Tel.No.:022-2743763,27437632, 27432890

Email:sbsnm@mgmuhs.com/Website: www.mgmsbsnm.edu.in

## CHOICE BASED CREDIT SYSTEM (CBCS)

## (Academic Year 2025-26)

## Curriculum for

## M.Sc. Allied Health Sciences

## M.Sc. Molecular Biology

## Semester III & IV

# Course Outcomes
# Semester III

| MMB 117 T & MMB 121 P | Genomics | Mapped PO | Teaching-Learning Methodology | Assessment Tools |
|---|---|---|---|---|
| CO1 | The student will understand large scale study of gene structure and function. | PO1, PO2 | Lecture, Practical, Assignment, Seminar, group discussion | Theory exam, Practical exam, Viva-voce, Seminar, Internal assessment, skill assessment |
| CO2 | The course will highlight the various technologies involved in mapping of genome. | PO1, PO2 | Lecture, Practical, Assignment, Seminar, group discussion | Theory exam, Practical exam, Viva-voce, Seminar, Internal assessment, skill assessment |
| CO3 | Students will understand the overview of genome regulation. | PO7, PO8 | Lecture, Practical, Assignment, Seminar, group discussion | Theory exam, Practical exam, Viva-voce, Seminar, Internal assessment, skill assessment |
| CO4 | Will explore applications of genomics in biomarker discovery, drug development, disease diagnostics, and personalized medicine. | PO1, PO2 | Lecture, Practical, Assignment, Seminar, group discussion | Theory exam, Practical exam, Viva-voce, Seminar, Internal assessment |
| **MMB 118 T & MMB 122 P** | **Proteomics** | **Mapped PO** | **Teaching-Learning Methodology** | **Assessment Tools** |
| CO1 | Students will gain knowledge of protein structure and function at large scale. | PO1, PO2 | Lecture, Practical, Assignment, Seminar, group discussion | Theory exam, Practical exam, Viva-voce, Seminar, Internal assessment, skill assessment |
| CO2 | Students will understand the post-translational modifications of protein, and their roles in biological systems. | PO1, PO2 | Lecture, Practical, Assignment, Seminar, group discussion | Theory exam, Practical exam, Viva-voce, Seminar, Internal assessment, skill assessment |
| CO3 | Students will understand identify protein characteristics and functions including protein -protein interaction | PO1, PO2 | Lecture, Practical, Assignment, Seminar, group discussion | Theory exam, Practical exam, Viva-voce, Seminar, Internal assessment, skill assessment |
| CO4 | Help to explore applications in biomarker discovery, drug development, disease | PO1, PO2 | Lecture, Practical, Assignment, Seminar, group discussion | Theory exam, Practical exam, |

| | | | | |
|---|---|---|---|---|
| | diagnostics, and personalized medicine. | | | Viva-voce, Seminar, Internal assessment, skill assessment |
| **MMB 119 T & MMB 123 P** | **Drug Discovery** | **Mapped PO** | **Teaching-Learning Methodology** | **Assessment Tools** |
| CO1 | Students will gain knowledge of high-throughput screening, computational drug design, and vitro assays. | PO1, PO2, PO5, PO6 | Lecture, Practical, Assignment, Seminar, group discussion | Theory exam, Practical exam, Viva-voce, Seminar, Internal assessment |
| CO2 | Students will understand drug testing phases, regulatory requirements, and ethical considerations. | PO1, PO2, PO6, PO7 | Lecture, Practical, Assignment, Seminar, group discussion | Theory exam, Practical exam, Viva-voce, Seminar, Internal assessment |
| CO3 | Will develop insights into pharmaceutical innovations and real-world drug development. | PO1, PO2, PO5, PO6 | Lecture, Practical, Assignment, Seminar, group discussion | Theory exam, Practical exam, Viva-voce, Seminar, Internal assessment |
| **MMB 120** | **Research Project / Dissertation** | **Mapped POs** | **Teaching-Learning Methodologies** | **Assessment Tools** |
| **CO1** | Formulate a research problem by reviewing scientific literature and identifying knowledge gaps in molecular biology. | PO1, PO2, PO3, PO4, PO5, PO6, PO8 | Faculty Mentorship and Supervision, Hands-on Laboratory Training, Documentation and Reporting | Dissertation Report, Viva Voce / Oral Defence (University Exam) |
| **CO2** | Design and execute experiments using appropriate methodologies, tools, and techniques relevant to biomedical research. | PO1, PO2, PO3, PO4, PO5, PO6, PO8 | Faculty Mentorship and Supervision, Hands-on Laboratory Training, Documentation and Reporting | Dissertation Report, Viva Voce / Oral Defence (University Exam) |
| **CO3** | Demonstrate proficiency in handling advanced molecular biology, biochemistry, microbiology, and bioinformatics methods as required for their research project. | PO1, PO2, PO3, PO4, PO5, PO6, PO8 | Faculty Mentorship and Supervision, Hands-on Laboratory Training, Documentation and Reporting | Dissertation Report, Viva Voce / Oral Defence (University Exam) |
| **CO4** | Critically analyse and interpret experimental data using appropriate statistical and computational tools. | PO1, PO2, PO3, PO4, PO5, PO6, PO8 | Faculty Mentorship and Supervision, Hands-on Laboratory Training, Documentation and Reporting | Dissertation Report, Viva Voce / Oral Defence (University Exam) |
| **CO5** | Adhere to ethical standards in biomedical research, including | PO5 | Faculty Mentorship and Supervision, Hands-on Laboratory Training, | Dissertation Report, Viva Voce / Oral Defence (University Exam) |

| | | | | |
|---|---|---|---|---|
| | biosafety, data integrity, and responsible reporting. | | Documentation and Reporting | |
| **CO6** | Communicate research findings effectively through well-structured dissertation writing, presentations, and potential publications. | PO6 | Faculty Mentorship and Supervision, Hands-on Laboratory Training, Documentation and Reporting | Dissertation Report, Viva Voce / Oral Defence (University Exam) |
| **CO7** | Work independently and collaboratively to solve research challenges and manage time efficiently during the project. | PO2 | Faculty Mentorship and Supervision, Hands-on Laboratory Training, Documentation and Reporting | Dissertation Report, Viva Voce / Oral Defence (University Exam) |
| **CO8** | Develop a research-oriented mind-set that prepares them for higher studies, industrial R&D, or academic research careers. | PO1, PO2, PO3, PO4, PO5, PO6, PO7, PO8 | Faculty Mentorship and Supervision, Hands-on Laboratory Training, Documentation and Reporting | Dissertation Report, Viva Voce / Oral Defence (University Exam) |
| **MMB 124 CP** | **MMB Directed Clinical Education-III** | **Mapped POs** | **Teaching-Learning Methodology** | **Assessment Tools** |
| **CO1** | Demonstrate proficiency in diagnostic and therapeutic techniques used in hospital laboratories. | PO1 | Pre-Clinical Orientation, Laboratory Hands-on Training, Problem-Based Learning. | Daily log book, Direct observation and feedback by mentors |
| **CO2** | Effectively communicate and collaborate with healthcare professionals and patients. | PO6 | Pre-Clinical Orientation, Laboratory Hands-on Training, Problem-Based Learning. | Daily log book, Direct observation and feedback by mentors |
| **CO3** | Develop decision-making skills for effective healthcare management and administration. | PO2, PO3 | Pre-Clinical Orientation, Laboratory Hands-on Training, Problem-Based Learning. | Daily log book, Direct observation and feedback by mentors |

