



SNS COLLEGE OF TECHNOLOGY

Coimbatore-35
An Autonomous Institution

Accredited by NBA – AICTE and Accredited by NAAC – UGC with ‘A+’
Grade Approved by AICTE, New Delhi & Affiliated to Anna University,
Chennai



DEPARTMENT OF AEROSPACE ENGINEERING

19ASZ301– ROBOTICS & AUTOMATION IN SPACE

III YEAR VI SEM

UNIT 5 –ROBOTIC APPLICATIONS IN SPACE

TOPIC - MICRO AND NANOROBOTS



INTRODUCTION TO MICRO AND NANOROBOTS



Micro/Nanorobots:

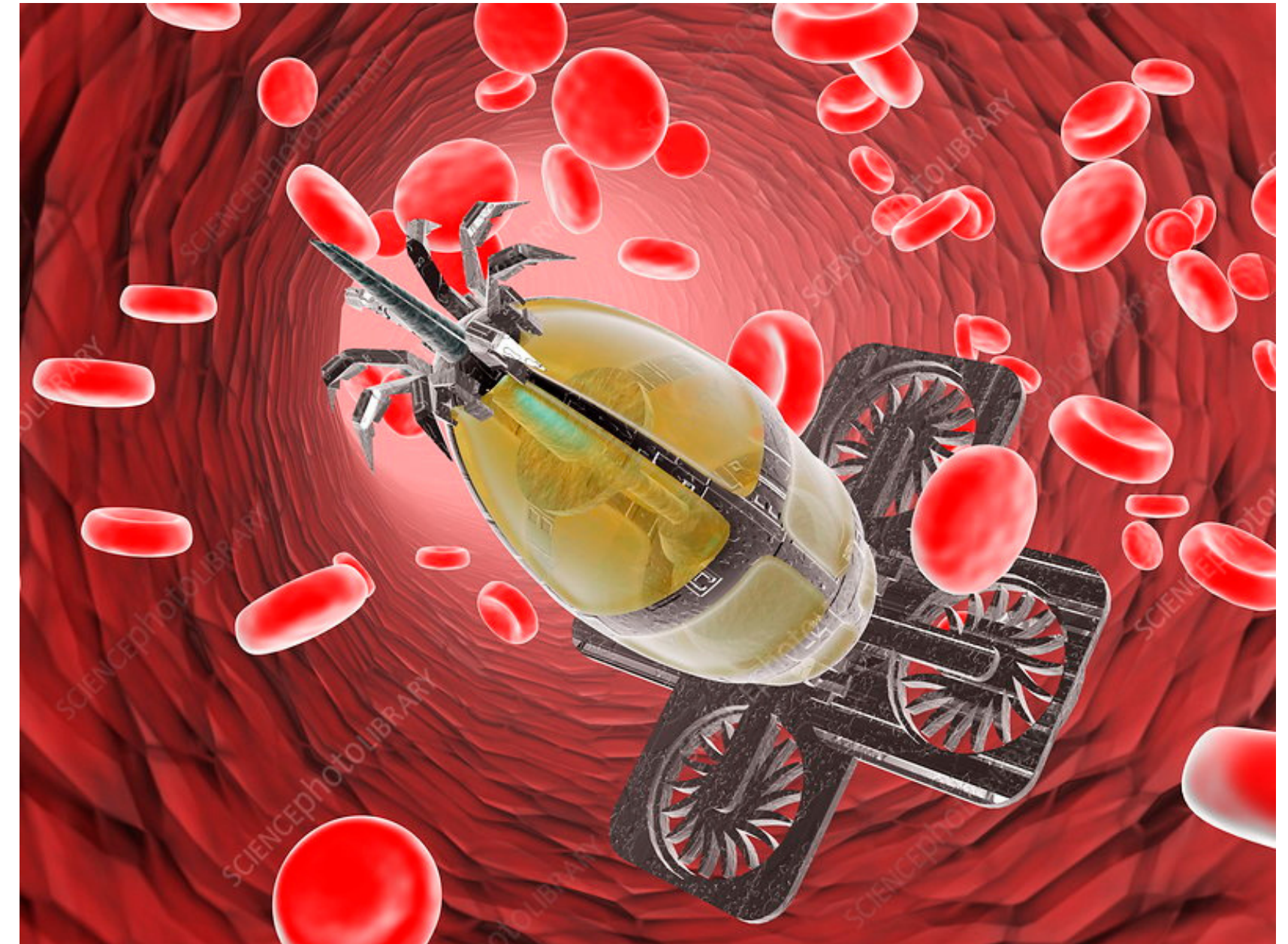
- Tiny robots ranging from micrometers to nanometers in size, designed to perform specific tasks at cellular or molecular levels.

Definitions:

- Microrobots: $\sim 1 \text{ mm}$ to $1 \mu\text{m}$ size range
- Nanorobots: $< 1 \mu\text{m}$ (nano-scale, 10^{-9} m)

Key Characteristics:

- Operate in microenvironments (e.g., bloodstream, tissue, microfluidics)
- Controlled using magnetic fields, light, or chemical gradients





APPLICATIONS OF MICRO AND NANOROBOTS



Domain	Application	Function
Medical	Targeted drug delivery	Directly attack tumors or infected cells
Diagnostics	In-body sensors	Monitor biological signals at the cellular level
Environmental	Pollutant detection	Collect and detect toxins at molecular scale
Manufacturing	Nanoassembly	Build tiny structures for electronics or optics



CHALLENGES AND FUTURE PROSPECTS IN SPACE



Challenges:

- Powering micro/nanorobots in vacuum
- Navigation in zero-gravity or radiation-rich environments
- Biocompatibility and toxicity for human-related applications

Future Directions:

- Swarms of nanorobots for material self-repair in satellites
- Embedded nanobots in spacesuits for physiological monitoring
- Autonomous microsensors on spacecraft for predictive maintenance

Aspect	Micro/Nanorobot Potential in Space
Structural Health	Internal inspection of spacecraft materials
Medical Monitoring	Real-time astronaut diagnostics
Environmental Sensing	Detection of contaminants, radiation exposure



Thank You