MALLA REDDY VISHWAVIDYAPEETH

SCHOOL OF DIGITAL HEALTH SCIENCES AND TECHNOLOGY

Program

Bachelor of Science (B.Sc.)

Medical Robotics

2025–26

MALLA REDDY VISHWAVIDYAPEETH
SCHOOL OF DIGITAL HEALTH SCIENCES AND TECHNOLOGY
BACHELOR OF SCIENCE (B.Sc.) IN MEDICAL ROBOTICS

VISION

To develop industry-ready graduates capable of designing, building, validating and deploying medical robotic systems that improve surgical precision, patient mobility, rehabilitation outcomes and healthcare-system efficiency.

MISSION

1. Build strong foundations in anatomy, physiology, biochemistry, pathology and microbiology relevant to medical-robotics practice.
2. Develop competence in sensors, actuators, embedded systems, control theory, robotics kinematics/dynamics, AI/ML and computer vision applied to healthcare.
3. Provide practical exposure to surgical/rehabilitation robotics, exoskeletons, autonomous navigation, digital twins, wearable robotics and robotic patient-monitoring systems through dedicated laboratories and internships.
4. Cultivate research, critical-thinking, project-management and entrepreneurial skills through a capstone research project and start-up pathway course.

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

Within a few years of graduation, graduates of the B.Sc. Medical Robotics programme will:

1. Apply integrated biomedical, robotics and digital-technology knowledge to design, develop and deploy medical robotic systems in clinical, rehabilitation or industry settings.
2. Pursue successful careers as medical robotics engineers, robotic-systems analysts, surgical/rehabilitation-robotics associates, healthcare-automation specialists, or progress to higher studies (M.Tech./M.Sc./MBA/MS) and research.
3. Demonstrate professional, ethical and regulatory responsibility in the design, testing and deployment of robots that interact with patients and sensitive health data.
4. Engage in lifelong learning, innovation and entrepreneurship to address emerging challenges in medical-robotics-enabled healthcare delivery, including in rural and under-served communities.

PROGRAMME OUTCOMES (POs)

On completion of the programme, graduates will be able to:

1. Medical Robotic Systems Design: Design, develop and implement medical robotic systems, integrating hardware (sensors, actuators, mechanical structures) and software (embedded control, AI/ML) tailored to healthcare applications.
2. AI and Autonomous Robotics in Healthcare: Apply AI/ML and computer-vision techniques to build autonomous/semi-autonomous robotic systems for diagnosis-support, patient monitoring, rehabilitation and surgical assistance.
3. Clinical Application of Robotics: Implement robotics for patient mobility (exoskeletons/prosthetics), remote monitoring, emergency/ICU care, surgical assistance and elderly/home-based care.
4. Simulation, Modelling and Optimization: Use simulation, digital-twin and CAD tools to model, test and optimize robotic systems for maximum safety, efficiency and usability in healthcare environments.

5. Ethics, Safety and Regulatory Compliance: Apply healthcare-robotics safety standards, data-privacy regulations (HIPAA/GDPR/DPDP Act, ISO 13482/IEC 60601 and allied medical-device norms) and professional ethics in the design and deployment of medical robots.
6. Research and Evidence-Based Practice: Conduct literature reviews, formulate research questions, and apply biostatistics and evidence-based methods to medical-robotics problems.
7. Communication and Teamwork: Communicate effectively with clinicians, engineers and patients, and function effectively as members/leaders of multidisciplinary robotics-development teams.
8. Project and Innovation Management: Plan, execute and manage medical-robotics projects and start-up ventures using modern project-management and design-thinking tools.
9. Environment, Society and Sustainability: Assess the societal, economic, ethical and environmental impact of medical-robotics technologies, with attention to equitable access and human-centred design.
10. Lifelong Learning: Recognize the need for, and engage in, independent and lifelong learning in the context of rapidly evolving robotics and health technologies.