# Semester IV

| MMB 125 T | Bioethics, IPR and Biosafety | Mapped PO | Teaching-Learning Methodology | Assessment Tools |
|---|---|---|---|---|
| CO1 | Effectively manage the health and safety aspects of a biological laboratory. | PO1, PO6, PO7, PO8 | Lecture, Practical, Assignment, Seminar, group discussion, workshop, guest lecture | Theory exam, Practical exam, Seminar, Internal assessment |
| CO2 | Give reliable, professional and informed advice and information to colleagues and managers | PO1, PO6, PO7, PO8 | Lecture, Practical, Assignment, Seminar, group discussion, jworkshop, guest lecture | Theory exam, Practical exam, Seminar, Internal assessment |
| CO3 | Help ensure that their institution complies with relevant legislation, liaise effectively with enforcing authorities and beware of the penalties for failing to comply. | PO1, PO6, PO7, PO8 | Lecture, Practical, Assignment, Seminar, group discussion, workshop, guest lecture | Theory exam, Practical exam, Seminar, Internal assessment |
| CO4 | Build a context of understanding through communication. | PO1, PO6, PO7, PO8 | Lecture, Practical, Assignment, Seminar, group discussion, workshop, guest lecture | Theory exam, Practical exam, Seminar, Internal assessment |
| CO5 | Mediate between other conflicting parties. | PO1, PO6, PO7, PO8 | Lecture, Practical, Assignment, Seminar, group discussion, workshop, guest lecture | Theory exam, Practical exam, Seminar, Internal assessment |
| CO6 | Exhibit de-escalatory behaviors in situations of conflict. | PO1, PO6, PO7, PO8 | Lecture, Practical, Assignment, Seminar, group discussion, workshop, guest lecture | Theory exam, Practical exam, Seminar, Internal assessment |
| CO7 | Demonstrate acknowledgment and validation of the feelings, opinions, and contributions of others. | PO1, PO6, PO7, PO8 | Lecture, Practical, Assignment, Seminar, group discussion, workshop, guest lecture | Theory exam, Practical exam, Seminar, Internal assessment |
| **MMB 120** | **Research Project / Dissertation** | **Mapped POs** | **Teaching-Learning Methodologies** | **Assessment Tools** |
| **CO1** | Formulate a research problem by reviewing scientific literature and identifying knowledge gaps in molecular biology. | PO1, PO2, PO3, PO4, PO5 | Faculty Mentorship and Supervision, Hands-on Laboratory Training, Documentation and Reporting | Dissertation Report, Viva Voce / Oral Defence (University Exam) |
| **CO2** | Design and execute experiments using appropriate methodologies, tools, and techniques relevant to biomedical research. | PO1, PO2, PO3, PO4, PO5,PO8 | Faculty Mentorship and Supervision, Hands-on Laboratory Training, Documentation and Reporting | Dissertation Report, Viva Voce / Oral Defence (University Exam) |
| **CO3** | Demonstrate proficiency in handling advanced molecular biology, biochemistry, microbiology, and bioinformatics | PO1, PO2, PO3, PO4, PO5, PO6, PO8 | Faculty Mentorship and Supervision, Hands-on Laboratory Training, | Dissertation Report, Viva Voce / Oral Defence (University Exam) |

| | | | | |
|---|---|---|---|---|
| | methods as required for their research project. | | Documentation and Reporting | |
| **CO4** | Critically analyse and interpret experimental data using appropriate statistical and computational tools. | PO1, PO2, PO3, PO4, PO5, PO6, | Faculty Mentorship and Supervision, Hands-on Laboratory Training, Documentation and Reporting | Dissertation Report, Viva Voce / Oral Defence (University Exam) |
| **CO5** | Adhere to ethical standards in biomedical research, including biosafety, data integrity, and responsible reporting. | PO4,PO7,PO8 | Faculty Mentorship and Supervision, Hands-on Laboratory Training, Documentation and Reporting | Dissertation Report, Viva Voce / Oral Defence (University Exam) |
| **CO6** | Communicate research findings effectively through well-structured dissertation writing, presentations, and potential publications. | PO3,PO4,PO6 | Faculty Mentorship and Supervision, Hands-on Laboratory Training, Documentation and Reporting | Dissertation Report, Viva Voce / Oral Defence (University Exam) |
| **CO7** | Work independently and collaborativelyto solve research challenges and manage time efficiently during the project. | PO2,PO4,PO8 | Faculty Mentorship and Supervision, Hands-on Laboratory Training, Documentation and Reporting | Dissertation Report, Viva Voce / Oral Defence (University Exam) |
| **CO8** | Develop a research-oriented mind-set that prepares them for higher studies, industrial R&D, or academic research careers. | PO1, PO2, PO3, PO4, PO5, PO6, PO8 | Faculty Mentorship and Supervision, Hands-on Laboratory Training, Documentation and Reporting | Dissertation Report, Viva Voce / Oral Defence (University Exam) |
| **MMB 126 P** | **Internship/Training (Clinical/ Industrial)** | Mapped POs | **Teaching-Learning Methodologies** | **Assessment Tools** |
| **CO1** | Demonstrate an understanding of industrial processes, laboratory practices, and molecular biological applications in real-life settings. | PO1, PO2, PO4,PO8 | Experiential Learning at Industry/Research Institute, Observation and Demonstration, Seminar/Discussion Sessions | Internship / training log book, Weekly Summary report, Industrial visit report, Seminar |
| **CO2** | Apply theoretical knowledge gained during coursework to practical situations in industry/clinical/research environments. | PO1, PO2, PO3, PO4, PO5, PO6,PO8 | Experiential Learning at Industry/Research Institute, Observation and Demonstration, Seminar/Discussion Sessions | Internship / training log book, Weekly Summary report, Industrial visit report, Seminar |
| **CO3** | Operate and gain familiarity with standard instruments, diagnostic tools, and workflows followed in molecular biology-related organizations. | PO1,PO3, PO5 | Experiential Learning at Industry/Research Institute, Observation and Demonstration, Seminar/Discussion Sessions | Internship / training log book, Weekly Summary report, Industrial visit report, Seminar |
| **CO4** | Analyse and document technical data, reports, and observations from industrial exposure. | PO2,PO4 | Experiential Learning at Industry/Research Institute, Observation and Demonstration, Seminar/Discussion Sessions | Internship / training log book, Weekly Summary report, Industrial visit report, Seminar |

