MALLA REDDY
VISHWAVIDYAPEETH
(Deemed to be University)

SCHOOL OF DIGITAL HEALTH SCIENCES & TECHNOLOGY

Fellowship in Medical Robotics

Created in 2025

Academic regulations for fellowship programmes

1. **DEFINITION**

   Fellowship: A fellowship is an advanced, structured programme focused on developing specialized competencies after the completion of a qualifying degree or equivalent experience. It offers structured learning and practical experience in a focused area. The purpose of the fellowship is to develop advanced knowledge, strengthen specialized skills, and prepare participants for professional growth within their chosen field.

2. **AIMS AND OBJECTIVES**

   The aim of the program is to provide program nurtures graduate and postgraduate candidates, building their expertise and skills to drive career excellence and impact in their chosen field.

   Full-Time Candidate: A full-time candidate is an individual who is enrolled exclusively in the fellowship program and is not engaged in any other professional, academic or employment obligations during the training period. These candidates are required to dedicate their time and effort to the structured fellowship programme, meeting the assigned outcomes through full-time participation that ensures immersive training and continuous engagement in all programme activities, including assigned duties, learning sessions, and assessments. Stipends for full-time fellowship candidates will be awarded as per MRV policy.

   Internal Candidate: An internal candidate is an individual currently employed by MRV or its affiliated institutes who wish to enhance their skills through the fellowship during their tenure at the institution. This includes faculty, residents, or staff. Internal candidates are not eligible for a stipend. Applications are subject to institutional approval.

   External Candidate: An external candidate is someone not employed by MRV or its affiliated hospitals and institutes at the time of applying for the fellowship. They may come from other academic institutions, healthcare organizations, or private practice. External candidates are required to complete all fellowship requirements as per MRV guidelines. No stipend will be provided.

   Sponsored Candidate: A sponsored candidate is nominated and financially supported by a recognized institution, organization, or employer such as a government body, healthcare institution, academic organization, or industry partner to pursue a fellowship at MRV. The sponsor typically covers fees or other program-related costs and may require the candidate to fulfill certain obligations, if any, upon completion as required by the sponsor. Employees sponsored by organizations must provide a formal no-objection certificate. Sponsored candidates are not eligible for a stipend.

3. PREREQUISITES

Criteria	Details
Eligibility	To be eligible for admission into the fellowship program at MRV, candidates must meet the following criteria: • Hold a recognized graduate or postgraduate degree with a completion certificate. • The fellowship must align with the candidate's prior qualifications and may require professional registrations. • Detailed eligibility criteria for ach fellowship, including approved qualifications are available on the MRV website.
Duration	• Undergraduate Degrees – Any recognized undergraduate degree – 12 months • Postgraduate Degrees – Any recognized undergraduate degree – 6 months • Super specialty Degrees – Any recognized speciality or advanced degree – 3 months * Duration for any category may be adjusted based on program requirements, as recommended by the Selection Committee.
Mode of Study	Theoretical, Lab-based Development, Simulation Workshops, Clinical Scenario Building, Capstone Project, Practical, Skill, Case-based

4. SELECTION AND COMMENCEMENT OF FELLOWSHIP

Fellowship Committee: The Fellowship Committee is established to uphold principles of transparency, fairness, and meritocracy in the selection process for the MRV Fellowship Program.

Composition of Fellowship Selection Committee

Sr. No.	Role/Position	Description / Designation
1	Chairperson	The Dean of the respective colleges and Schools of Eminence at MRV
2	Subject Expert	A Professor or Associate Professor from the concerned colleges and Schools of Eminence, MRV
3	Guide / Co-Guide	A Professor, Associate Professor, or Assistant Professor from the concerned colleges and Schools of Eminence, MRV
4	Convener	The Fellowship Coordinator of MRV
5	Ex officio Members	The Registrar and the Controller of Examinations,

		MRV

Duties of the Fellowship Selection Committee

- Ensure that the MRV fellowship program commences twice a year in accordance with the academic calendar issued by the university.
- Oversee the preparation and communication of the program schedule, including application deadlines, interview dates, and the start of training through the MRV website and relevant academic departments.
- Thoroughly evaluate all applications to ensure candidates meet the minimum requirements for completion.
- Assess academic credentials, prior qualifications, and overall suitability for the fellowship program.
- Conduct interviews for shortlisted candidates to evaluate knowledge, skills, and overall preparedness.
- Recommend a final list of eligible candidates for approval by the Vice-Chancellor based on the evaluation and interview outcomes.
- Oversee all aspects of the fellowship program from scheduling, implementation, to completion.

5. FEE STRUCTURE

Program Fees: The basic fee structures for each fellowship program are available on the respective program on the MRV website.