PROGRAMME SPECIFIC OUTCOMES (PSOs)

At the end of the programme, graduates of B.Sc. Medical Robotics will specifically be able to:

1. Integrate foundational biomedical sciences (anatomy, physiology, biochemistry, pathology, microbiology) with robotics, mechatronics and embedded-systems tools to support clinical and rehabilitation decision-making.
2. Build, program, simulate and deploy medical robotic systems – surgical/rehabilitation robots, exoskeletons and prosthetics, assistive/wearable robots, autonomous navigation platforms, and robotic patient-monitoring systems – for real-world healthcare settings.
3. Apply sensing, control-systems, AI/ML, computer-vision and data-analytics tools to robotic platforms for predictive, autonomous and decision-support healthcare applications.
4. Formulate, execute and present an independent research project or medical-robotics start-up proposal, demonstrating design-thinking, project-management and entrepreneurial competence.

MALLA REDDY VISHWAVIDYAPEETH
SCHOOL OF DIGITAL HEALTH SCIENCES AND TECHNOLOGY
BACHELOR OF SCIENCE (B.Sc.) IN MEDICAL ROBOTICS
COURSE STRUCTURE

I year I semester

S.NO	SUBJECT	L	T	P	C
1	Introduction to Human Anatomy	4	-	-	4
2	Introduction to Human Physiology	4	-	-	4
3	Introduction to Medical Biochemistry	4	-	-	4
4	Sociology	2	-	-	2
5	English & Communication Skills	1	-	2	2
6	Basic Computers & Programming Fundamentals	1	-	2	2
7	Practicals in Human Anatomy	-	-	4	2
8	Practicals in Physiology	-	-	4	2
		16	**-**	**12**	**22**

I year II semester

Sl. No	Name of the Subject/Practical	Contact Hours/week			Credits
		L	T	P	
1	Microbiology	**2**	**-**	**-**	**2**
2	Pathology	**2**	**-**	**-**	**2**
3	Occupational health	**2**	**-**	**-**	**2**
4	Languages for Coding	**2**	**-**	**-**	**2**
5	Introduction to Github	**1**	**-**	**-**	**1**
6	Essentials of Research Design & Literature Reviews	**3**	**-**	**-**	**3**
7	Essential Biostatistics	**2**	**-**	**-**	**2**
8	Digital Health Terminology	**1**	**-**	**-**	**1**
9	Regulations and Ethics	**1**	**-**	**-**	**1**
10	Practicals in Microbiology	**-**	**-**	**2**	**1**
11	Practicals in Pathology	**-**	**-**	**2**	**1**
12	Practicals in Coding	**-**	**-**	**4**	**2**
TOTAL		**16**	**0**	**8**	**20**

II year III semester

Sl. No	Name of the Subject/Practical	Contact Hours/week			Credits
		L	T	P	
1	Advanced data analytics (R/ SPSS/ STATA/ SAS)	3	-	-	3
2	Data Visualization and GIS	3	-	-	3
3	Evidence based Medical Tools	2	-	-	2
4	Health Algorithms to Application	2	-	-	2
5	Mobile Apps & Web Apps	2	-	-	2
6	Database Features	1	-	-	1
7	API, Plug-in Integration	2	-	-	2
8	Dashboards for Healthcare	1	-	2	2
9	Practicals in Advanced data analytics	-	-	2	1
10	Practicals in Data Visualization	-	-	2	1
11	Practicals in Mobile Apps & Web Apps	-	-	2	1
TOTAL		16	0	8	20

II year IV semester

Sl. No	Name of the Subject/Practical	Contact Hours/week			Credits
		L	T	P	
1	Introduction to electronics circuits & platforms	2	-	-	2
2	Introduction to Sensors & Health Functions	2	-	-	2
3	Introduction to Robotics components	3	-	-	3
4	Sensing using ultrasonic LIDAR & RADAR	2	-	-	2
5	AI/ML/Gen AI/ computer vision	3	-	-	3
6	Rapid Prototyping and 3D Printing	-	-	4	2
7	Digital Signal Processing	2	-	-	2
8	Practicals in Robotics modelling	-	-	4	2
9	Practicals in AI/ML/Gen AI	-	-	4	2
	TOTAL	16	0	12	20