| | | | | |
|---|---|---|---|---|
| **CO5** | Exhibit improved professional skills including communication, teamwork, adaptability, and workplace ethics. | PO1,PO2,PO5, PO7 | Experiential Learning at Industry/Research Institute, Observation and Demonstration, Seminar/Discussion Sessions | Internship / training log book, Weekly Summary report, Industrial visit report, Seminar |
| **CO6** | Critically evaluate the role of molecular biology in healthcare, diagnostics, pharmaceuticals, and research. | PO1, PO2, PO6, PO8 | Experiential Learning at Industry/Research Institute, Observation and Demonstration, Seminar/Discussion Sessions | Internship / training log book, Weekly Summary report, Industrial visit report, Seminar |
| **CO7** | Identify potential career pathways and entrepreneurial opportunities in the molecular biology sector | PO6, PO8 | Experiential Learning at Industry/Research Institute, Observation and Demonstration, Seminar/Discussion Sessions | Internship / training log book, Weekly Summary report, Industrial visit report, Seminar |
| **CO8** | Integrate biosafety, regulatory, and quality assurance practices into professional conduct. | PO5, PO6, PO8 | Experiential Learning at Industry/Research Institute, Observation and Demonstration, Seminar/Discussion Sessions | Internship / training log book, Weekly Summary report, Industrial visit report, Seminar |

## OUTLINE OF COURSE CURRICULUM

## M.Sc. MOLECULAR BIOLOGY

### Semester III

| Code No. | Core Course | Credits/Week | | | | | Hrs/Semester | | | | | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Lecture (L) | Tutorial (T) | Practical (P) | Clinical Posing/ Rotation (CP) | Total Credits (C) | Lecture (L) | Tutorial (T) | Practical (P) | Clinical Posing/ Rotation (CP) | Total (hrs.) | Internal Assement (IA) | Semester End Exam (SEE) | Total |
| **Discipline Specific Core Theory** | | | | | | | | | | | | | | |
| MMB 117 T | Genomics | 3 | - | - | - | 3 | 45 | - | - | - | 45 | 20 | 80 | 100 |
| MMB 118 T | Proteomics | 3 | - | - | - | 3 | 45 | - | - | - | 45 | 20 | 80 | 100 |
| MMB 119 T | Drug Discovery | 3 | - | - | - | 3 | 45 | - | - | - | 45 | 20 | 80 | 100 |
| MMB 120 | Research Project/ Disserration | - | - | 10 | - | 5 | - | - | 150 | - | 150 | 50 | - | 50 |
| **Discipline Specific Core Practical** | | | | | | | | | | | | | | |
| MMB 121 P | Genomics | - | - | 2 | - | 1 | - | - | 30 | - | 30 | 10 | 40 | 50 |
| MMB 122 P | Proteomics | - | - | 2 | - | 1 | - | - | 30 | - | 30 | 10 | 40 | 50 |
| MMB 123 P | Drug Discovery | - | - | 4 | - | 2 | - | - | 60 | - | 60 | 10 | 40 | 50 |
| MMB 124 CP | MMB Directed Clinical Education III | - | - | - | 12 | 4 | - | - | - | 180 | 180 | - | 50 | 50 |
| **Total** | | 9 | 0 | 18 | 12 | 22 | 135 | 0 | 270 | 180 | 585 | 140 | 410 | 550 |

## OUTLINE OF COURSE CURRICULUM

## M.Sc. MOLECULAR BIOLOGY

### Semester IV

| Code No. | Core Course | Credits/Week | | | | | Hrs/Semester | | | | | Marks | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | | Lecture (L) | Tutorial (T) | Practical (P) | Clinical Posing/ Rotation (CP) | Total Credits (C) | Lecture (L) | Tutorial (T) | Practical (P) | Clinical Posing/ Rotation (CP) | Total (hrs.) | Internal Assement (IA) | Semester End Exam (SEE) | Total |
| **Discipline Specific Core Theory** | | | | | | | | | | | | | | |
| MMB 125 T | Bioethics, IPR and Biosafety | 3 | - | - | - | 3 | 45 | - | - | - | 45 | 20 | 80 | 100 |
| **Discipiline Specific Core Practical** | | | | | | | | | | | | | | |
| MMB 120 | Research Project/ Disserration | - | - | 22 | - | 11 | - | - | 330 | - | 330 | - | 200 | 200 |
| MMB 126 P | Internship/ Training (Clinical/ Industrial) | - | - | - | 18 | 6 | - | - | - | 210 | 210 | - | 50 | 50 |
| **Total** | | 3 | 0 | 22 | 18 | 20 | 45 | 0 | 330 | 210 | 585 | 20 | 330 | 350 |

# SECOND YEAR

## M.Sc. MOLECULAR BIOLOGY

## SEMESTER III

| CODE NO | CORE SUBJECT |
|---|---|
| **Discipline Specific Core Theory** | |
| MMB 117 T | Genomics |
| MMB 118 T | Proteomics |
| MMB 119 T | Drug discovery |
| MMB 120 | Research Project/ Dissertation |
| **Discipline Specific Core Practical** | |
| MMB 121 P | Genomics |
| MMB 122 P | Proteomics |
| MMB 123 P | Drug discovery |
| MMB 124 CP | MMB Directed Clinical Education III |

| | |
|---|---|
| **Name of the Program** | **Molecular Biology** |
| **Semester** | **Semester III** |
| **Name of the Subject** | **Genomics** |
| **Subject Code** | **MMB 117 T** |

| | |
|---|---|
| **Teaching Objective** | • To understand the basics concept of genomics, DNA sequencing technology.<br>• To understand gene evolution and methods of mapping of genome.<br>• To understand gene structure and function including regulation genome activity.<br>• Applications of genomics in synthetic biology and bioengineering. |
| **Course Outcomes** | • The student will understand large scale study of gene structure and function.<br>• The course will highlight the various technologies involved in mapping of genome.<br>• Students will understand the overview of genome regulation.<br>• Will explore applications of genomics in biomarker discovery, drug development, disease diagnostics, and personalized medicine. |