6. PROCEDURE FOR SELECTION AND ADMISSION

- **Eligibility Check:** Verify that applicants meet the basic eligibility criteria, including academic qualifications, professional experience, and relevant skills.
- **Document Review:** The Selection Committee reviews all applications for completeness and ensures they satisfy the program's eligibility requirements.
- **Personal or Virtual Interviews:** Shortlisted candidates may be invited for interviews, either in person or virtually. This allows the Committee to assess communication skills, motivation, and overall suitability for the fellowship.
- **Merit-Based Selection:** The Committee selects the most qualified candidates based on a combination of academic performance, professional experience, interview performance, and alignment of the applicant's goals with the objectives of the fellowship.

7. ALLOTMENT OF FELLOWSHIP GUIDE

Assignment of Guides: The allotment of fellowship Guides shall be undertaken by the Selection Committee, ensuring that only eligible and approved faculty members are assigned as Guides or mentors.

Criteria for Allotment are based on:

- Alignment of the fellow's area of interest with the Guide's specialization
- Availability and consent of the Guide
- Existing rotation or merit-based preferences as determined by the Committee

Role and Responsibilities of the Guide:

- Mentoring the fellow to acquire required skills and academic knowledge
- Providing guidance and support to ensure progress throughout the fellowship

- Conducting regular evaluations and offering academic and professional advice and submit periodic report to the Fellowship coordinator
- Supporting the fellow in meeting program requirements and objectives

External Collaborators: External collaborators from recognized institution may serve as fellowship co-Guides in conjunction with a Guide from MRV.

Change of Guide: Fellows may request a change of Guide, subject to approval by the Selection Committee.

8. FELLOWSHIP PROGRAM DESIGN

The fellowship program is designed to provide a structured and comprehensive learning experience that develops relevant skills, knowledge, and professional competencies. Upon completion, they should demonstrate proficiency in core skills, apply their knowledge effectively in professional settings, maintain professional standards, and document their progress.

Logbook Maintenance: Fellows must maintain a logbook throughout the program. The required entries may vary depending on the fellowship. The logbook will be reviewed and evaluated on a daily or weekly basis by the assigned Guide. Regular face-to-face feedback sessions with the Guide will be conducted to monitor progress and provide guidance.

Final Assessment and Exit Examination:

The final assessment by the assigned guides includes the following components:

1. Multiple Choice Questions (MCQs): 25 marks
2. Practical Skills Assessment: Three case scenarios with discussion; each case carries 20 marks (total 60 marks)
3. Logbook Maintenance: 15 marks

The candidate must appear and secure a minimum of 50% marks in each of the above listed components. The total marks are 100, and a minimum aggregate score of 50% is required to successfully complete the fellowship.

Any additional outputs or deliverables may be determined in consultation with the Guide and require prior written approval from the Selection Committee.

9. MINIMUM STANDARD AND CREDITS FOR THE AWARD OF THE FELLOWSHIP

- Fellows must maintain a **minimum of 80% attendance** across all program activities.
- A **minimum overall score of 50%** is required to pass the fellowship.

10. FELLOWSHIP COMPLETION CERTIFICATE

Issued by MRV: Upon successful completion of all training, periodic evaluations, and final examinations, fellows will be awarded a certificate.

The certificate should include details such as:

- Name of the candidate
- Fellowship program details
- Program completion status

Fellowship in Medical Robotics

Course Overview

The Fellowship in Medical Robotics is an advanced, practice-based program designed to provide participants with the knowledge and applied skills required to design, develop, integrate, and validate robotic systems for healthcare applications. The fellowship covers surgical, therapeutic, rehabilitative, assistive, teleoperated, and AI-enabled robotic systems, along with control systems, sensing technologies, mechatronics, simulation platforms, safety standards, and regulatory compliance.

Participants gain practical exposure through laboratory demonstrations, simulation-based design exercises, mechanics and control prototyping, sensor integration assignments, and a capstone applied innovation project focused on real-world medical robotics deployment scenarios.

Course Objectives

1. To provide foundational and advanced knowledge of medical robotic systems and components.
2. To develop proficiency in mechatronics, actuators, sensors, embedded systems, and robotic control.
3. To impart working knowledge of kinematics, motion planning, and trajectory control techniques.
4. To introduce perception, haptics, and AI-based robotic navigation modules.
5. To build competency in robotic simulation platforms (ROS, MATLAB, Gazebo, Unity).
6. To strengthen understanding of safety, testing, reliability, and regulatory frameworks for medical robotics.
7. To prepare participants to conceptualize, design, prototype, and evaluate robotic solutions for real-world healthcare applications.