III year V semester

Sl. No	Name of the Subject/Practical	Contact Hours/week			Credits
		L	T	P	
1	Autonomous Mobile Navigation for robotics	3	-	-	3
2	Swarm Robotics	2	-	-	2
3	AR/ VR/ MR for Health care	3	-	-	3
4	Simulation of Robotics	2	-	-	2
5	Market Research & Needs Assessment	2	-	-	2
6	Practicals in AR/ VR/ MR for Health care	-	-	4	2
7	Practicals in Simulation of Robotics	-	-	4	2
8	Internship	-	-	-	4
TOTAL					

III year VI semester

Sl. No	Name of the Subject/Practical	Contact Hours/week			Credits
		L	T	P	
1	Digital Twins for Robotics	3	-	-	3
2	Robotics for Bedside Patient Monitoring	2	-	-	2
3	Robotics for Emergency and ICU Care	2	-	-	2
4	Robotics for Home-based Healthcare	3	-	-	3
5	Robotics for occupational well-being	2	-	-	2
6	Robotics for Elderly care	2	-	-	2
7	Robotics for Health care Logistics	2	-	-	2
8	Healthcare E-commerce	2	-	-	4
9	Robotics for Finance for Healthcare Settings	2	-	-	2
TOTAL		12	0	16	20

IV year VII semester

Sl. No	Name of the Subject/Practical	Contact Hours/week			Credits
		L	T	P	
1	Digital Transformation of Healthcare	3	-	-	3
2	Digital Health Project Management	3	-	-	3
3	Wearable diagnostics	2	-	-	2
4	Exoskeletons & Humanoid for Health Care	2	-	-	2
5	Drone & UAVs	2	-	-	2
6	Sustainability & recycling	2	-	-	2
7	Cyber Security for Health	2	-	-	2
8	Research Project Design	4	-	-	4
TOTAL		16	0	8	20

IV year VIII semester

Sl. No	Name of the Subject/Practical	Contact Hours/week			Credits
		L	T	P	
1	Research Project	-	-	-	12
2	Review of Topics/Electives	4	-	-	4
3	Critical thinking	2	-	-	2
4	Health Care Start up pathway	2	-	-	2
TOTAL		8	0	0	20

1.1 Under Graduate Programme

Sl. No.	Course	Duration	Eligibility for admission
1	B.Sc. in Medical Robotics (Four-Year Honours / Honours with Research, NEP 2020 compliant)	4 years (8 semesters)	Candidate must have passed 10+2 (or equivalent) examination from a recognised Board with Physics, Chemistry, and Mathematics/Biology as principal subjects, along with English as a subject of study. Candidates with Mathematics are preferred given the robotics/control-systems and programming content of the curriculum; candidates with Biology are equally eligible given the biomedical-foundation component. Minimum aggregate of 45% marks (40% for SC/ST/OBC and other reserved categories as per applicable State/UGC norms) in the qualifying examination. Admission shall be based on merit in the qualifying entrance test as notified by the University from time to time, followed by counselling as per Malla Reddy Vishwavidyapeeth admission regulations.

1.2. Medium of Instruction:

English.

1.3 Duration of the Course

4 years (8 semesters); Two semesters per year, each of minimum 90 working days including internal assessment and examinations.

1.4 Examination Regulations

1.4.1 Attendance:

A minimum of 80% attendance in each course (theory and practical) is mandatory for eligibility to appear in the End-Semester Examination; condonation up to 65% may be granted by the Vice-Chancellor on genuine medical/other grounds as per University rules.