| Sr. No. | TOPIC | No. of Hrs. |
|---|---|---|
| 1 | Introduction to genomics, completegenomes, the "omics" revolution, early sequencing efforts, DNA sequencing technology developed. | **5** |
| 2 | Structural genomics, Functional genomics, Epigenomics, Metagenomics, Pharmacogenomics. | **5** |
| 3 | Gene evolution and the human genome, human genome project, the content of human nuclear genome, tandemly repeated DNA, interspersed genome-wide repeats, human mitochondrial genome, genome evolution-acquisition of new genes (gene duplication, from other species, transposable elements), Non-coding DNA. | **10** |
| 4 | Mapping genomes, DNA markers for genetic mapping, physical mapping, restriction mapping, Fluorescent *in situ*hybridization(FISH), Sequence tagged site (STS) mapping, sequencing pipelines and databases, discovery of molecular biomarker (Northern blot, Gene expression, SAGE, DNA Microarray). | **10** |
| 5 | Overview of regulation of genome activity, genome rearrangements, gene silencing by modification of histones and DNA, RNA in gene regulation, regulation of genome activity during development: Vulva development in *Caenorhabditiselegans*, Development in*Drosophila melanogaster.* | **10** |
| 6 | Genomic medicine, synthetic biology and bioengineering | **5** |
| **Total** | | **45 hrs** |

**Reference Books:**


1. Essential molecular biology by T. A. Brown, Oxford university press.
2. Molecular Biology Lab fax I & II: T. A. Brown.
3. Gene Cloning and DNA analysis: An introduction, (2006) 5/e. T. A. Brown, Black Well Publishing Company.
4. Principles of Gene Manipulation; S. B. Primrose, R. M. Twyman& R. W. old; Blackwell Science, 6th Edition (2001).
5. Molecular Cloning lab manual; Joseph Sambrook, David W. Russell, cold Spring Harbor Laboratory Press, 3rd Edition (2001)
6. Genomics: Fundamentals and applications by: Supratim Choudhuri, David B. Carlson
7. Introduction to Genomics Third edi.by Arthur M. Lesk

## MMB 121 P: GENOMICS

| Sr. No. | Topic | No. of Hrs. |
|---|---|---|
| 1 | Endonuclease digestion of nuclei, (RFLP) | **5** |
| 2 | Western blotting | **5** |
| 3 | Elisa reader based assay | **5** |
| 4 | Polymerase Chain Reaction (PCR) | **10** |
| 5 | Demonstration on Northern & Southern blotting | **5** |
| **Total** | | **30 hrs.** |

**Reference Books:**


1. Essential molecular biology by T. A. Brown, Oxford university press.
2. Molecular Biology Lab fax I & II: T. A. Brown.
3. Gene Cloning and DNA analysis: An introduction, (2006) 5/e. T. A. Brown, Black Well Publishing Company.
4. Principles of Gene Manipulation; S. B. Primrose, R. M. Twyman& R. W. old; Blackwell Science, 6th Edition (2001).
5. Molecular Cloning lab manual; Joseph Sambrook, David W. Russell, cold Spring Harbor Laboratory Press, 3rd Edition (2001)
6. Genomics: Fundamentals and applications by: SupratimChoudhuri, David B. Carlson
7. Introduction to Genomics Third edi.by Arthur M. Lesk

| | |
|---|---|
| **Name of the Program** | **Molecular Biology** |
| **Semester** | **Semester III** |
| **Name of the Subject** | **Proteomics** |
| **Subject Code** | **MMB 118 T** |

| | |
|---|---|
| **Teaching Objective** | • To understand the concept of proteome and proteomics.<br>• To study the structure, function, and interactions of proteins, along with their role in cellular processes and disease mechanisms.<br>• To train students in using proteomic databases, computational tools, and software for protein structure prediction and functional analysis.<br>• Educate on quality control, ethical concerns, and regulatory guidelines in proteomics research and clinical applications. |
| **Course Outcomes** | • Students will gain knowledge of protein structure and function at large scale.<br>• Students will understand the post-translational modifications of protein, and their roles in biological systems.<br>• Students will understand identify protein characteristics and functions including protein -protein interaction<br>• Help to explore applications in biomarker discovery, drug development, disease diagnostics, and personalized medicine. |

| **Sr. No.** | **TOPIC** | **No. of Hrs.** |
|---|---|---|
| 1 | Introduction to Proteomics, Immunoproteomics, Nutriproteomics, scope of proteomics, limitations of proteomics studies. | **5** |
| 2 | Proteomes and complexity, post-translational modifications, phosphorylation, ubiquitination, structure- function relationship of proteins, protein domains within a protein with independent function. Protein binding sites & protein subunits in large protein molecules. Effect of protein modification & cleavage eg: caspases, mammalian cytochrome C Importance of 3D- structure of proteins on its functions eg: reverse transcriptase. | **10** |
| 3 | Protein-ligand interactions, protein binding to small molecules & ions, oxygen binding eg: Hemoglobin, Calcium activation of troponin, modification of enzymes by binding to cofactors and coenzymes, Protein- receptor, Protein- Nucleic acid interaction, G protein receptor interaction and activation, histone binding to DNA, Prions allosteric changes in protein conformation due to ligand binding | **10** |
| 4 | Methods of studying proteins and current proteomic technologies protein detection with immunoassay, identifying proteins that are post-translationally modified, mass spectrometry and protein profiling protein chips, reverse-phased protein microarrays, Ab-microarray, Tissue – microarray. | **10** |
| 5 | Practical applications of proteomics, biomarkers, current research methodologies, protein engineering, basic concepts for designing a new protein, energy status of protein molecules, Protein crystallization, X-Ray Crystallography for determination of protein structure | **5** |
| 6 | Emerging trends in proteomics, Human plasma proteome, proteome informatics. | **5** |
| **Total** | | **45 hrs.** |

## MMB 122 P: PROTEOMICS

| Sr. No. | Topic | No. of Hrs. |
|---|---|---|
| 1 | Protein crystallization method | **5** |
| 2 | 2- D gel electrophoresis of proteins | **10** |
| 3 | Measurement of glycosylation in protein | **5** |
| 4 | Chemical modification of proteins *in vitro*& functional studies. | **3** |
| 5 | Immobilization of proteins. | **5** |
| 6 | Demonstration of Antibody Microarray. | **2** |
| **Total** | | **30 hrs.** |