Curriculum with Part-wise Syllabus & Modules

Part 1: Foundations of Medical Robotics

Module	Topics Covered
Introduction to Medical Robotics	Role of robotics in healthcare; types of medical robots; surgical, rehabilitation, assistive, diagnostic robots; clinical workflow mapping
Mechatronics & Embedded Control	Actuators, servomotors, microcontrollers; embedded programming; electrical and mechanical integration
Kinematics, Dynamics & Control	Forward and inverse kinematics; trajectory planning; PID and impedance control; joint space and task space control
Sensors & Perception	Force, torque, haptic sensors; IMU; computer vision basics; sensing architectures; integration and testing
Simulation of Robotic Systems	ROS, Gazebo, MATLAB Robotics Toolbox; simulation workflows; digital modelling; test environments
Safety & Reliability in Medical Robotics	Risk assessment; mechanical safety standards; reliability engineering; redundancy strategies

Part 2: Advanced Systems, Analytics & Implementation

Module	Topics Covered
Advanced Surgical Robotics	Mechanisms for minimally invasive surgery; tele-surgery; surgical manipulators; catheter robots
Computer Vision & AI for Robotics	Object detection and tracking; segmentation; path planning; ML models for autonomous robotic actions
Rehabilitation & Assistive Robotics	Exoskeletons; gait support devices; intelligent prosthetics; neuromuscular rehabilitation
Human-Robot Interaction & Haptics	Haptic sensing; tactile-feedback systems; interactive robotic platforms; ergonomic control mapping
Regulatory & Medical Device Standards	Medical device risk classification; testing guidelines; verification and validation; documentation standards
Capstone Project	Design and prototype of a medical robotic subsystem with testing and viva-voce demonstration

Program Outcomes

SR.N.	Program Outcome	Detailed Description
1	**Understanding Medical Robotic Ecosystems**	Demonstrate foundational and applied understanding of robotic systems deployed in clinical environments
2	**Integration of Mechanical, Electrical & Embedded Subsystems**	Combine actuators, sensors, microcontrollers, motors, AI modules, and communication systems into functional robotic devices
3	**Medical Robotics Safety & Compliance**	Apply testing standards, risk assessments, and safety protocols to ensure robust clinical deployment
4	**Regulatory & Medico-Technical Understanding**	Interpret and apply standards governing medical robotics innovation and device approval pathways
5	**Competence in Robotics Simulation & Control**	Use ROS, MATLAB, Gazebo and computational control models to test robotic functions
6	**Innovation in Medical Robotics**	Design novel robotic applications to enhance surgical, rehabilitation, diagnostic, or supportive workflows
7	**Healthcare-Centered Engineering**	Adapt robotic solutions to clinical needs, ergonomics, usability, and safety standards
8	**Practical Prototyping & Experimental Validation**	Demonstrate hands-on functioning prototypes supported by quantitative and qualitative evaluation metrics

Course Outcomes

	Course Outcome	Detailed Description
1	**Explain Robotics Fundamentals**	Understand the structure, architecture, components, and working principles of medical robotic systems
2	**Integrate Mechatronics & Control Systems**	Apply actuators, controllers, embedded systems, and mechanical subsystems to build functional robotic components
3	**Use Sensors, Perception & Vision Modules**	Integrate force sensors, encoders, haptics, and computer-vision modules for perception and feedback in robotic operations
4	**Apply AI & Computational Control**	Implement control algorithms, feedback strategies, and AI-based decision algorithms for robotic motion and automation
5	**Prototype with Simulation Platforms**	Utilize ROS, MATLAB, Gazebo, or equivalent platforms to model, simulate, and optimize robotic mechanisms
6	**Design and Validate Robotic Systems**	Develop robotic prototypes and evaluate them for accuracy, reliability, safety, and operational performance

7	**Adapt Robotics to Clinical Workflows**	Map robotic applications to surgical, rehabilitation, diagnostic, and patient-care processes based on clinical needs
8	**Demonstrate Medical Robotics Innovation**	Develop and present a capstone project demonstrating a novel robotic solution addressing a realistic healthcare challenge

Recommended Books & E-Resources
Textbooks:

- Medical Robotics — Rosen & Hannaford
- Robotics: Modelling, Planning and Control — Siciliano
- Surgical Robotics — Taylor & Stoianovici
- Mechatronics in Health Systems — Howard
- MATLAB Robotics System Toolbox — MathWorks

Journals & E-Resources:

- IEEE Xplore Robotics Collections
- ROS Documentation Hub
- MIT OpenCourseWare — Robotics
- Springer Medical Robotics Series
- WHO Guidance on Medical Device Safety