1.4.2 Internal Assessments:

Course Type	Component	Weightage	Description
Theory Courses	Continuous Internal Assessment (CIA)	30%	Two mid-term tests (best of 2 or average), assignments/quizzes, seminars, attendance.
Practical / Laboratory Courses	Continuous Internal Assessment	30%	Lab records, in-lab performance, viva-voce during the semester.

Exam pattern for internal assessment

Theory Courses (Internal Examination, 30 marks, 2 hours)

Section	Instruction	No. of Questions	Total Marks
A	Very Short Questions	5 × 2 marks	10
B	Short Questions	2 × 5 marks	10
C	Essay Questions	1 × 10 marks	10

Practical Courses (Internal Examination, 30 marks, 2 hours)

Section	Instruction	Total Marks
A	Spotter- Lab practical evaluation	15
B	Viva voce	15
	Total	**30**

1.4.3 University Examinations (External):

Course Type	Component	Weightage	Description
Theory Courses	End-Semester University Examination (ESE)	70%	Written examination of 3 hours covering the entire syllabus (all units).
Practical / Laboratory Courses	End-Semester Practical Examination	70%	Conduct of experiment/task, output/demo, record and viva-voce by internal + external examiner.

Theory Courses (End-Semester Examination, 70 marks, 3 hours)

Section	Instruction	No. of Questions	Total Marks
A	Very Short Questions	10 × 2 marks	20
B	Short Questions	6 × 5 marks	30
C	Essay Questions	2 × 10 marks	20

Total End-Semester marks = 70 (scaled from the above, or awarded directly out of 70 as per University question-paper template); combined with 30 CIA marks to yield 100.

Practical Courses (End-Semester Examination, 0 marks)

Section	Instruction	Total Marks
A	Spotter- Lab practical evaluation	20
B	Major Practical	10
C	Internal Viva	15
D	External Viva	15
E	Record	10
	Total	**70**

A student must secure a minimum of 'P' grade (40% aggregate, with at least 40% in ESE) to pass a course. A student who fails in a course may reappear in the subsequent supplementary/arrear examination.

Promotion to the next semester is automatic; however, a student must clear all backlog courses up to Semester IV before being permitted to register for Semester VII, and must clear all UG-level backlogs before the award of degree.

Malpractice in examinations shall be dealt with as per the University's Unfair Means regulations, ranging from cancellation of the concerned examination to debarment.

The Research Project/Dissertation (Semester VIII) must be submitted with a plagiarism similarity index within University-prescribed limits (typically <=10% excluding references) prior to viva-voce.

I year I semester

S.NO	SUBJECT	L	T	P	C
1	Introduction to Human Anatomy	4	-	-	4
2	Introduction to Human Physiology	4	-	-	4
3	Introduction to Medical Biochemistry	4	-	-	4
4	Sociology	2	-	-	2
5	English & Communication Skills	1	-	2	2
6	Basic Computers & Programming Fundamentals	1	-	2	2
7	Practicals in Human Anatomy	-	-	4	2
8	Practicals in Physiology	-	-	4	2
	TOTAL	**16**	**-**	**12**	**22**

SEMESTER-I

INTRODUCTION TO HUMAN ANATOMY

L/T/P/C
3/-/-/3

Learning Outcome:

1. Describe the gross structure and organisation of the human musculoskeletal, nervous and cardiovascular systems.
2. Explain the anatomical basis of common patient-mobility and rehabilitation needs relevant to robotic assistive devices.
3. Correlate anatomical landmarks with sensor/actuator placement for wearable and rehabilitation robotics.
4. Identify the major organ systems and their anatomical relationships relevant to surgical/robotic intervention sites.

UNIT-I
SKELETAL AND MUSCULAR SYSTEMS

Bones, joints and connective tissue; skeletal, smooth and cardiac muscle; anatomical basis of human motion relevant to exoskeleton and prosthetic design.

UNIT-II
NERVOUS SYSTEM

Brain, spinal cord, peripheral nerves, sensory organs; neuromuscular control pathways relevant to rehabilitation robotics and brain-machine/human-robot interfaces.