**Reference Books:**


1. Introduction to Proteomics: Principles and Applications by Nawin C. Mishra , Günter Blobel, Wiley publisher.
2. Principles of Proteomics by Richard Twyman, Garland science/BIOS Scientific publisher.
3. Principles and techniques of biochemistry and molecular biology by Wilson and Walker, Cambridge University Press.
4. Tools and techniques of biotechnology, MousumiDebnath, Pointer Publishers, 1st edition.
5. Proteomics: Theory and Practice, Gomase VS and Chikhale NJ, Himalaya Publication House

| | |
|---|---|
| **Name of the Program** | **Molecular Biology** |
| **Semester** | **Semester III** |
| **Name of the Subject** | **Drug Discovery** |
| **Subject Code** | **MMB 119 T** |

| | |
|---|---|
| **Teaching Objective** | • To teach the stages from target identification to lead optimization.<br>• To cover high-throughput screening, computational drug design, and in vitro assays.<br>• To explain drug testing phases, regulatory approvals, and ethical considerations.<br>• To explore the role of genomics, proteomics, and AI in drug development. |
| **Course Outcomes** | • Students will gain knowledge of high-throughput screening, computational drug design, and vitro assays.<br>• Students will understand drug testing phases, regulatory requirements, and ethical considerations.<br>• Will develop insights into pharmaceutical innovations and real-world drug development. |

| **Sr. No.** | **TOPIC** | **No. of Hrs.** |
|---|---|---|
| 1 | Introduction to drug discovery**,** Pharmaceutical industry and drug development process, **s**tandard Drug Discovery Model, Small molecule drugs, Biologicals | **5** |
| 2 | Molecular Interactions in Proteins and Enzymes, Discovery, Innovation and Emerging Technologies, Examples of drug ability, Issues in the pharmaceutical industry. | **10** |
| 3 | Right target, Overview on target validation, Systems Approaches in Drug Discovery, Chemical Genetics, Target selection and biomarkers**,** Protein modelling strategies. | **10** |
| 4 | The right drugs, *Insilico* drug design, Structural biology for drug design, Bioanalytical Techniques, High throughput screening, High content screening, Re-purposing drugs, Fragment-based drug design, Whole animal imaging, Gene therapy, Molecular Toxicology in Preclinical Studies. | **10** |
| 5. | Getting drugs to market, Financing and protecting drug discovery, Designing Clinical Trials, Current therapeutic challenges in Infection, Cardiovascular disease, Cancer, Inflammation and COPD, Neurodegenerative diseases | **5** |
| 6 | Regulatory process, FDA drug regulatory process policy and economic considerations in drug development | **5** |
| **Total** | | **45 hrs** |

## MMB 123 P: DRUG DISCOVERY

| Sr. No. | **Topic** | **No. of Hrs.** |
|---|---|---|
| 1 | Disease and Drug target identification and bioassay: Obesity, pancreatic lipase and development of natural substrate based assay for pancreatic lipase | 15 |
| 2 | Preparation of molecule and extract library: preparation of plant extracts (sequential extract) and TLC profiling | 10 |
| 3 | High throughput screening and selection: Lipase inhibition assay 96 well format system and selection | 15 |

| | | |
|---|---|---|
| 4 | Drug ability: IC 50 of lipase inhibitor, reversibility/irreversibility, Ki (Inhibitory concentration) | 10 |
| 5 | Invitro-toxicity assay: MTT | 10 |
| **Total** | | **60 hrs.** |

**Reference Books:**

1. Drug discovery and development (II edi.) by Raymond G. Hill, Humphrey P. Rang
2. Basic principles of drug discovery and development by: Benjamin Blass
3. Successful drug discovery by: Janos Fischer, David P.Rotella

| | |
|---|---|
| **Name of the Program** | **M.Sc. Molecular Biology** |
| **Semester** | **Semester III** |
| **Name of the Course** | **Research Project/ Dissertation** |
| **Course Code** | **MMB 120** |

| | |
|---|---|
| **Course Objective** | The dissertation course is designed to provide postgraduate students with hands-on experience in scientific research, enabling them to apply theoretical knowledge and laboratory skills acquired during the M.Sc. Molecular Biology program. The objective is to cultivate independent thinking, critical analysis, problem-solving abilities, and technical expertise in experimental design, data collection, analysis, and interpretation. It also aims to nurture scientific communication skills, ethical research practices, and the capacity to contribute meaningfully to biomedical and translational research. |
| **Course Outcomes** | • Formulate a research problem by reviewing scientific literature and identifying knowledge gaps in molecular biology<br>• Design and execute experiments using appropriate methodologies, tools, and techniques relevant to biomedical research.<br>• Demonstrate proficiency in handling advanced molecular biology, biochemistry, microbiology, and bioinformatics methods as required for their research project.<br>• Critically analyse and interpret experimental data using appropriate statistical and computational tools.<br>• Adhere to ethical standards in biomedical research, including biosafety, data integrity, and responsible reporting.<br>• Communicate research findings effectively through well-structured dissertation writing, presentations, and potential publications.<br>• Work independently and collaboratively to solve research challenges and manage time efficiently during the project.<br>• Develop a research-oriented mind-set that prepares them for higher studies, industrial R&D, or academic research careers. |

**Research Project / Dissertation:**

The dissertation is a mandatory component of the M.Sc. Molecular Biology program, designed to provide students with hands-on research experience and the opportunity to apply theoretical knowledge to practical problems. It involves independent project work under the guidance of a faculty supervisor, focusing on advanced areas of such as molecular biology, immunology, microbiology, or therapeutics. The dissertation aims to develop critical thinking, problem-solving, data analysis, and scientific writing skills, preparing students for careers in research, industry, or higher studies**.** The dissertation process is stringent and span over two year, the student has to design a protocol and submit it to the institutional research advisory committee and get it approved form it, thereafter the student has to submit the proposal for institutional ethical approval for animal and human ethics committees ( Recognized by DHR-ICMR)**,** post approval the student has to conduct a thorough research project work to achieve the objectives mentioned in the approved proposal **(Total - 150 hrs)**

| | |
|---|---|
| **Name of the Program** | **M.Sc. Molecular Biology** |
| **Semester** | **Semester III** |
| **Name of the Course** | **MMB Directed Clinical Education – III** |
| **Course Code** | **MMB 124 CP** |

| | |
|---|---|
| **Course Outcomes** | • Demonstrate proficiency in diagnostic and therapeutic techniques used in hospital laboratories.<br>• Effectively communicate and collaborate with healthcare professionals and patients.<br>• Develop decision-making skills for effective healthcare management and administration. |

Community orientation and; clinical visit (Including related Practical to the Parent course) Molecular Biology students will gain extensive clinical exposure in a hospital setting, allowing them to refine their skills in various diagnostic and therapeutic procedures. Under the supervision of experienced professionals, they will progressively interact with patients and healthcare personnel, enhancing their understanding in molecular biology applications in real-world scenarios. Their training will encompass quality assurance (QA) and quality control (QC) in NABH and NABL-accredited laboratories, ensuring they are well-versed in regulatory standards and best practices. Additionally, students will develop problem-solving skills and learn to address complications in healthcare management. This hands-on experience will also prepare them for administrative roles in hospital settings, equipping them with the knowledge, skills, and aptitude required for effective healthcare delivery. Through this structured clinical education, students will be immersed in a dynamic hospital environment, strengthening their competency in molecular biology. **(Total - 180 hrs.)**

# SECOND YEAR

## M.Sc. MOLECULAR BIOLOGY

## SEMESTER- IV

| Code No. | Core Subjects |
|---|---|
| **Discipline Specific Core Theory** | |
| MMB 125 T | Bioethics, IPR and Biosafety |
| **Discipline Specific Core Practical** | |
| MMB 126 P | Internship/ Training (Clinical/ Industrial) |
| MMB 120 | Research Project/ Dissertation |

| | |
|---|---|
| **Name of the Program** | **M.Sc. Molecular Biology** |
| **Semester** | **Semester IV** |
| **Name of the Course** | **Bioethics, IPR and Biosafety** |
| **Course Code** | **MMB 125 T** |

| | |
|---|---|
| **Course Objective** | • To familiarize students with ethical issues in biomedical research and healthcare.<br>• To provide knowledge about intellectual property rights and their relevance in biotechnology.<br>• To understand biosafety principles and regulatory frameworks related to research and product development. |
| **Course Outcomes** | After completing this course, students will be able to:<br>• **Evaluate** ethical concerns in biomedical and biotechnological practices.<br>• **Understand** different types of IPR and their applications.<br>• **Apply** various national and international guidelines in biomedical and health research**.** |

| Sr. No. | Topics | No. of Hrs. |
|---|---|---|
| **1** | **Introduction to Bioethics:** Principles of biomedical ethics: autonomy, beneficence, non-maleficence, justice. Ethics in clinical research: Informed consent, confidentiality, human and animal experimentation. Ethical guidelines: ICMR, DHR, ANRF, Helsinki Declaration, Belmont Report. Case studies in biomedical ethics. | **12** |
| **2** | **Intellectual Property Rights (IPR):** Types of IPR: Patents, Copyrights, Trademarks, Trade secrets, Plant variety protection. Patent filing process (India and international). Patentability criteria and limitations in biotechnology. Importance of IPR in academia and industry. | **12** |
| **3** | **Biosafety and Biosecurity:** Definition and classification of biological hazards, Risk assessment and management in laboratory and field research, Containment facilities: Biosafety levels (BSL I–IV), Guidelines: Cartagena Protocol, NIH Guidelines, DBT & WHO norms, Dual-use research and bioterrorism concerns. | **12** |
| **4** | **Regulatory Frameworks and Institutional Oversight:** Institutional Biosafety Committee (IBSC), Review Boards, Ethical Committees. NABH, NABH Digital Health Standards for Hospitals, NABL, JCI, ISO. National and international regulatory bodies: RCGM, GEAC, CDSCO, WHO. Biosafety and ethics in genome editing (e.g., CRISPR), stem cell research, GMOs. Recent advancements and controversies. Cyber Security, HIPAA, GDPR, DPDP Act 2023 India. | **9** |
| **Total** | | **45 hrs.** |

**Reference book:**

1. **Bioethics & Biosafety** – R. C. Dubey
2. **Intellectual Property Rights in Biotechnology** – P. Narayanan
3. **Bioethics and Biosafety in Biotechnology** – V. Sree Krishna
4. **ICMR Ethical Guidelines for Biomedical Research** (latest version)
5. WIPO, DBT, ICMR, DHR, ANRF, NABH, NABL, HIPPA, GDPR, DPDP Act 2023, India and WHO online resources.

| | |
|---|---|
| **Name of the Program** | **M.Sc. Molecular Biology** |
| **Semester** | **Semester IV** |
| **Name of the Course** | **Research Project/ Dissertation** |
| **Course Code** | **MMB 120** |

| | |
|---|---|
| **Course Objective** | The dissertation course is designed to provide postgraduate students with hands-on experience in scientific research, enabling them to apply theoretical knowledge and laboratory skills acquired during the M.Sc. Molecular Biology program. The objective is to cultivate independent thinking, critical analysis, problem-solving abilities, and technical expertise in experimental design, data collection, analysis, and interpretation. It also aims to nurture scientific communication skills, ethical research practices, and the capacity to contribute meaningfully to biomedical and translational research. |
| **Course Outcomes** | • Formulate a research problem by reviewing scientific literature and identifying knowledge gaps in molecular biology<br>• Design and execute experiments using appropriate methodologies, tools, and techniques relevant to biomedical research.<br>• Demonstrate proficiency in handling advanced molecular biology, biochemistry, microbiology, and bioinformatics methods as required for their research project.<br>• Critically analyse and interpret experimental data using appropriate statistical and computational tools.<br>• Adhere to ethical standards in biomedical research, including biosafety, data integrity, and responsible reporting.<br>• Communicate research findings effectively through well-structured dissertation writing, presentations, and potential publications.<br>• Work independently and collaboratively to solve research challenges and manage time efficiently during the project.<br>• Develop a research-oriented mind-set that prepares them for higher studies, industrial R&D, or academic research careers. |

**The Dissertation work will begin from 3rdSemester and will continue through the 4thSemester. (330 hrs)**

1. Dissertation/Project work should be carried out as an individual Dissertation and actual bench work.
2. The students will carry independent project work under the supervision of the staff of Department on an advanced topic assigned to him/her. In house projects are encouraged. Students may be allowed to carry out the project work in other Departmental laboratories /Research institutes /Industries as per the availability of Infrastructure.
3. Co guides from the other institutions may be allowed.
4. The Research Project/ Disserrationwill begin from 3rd Semester, and will continue through the 4th Semester.
5. The Research Project/ Disserrationreport (also work book shall be presented at the time of presentation and viva voce) will be submitted at the end of the 4th Semester and evaluated.
6. Five copies of the project report shall be submitted to the Director, SBS.
7. For the conduct of the End Semester Examination and evaluation of Research Project/ Disserrationwork the University will appoint External Examiners.
8. Since the dissertation is by research, Research Project/ Disserrationwork carries a total of 250 marks and evaluation will be carried out by both internal and external evaluators.
9. The student has to defend his/her Research Project/ DisserrationWork in a seminar which will be evaluated by a internal and external experts appointed by the University.
10. The assignment of marks for Research Project/ Disserrationis as follows:
    Part I-
    Topic Selection, Review of Literature, Novelty of works-50 marks
    Part-II-
    a. Continuous Internal Assessment, Novelty, Overall Lab Work Culture - 100 Marks
    b. Research Project/ Disserrationwork book: 50 Marks
    c. Viva-Voce: 50 Marks

| | |
|---|---|
| **Name of the Program** | **M. SC Molecular Biology** |
| **Semester** | **Semester IV** |
| **Name of the Subject** | **INTERNSHIP/TRAINING (CLINICAL/ INDUSTRIAL)** |
| **Subject Code** | **MMB 126 P** |