UNIT-III
CARDIOVASCULAR AND RESPIRATORY SYSTEMS

Heart, blood vessels, lungs; vital-sign generation points relevant to robotic patient-monitoring sensor placement.

UNIT-IV
DIGESTIVE, URINARY AND ENDOCRINE SYSTEMS

Gross anatomy of abdominal and endocrine organs; relevance to surgical-robotics access planning.

UNIT-V
INTEGUMENTARY AND REPRODUCTIVE SYSTEMS

Skin structure (relevant to wearable-robotics interface design), and overview of the reproductive system.

RECOMMENDED TEXT BOOKS

1. BD Chaurasia's Handbook of General Anatomy, latest edition.
2. Ross and Wilson, *Anatomy and Physiology in Health and Illness*, latest edition.
3. Relevant peer-reviewed articles on anatomical considerations in wearable/rehabilitation robotics.

INTRODUCTION TO HUMAN PHYSIOLOGY

L/T/P/C
3/-/-/3

Learning Outcome:

1. Explain the physiological basis of circulation, respiration and neuromuscular function.
2. Describe homeostatic mechanisms relevant to vital-sign sensing in robotic patient-monitoring systems.
3. Relate musculoskeletal physiology to movement patterns required for exoskeleton and rehabilitation-robot control.
4. Apply physiological concepts to the design of sensor-driven feedback loops in medical robots.

UNIT-I
CIRCULATORY AND RESPIRATORY PHYSIOLOGY

Cardiac cycle, blood pressure regulation, gas exchange; basis for robotic vital-sign monitoring sensors.

UNIT-II
NERVOUS AND MUSCULAR PHYSIOLOGY

Neuromuscular junction, reflex arcs, motor-unit recruitment; relevance to gait analysis and rehabilitation-robot control loops.

UNIT-III
ENDOCRINE AND EXCRETORY PHYSIOLOGY

Hormonal regulation, renal function; relevance to closed-loop drug-delivery robotic systems.

UNIT-IV
DIGESTIVE AND IMMUNE PHYSIOLOGY

Digestive processes, immune response basics relevant to biocompatibility of implantable/wearable robotic devices.

UNIT-V
INTEGRATED HOMEOSTASIS

Feedback control systems in human physiology as a model for robotic control-system design.

RECOMMENDED TEXT BOOKS

1. Guyton and Hall, *Textbook of Medical Physiology*, latest edition.
2. Sembulingam, *Essentials of Medical Physiology*, latest edition.
3. Selected readings on physiological control systems as models for robotic feedback control.

INTRODUCTION TO MEDICAL BIOCHEMISTRY

L/T/P/C
3/-/-/3

Learning Outcome:

1. Explain the structure and function of biomolecules relevant to biosensor design.
2. Describe enzyme kinetics and metabolic pathways relevant to biochemical-sensor calibration.
3. Relate biochemical markers to physiological states monitored by robotic diagnostic devices.
4. Discuss biocompatibility considerations for materials used in implantable/wearable medical robots.

UNIT-I
BIOMOLECULES

Carbohydrates, lipids, proteins and nucleic acids; relevance to biosensor substrates.

UNIT-II
ENZYMES AND METABOLISM

Enzyme kinetics, energy metabolism; basis for enzymatic biosensors used in robotic diagnostic platforms.

UNIT-III
CLINICAL BIOCHEMISTRY MARKERS

Blood glucose, electrolytes, lipid profile; relevance to closed-loop robotic monitoring/delivery systems.

UNIT-IV
BIOMATERIALS AND BIOCOMPATIBILITY

Basic biochemical principles governing biocompatibility of materials used in prosthetics, exoskeletons and implantable robotic devices.

RECOMMENDED TEXT BOOKS

1. Harper's Illustrated Biochemistry, latest edition.
2. DM Vasudevan, *Textbook of Biochemistry for Medical Students*, latest edition.
3. Reference material on biomaterials and biocompatibility standards (ISO 10993 series).