| | |
|---|---|
| **Course Objective** | • To expose students to real-world applications of molecular biology in industries, hospitals, research laboratories, and healthcare facilities.<br>• To bridge the gap between academic knowledge and industrial/clinical practices.<br>• To provide hands-on experience with advanced instruments, techniques, and workflows used in molecular biology.<br>• To develop professional skills including teamwork, communication, problem-solving, and ethical practices.<br>• To enhance students' understanding of regulatory requirements, quality control, biosafety, and industry standards.<br>• To prepare students for careers in molecular biology industries, research organizations, hospitals, and entrepreneurial ventures. |
| **Course Outcomes** | After completing this course, students will be able to:<br>• Demonstrate an understanding of industrial processes, laboratory practices, and molecular biological applications in real-life settings.<br>• Apply theoretical knowledge gained during coursework to practical situations in industry/clinical/research environments.<br>• Operate and gain familiarity with standard instruments, diagnostic tools, and workflows followed in molecular biology-related organizations.<br>• Analyze and document technical data, reports, and observations from industrial exposure.<br>• Exhibit improved professional skills including communication, teamwork, adaptability, and workplace ethics.<br>• Critically evaluate the role of molecular biology in healthcare, diagnostics, pharmaceuticals, and research.<br>• Identify potential career pathways and entrepreneurial opportunities in the molecular biology sector.<br>• Integrate biosafety, regulatory and quality assurance practices into professional conduct. |

**Internship/Training (Clinical/ Industrial):**

The Industrial Visit / Internship is an integral part of the M.Sc. Molecular biology program, designed to provide students with exposure to real-world applications of molecular biology in industry, research laboratories, hospitals, and healthcare settings. It enables students to bridge classroom learning with practical experience, understand professional work environments, and gain insights into industrial processes, regulatory practices, and advanced technologies. This component also enhances problem-solving, teamwork, and communication skills, preparing students for careers in molecular biology research, clinical diagnostics, pharmaceuticals, and allied industries. The students hasto search the Internship/Training (Clinical/ Industrial) opportunities on their own at least 2 to 3 months prior before starting of the actual course. The student has to prepare the detailed log book along with weekly summary report **(Total 210 hrs.)**

**MGM SCHOOL OF BIOMEDICAL SCIENCES, NAVI MUMBAI**
**(A constituent unit of MGM INSTITUTE OF HEALTH SCIENCES)**
**Department of Molecular Biology**
(Deemed to be University u/s 3 of UGC Act 1956)
Grade "A++" Accredited by NAAC
Sector 1, Kamothe Navi Mumbai-410209, Tel.No.:022-27437631,27432890
Email. sbsnm@mgmuhs.com/ Website : www.mgmsbsnm.edu.in

# Internship / Training Logbook

## MASTER
## IN
## MOLECULAR BIOLOGY

**STUDENT NAME:** _____

**PRN NUMBER:** _____

**BATCH:**_____

**SEMESTER:**_____

**PERIODFROM:**_____**TO**_____

**COORDINATOR** **HOD** **DIRECTOR**

**MGM SCHOOL OF BIOMEDICAL SCIENCES, NAVI MUMBAI**
**(A constituent unit of MGM INSTITUTE OF HEALTH SCIENCES)**
**Department of Molecular Biology**
(Deemed to be University u/s 3 of UGC Act 1956)
Grade "A++" Accredited by NAAC
Sector 1, Kamothe Navi Mumbai-410209, Tel.No.:022-27437631,27432890
Email. sbsnm@mgmuhs.com/ Website : www.mgmsbsnm.edu.in

## AIM:

To provide a structured learning experience that enhances students technical, analytical, and professional skills while addressing the evolving needs of healthcare organizations. By integrating academic knowledge with hands-on practice, these internships prepare molecular biology students to become competent professionals capable of driving molecular applications in healthcare.

**Guidelines**:

1. The internship shall commence after the student has completed and passed all subjects up to Semester III
2. The internship is compulsory
3. The duration of the internship shall be 210 Hours.
4. Activities carried out by the student during the internship must be clearly mentioned.

**Evaluation of Internees:**

**Formative Evaluation:** The continuous assessment of interns during their internship should be conducted by the Head of the Department, assigned faculty, or a designated individual from the organization (in the case of industry-based internships). The primary objective of this evaluation is to ensure that interns develop the necessary competencies to function effectively in real-world scenarios. This can be facilitated through the maintenance of records or a logbook by all interns. Such documentation serves as tangible evidence of the training process and, more importantly, reflects the intern's progression in acquiring the required competencies for professional performance.

**Summative Evaluation:** It will be based on the observations of the assigned person from the Department/Organization and record/logbook maintained by the intern.
Based on this two evaluations, the Head of the Department shall issue certificate of satisfactory completion of the training.

# MGM SCHOOL OF BIOMEDICAL SCIENCES

**(A constituent unit of MGM INSTITUTE OF HEALTH SCIENCES)**

(Deemed to be University u/s 3 of UGC Act 1956)

Grade "A$^{++}$" Accredited by NAAC

Sector 1, Kamothe, Navi Mumbai-410209, Tel.No.: 022-2743763, 27437632, 27432890

Email. sbsnm@mgmuhs.com/ Website: www.mgmsbsnm.edu.in

DEPARTMENT OF MOLECULAR BIOLOGY


## Internship/ Training Completion Certificate

**Class:** _____ **Year:** _____

This is to certify that_____, bearing PRN_____,

has successfully completed the internship at _____**from** _____to_____. During this period, the student has completed a total of **210 hours** of internship as per the university guidelines.

The student demonstrated a high level of professionalism, technical competence, and problem-solving skills. We wish him/her success in his/her future endeavours.

| | |
|---|---|
| Head of the Department | Director |
| Dept. of Molecular Biology | MGMSBS |
| MGMSBS, MGMIHS | Kamothe, Navi Mumbai |

# Weekly Summary Report

**Week**: _____

**Total Hours Completed This Week**: _____

**Key Activities Performed**:

---

**Challenges Faced & How They Were Addressed**:

---

**New Skills Acquired**:

---

**Comments by Internship Supervisor**:

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**STUDENT'SDAILYLOG RECORD**

| Date/Day | Task & Activities | Skill gained | Hours Completed | Supervisor Signature |
|---|---|---|---|---|
| | | | | |

# MGM SCHOOL OF BIOMEDICAL SCIENCES

**(A constituent unit of MGM INSTITUTE OF HEALTH SCIENCES)**

(Deemed to be University u/s 3 of UGC Act 1956)