SOCIOLOGY

L/T/P/C
2/-/-/2

Learning Outcome:

1. Explain basic sociological concepts and their relevance to healthcare delivery.
2. Discuss the social determinants of health and disability.
3. Analyse societal attitudes toward assistive and robotic technologies in healthcare.
4. Evaluate the social impact of automation and robotics on healthcare employment and access.

UNIT-I
FOUNDATIONS OF SOCIOLOGY

Basic concepts, social institutions, and social stratification.

UNIT-II
SOCIOLOGY OF HEALTH AND ILLNESS

Social determinants of health, disability and ageing.

UNIT-III
TECHNOLOGY AND SOCIETY

Social acceptance of assistive devices and robots; ethical and cultural considerations.

UNIT-IV
ROBOTICS, AUTOMATION AND SOCIAL CHANGE

Impact of healthcare automation on employment, access and equity.

RECOMMENDED TEXT BOOKS

1. Standard sociology textbook prescribed by the Board of Studies.
2. Selected readings on the sociology of technology and healthcare.

ENGLISH & COMMUNICATION SKILLS

L/T/P/C
2/-/-/2

Learning Outcome:

1. Demonstrate proficiency in written and spoken English for academic and professional contexts.
2. Prepare technical reports, presentations and documentation relevant to robotics projects.
3. Communicate effectively with clinicians, engineers and patients in multidisciplinary teams.
4. Apply listening and interpersonal skills in group-project and viva-voce settings.

UNIT-I
GRAMMAR AND COMPOSITION

Sentence structure, technical vocabulary, and report writing.

UNIT-II
PRESENTATION SKILLS

Oral presentations, technical documentation and viva preparation.

UNIT-III
PROFESSIONAL COMMUNICATION

Email/report etiquette, group discussions, interview skills.

UNIT-IV
COMMUNICATION IN MULTIDISCIPLINARY TEAMS

Communicating technical robotics concepts to clinical and non-technical stakeholders.

RECOMMENDED TEXT BOOKS

1. Standard English-for-technical-communication textbook prescribed by the Board of Studies.
2. University-prescribed communication-skills lab manual.

BASIC COMPUTERS & PROGRAMMING FUNDAMENTALS

L/T/P/C
2/-/-/2

Learning Outcome:

1. Explain computer hardware, operating systems and basic networking concepts.
2. Write elementary programs using structured-programming logic.
3. Use productivity and documentation software for academic and technical work.
4. Describe the role of computing in robotic systems.

UNIT-I
COMPUTER FUNDAMENTALS

Hardware, operating systems, file systems, basic networking.

UNIT-II
PROGRAMMING FUNDAMENTALS

Variables, control structures, functions using a beginner-friendly language.

UNIT-III
PRODUCTIVITY TOOLS

Word processing, spreadsheets, presentation software for technical documentation.

UNIT-IV
COMPUTING IN ROBOTICS

Overview of how computing underlies sensing, control and AI in robotic systems.

RECOMMENDED TEXT BOOKS

1. Standard "Introduction to Computers" textbook prescribed by the Board of Studies.
2. Online tutorials/MOOC modules (NPTEL/SWAYAM) on computer fundamentals and introductory programming.

PRACTICALS IN HUMAN ANATOMY

L/T/P/C
-/-/2/1

Learning Outcome:

Students will be able to identify anatomical models/specimens and correlate anatomical landmarks with robotic sensor/actuator placement.

List of Experiments/Exercises:

Identification of skeletal and muscular models; surface-marking of major joints and vital-sign monitoring points; anatomical measurement exercises relevant to exoskeleton fitting.

PRACTICALS IN PHYSIOLOGY

L/T/P/C
-/-/2/1

Learning Outcome:

Students will be able to record and interpret basic physiological parameters (pulse, blood pressure, respiratory rate) relevant to robotic vital-sign sensing.

List of Experiments/Exercises:

Recording of pulse, blood pressure and respiratory rate; simple reflex-arc demonstrations; basic ECG recording and interpretation exercises.