Grade "A$^{++}$" Accredited by NAAC

Sector 1, Kamothe, Navi Mumbai-410209, Tel.No.: 022-2743763, 27437632, 27432890

Email. sbsnm@mgmuhs.com/ Website: www.mgmsbsnm.edu.in


## Final Evaluation (50 Marks)

1. Technical Knowledge & Application (10 marks): _____
2. Problem-Solving & Critical Thinking (5 marks): _____
3. Communication & Teamwork (5marks): _____
4. Professionalism & Punctuality (5marks): _____
5. Quality of Log Book Maintenance (5 marks): _____
6. Learning Outcome & Skill Development (5marks): _____
7. Final Internship Report Quality (5marks): _____
8. Student's Initiative & Engagement (5marks): _____
9. Overall Performance (5marks): _____
10. Total: _____
11. **Final Remark:**

    _____

    _____

Sign of Internal Examiner: _____

Sign of External Examiner: _____

# Scheme of University Examination Theory for PG Program:

General structure / patterns for setting up question papers for Theory / Practical courses, their evaluation weightages for PG programs of MGMSBS are given in the following tables

## Marks scheme for the University exam:

Final theory marks will be 100 marks (80 marks University Theory exam + 20 Marks Internal assessment).

| **Question** | | **Marks distribution** | **Marks allotted per section** | **Marks** |
|---|---|---|---|---|
| Sec: A | MCQ | 10 x 1 M = 10 | 10 | 10 |
| Sec: B | SAQ | 3/4x 5 M = 15 | 15 | 35 |
| Sec: B | LAQ | 2/3 x 10 M = 10 | 20 | |
| Sec: C | SAQ | 3/4x 5 M = 15 | 15 | 35 |
| Sec: C | LAQ | 2/3x 10 M = 10 | 20 | |
| **Total** | | | | **80 Marks** |

## Practical exam pattern: Total 40 marks with following breakup:

| **Exercise** | **Description** | **Marks** |
|---|---|---|
| Q No 1 | Practical exercise - 1 | 1 x15=15 M |
| Q No 2 | Station exercise | 2x5M=10 M |
| Q No 3 | VIVA | 10 M |
| Q No 4 | Journal | 5M |
| **Total** | | **40 Marks** |

**Practical to be conducted at respective departments and marks submitted jointly by the parent department to the university.**

## Breakup of theory IA calculation for 20 marks

| **Description** | **Marks** |
|---|---|
| Internal exam (at department) | 15 marks |
| Seminar | 5 marks |
| **Total** | **20 Marks** |

## Breakup of practical IA calculation:

| **Description** | **Marks** |
|---|---|
| Internal exam (at department) | 10 marks |
| Viva | 5 marks |
| Journal | 5 marks |
| **Total** | **20 Marks** |

**Note** –20 marks to be converted to 10 marks weightage for submission to the university.

# Model Checklist for Evaluation of the Clinical Directed Posting (PG)

Name of the student: _____Date:_____
Program: _____
Semester: _____ Name of the internal faculty/Observer: _____
Name of the External Faculty/Observer:_____

| **Core Competencies** | Marks allotted | Marks obtained |
|---|---|---|
| Students will begin to develop critical thinking abilities utilizing the allied health personnel roles of communicator and caregiver. Students will learn principles of professional allied health personnel practice and provide direct care to individuals within a medical surgical setting while recognizing the diverse uniqueness of individuals with health alterations. | | |
| **Clinical Teaching** | | |
| a. Demonstrate beginning competency in technical skills. | 10 | |
| **Independent Work by Student guided by faculty** | | |
| a. Develop effective communication skills (verbally and through charting) with patients, team members, and family | 2.5 | |
| b. Identify intra and inter-professional team member roles and scopes of practice. Establish appropriate relationships with team members. | 2.5 | |
| **Hands on practical work by students** | | |
| a. Protect confidentiality of electronic/manual health records data, information, and knowledge of technology in an ethical manner | 05 | |
| **Independent work by student** | | |
| a. Demonstrate expected behaviors and complete tasks in a timely manner. Arrive to clinical experiences at assigned times. Maintain professional behavior and appearance. | 05 | |
| **Log book** | 10 | |
| **Viva** | 10 | |
| **Attendance** | 05 | |
| **Total** | **50 Marks** | |

Sign of Internal Examiner:_____
Sign of External Examiner:_____

**Evaluation for Semester III – Dissertation (PG) (Internal Assessment)**

| **Dissertation/Project Proposal : overall performance of the student** | **Marks allotted** | **Marks Obtained** |
|---|---|---|
| Open mindedness/ Receptivity to feedback Integrates feedback | 5 Marks | |
| Meets deadlines / Regularity in meeting / Consistency in communication | 10 Marks | |
| **Continuous Internal evaluation (CIE)** | | |
| Interest shown in selecting topic | 5 marks | |
| Appropriate review | 10 marks | |
| Discussion with guide and other faculty | 10 marks | |
| Quality of protocol | 5marks | |
| Preparation of proforma / log book / daily reports | 5marks | |
| **TOTAL** | **Out of 50** | |

**Evaluation for Semester IV - Evaluation parameter (Research Project / Dissertation)**

| Evaluation parameter ( Semester IV) | Continuous Internal Evaluation (CIE) | Semester End Evaluation (SEE) | |
|---|---|---|---|
| | Guide | Internal examiner | External examiner |
| Thesis preparation, Novelty, Overall Lab Work Culture | 25 | - | - |
| Dissertation/Project work book | 25 | 25 | 25 |
| Evaluation of thesis including Viva Voce | - | 50 | 50 |
| Total | 50 | 75 | 75 |
| **Overall Total = 200** | | | |

**Evaluation for Semester IV - Evaluation of the Internship/Training (Clinical/ Industrial) (PG)**

Name of the student: _____Date:_____
Program: _____
Semester: _____ Name of the internal faculty/Observer: _____
Name of the External Faculty/Observer: _____

# Final Evaluation (50 Marks)

1. Technical Knowledge & Application (10 marks): _____
2. Problem-Solving & Critical Thinking (5 marks): _____
3. Communication & Teamwork (5 marks): _____
4. Professionalism & Punctuality (5 marks): _____
5. Quality of Log Book Maintenance (5 marks): _____
6. Learning Outcome & Skill Development (5 marks): _____
7. Final Internship Report Quality (5 marks): _____
8. Student's Initiative & Engagement (5 marks): _____
9. Overall Performance (5 marks): _____
10. Total: _____
11. **Final Remark:**

    _____

    _____

Sign of Internal Examiner: _____

Sign of External Examiner: _____

# MGM INSTITUTE OF HEALTH SCIENCES

(Deemed to be University u/s 3 of UGC Act, 1956)

**Grade 'A' Accredited by NAAC**

**Sector-01, Kamothe, Navi Mumbai - 410209**

**Tel 022-27432471, 022-27432994, Fax 022-27431094**

**E-mail- registrar@mgmuhs.com Website : www.mgmuhs.com**