I year II semester

S.NO	SUBJECT	L	T	P	C
1	Microbiology	3	-	-	3
2	Pathology	3	-	-	3
3	Occupational Health	2	-	-	2
4	Programming Languages for Robotics (Python & C)	3	-	-	3
5	Introduction to GitHub & Version Control	1	-	-	1
6	Essentials of Research Design & Literature Reviews	2	-	-	2
7	Essential Biostatistics	2	-	-	2
8	Medical Robotics Terminology & Fundamentals	2	-	-	2
9	Regulations and Ethics in Medical Robotics	2	-	-	2
10	Practicals in Microbiology	-	-	2	1
11	Practicals in Pathology	-	-	2	1
12	Practicals in Coding	-	-	4	2
	TOTAL	**20**	**-**	**8**	**24**

SEMESTER-II

MICROBIOLOGY

L/T/P/C
3/-/-/3

Course Outcomes (COs):

On completion of this course, students will be able to:

1. Explain the fundamental concepts of Introduction to Microbiology.
2. Apply the principles of Microbial Groups.
3. Analyse and evaluate Microscopy and Staining Technique.
4. Design and develop solutions using Bacterial Growth and Metabolism.

UNIT-I

INTRODUCTION TO MICROBIOLOGY

1. History of Microbiology
2. Scope of Microbiology
3. Branches of Microbiology

UNIT-II

MICROBIAL GROUPS

1. Bacteria, Fungi, Protozoa, Algae, Viruses

UNIT-III

MICROSCOPY AND STAINING TECHNIQUE

1. Types of Microscopes
2. Staining Techniques

UNIT-IV

BACTERIAL GROWTH AND METABOLISM

1. Bacterial Growth
2. Bacterial reproduction
3. Bacterial Metabolism

UNIT-V

CULTURE MEDIA AND TECHNIQUE

1. Types of Culture Media
2. Agar Plate Technique
3. Incubation and Maintenance

UNIT-VI

STERILIZATION AND DISINFECTION

1. Sterilization Methods
2. Disinfection and Antiseptics

UNIT-VII

IMMUNOLOGY (BASIC CONCEPTS)

1. Immunity
2. Antigen-Antibody Interactions
3. Vaccination

UNIT-VIII

MICROBIAL PATHOGENESIS AND DISEASE

1. Pathogenic Mechanisms
2. Disease caused by Microorganism

UNIT-IX

ANTIMICROBIAL AGENTS

1. Antibiotics
2. Antiviral, Antifungal and Antibiotic Resistance
3. Antibiotic Resistance

Suggested References:

1. Latest edition standard textbook(s) prescribed by the Board of Studies for the course.
2. Relevant peer-reviewed journal articles and technical documentation (e.g., HL7/FHIR specifications, WHO/ABDM guidelines, vendor/tool documentation) as applicable to the topic.
3. Open-access datasets, MOOC modules (NPTEL/SWAYAM/Coursera) and case studies relevant to the unit content, as recommended by the course coordinator.

PATHOLOGY

L/T/P/C
3/-/-/3

Course Outcomes (COs):

On completion of this course, students will be able to:

1. Explain the fundamental concepts of Introduction to Pathology.
2. Apply the principles of Cell Injury and Adaptation.
3. Analyse and evaluate Inflammation and Repair.
4. Design and develop solutions using Hemodynamic Disorders.

UNIT-I

INTRODUCTION TO PATHOLOGY

1. History of Pathology
2. Scope of Microbiology
3. Branches of Microbiology

UNIT-II

CELL INJURY AND ADAPTATION

1. Cell Injury
2. Types of Necrosis
3. Cellular adaptations
4. Mechanisms of Injury

UNIT-III

INFLAMMATION AND REPAIR

1. Acute Inflammation
2. Chronic Inflammation
3. Healing and Tissue Repair

UNIT-IV

HEMODYNAMIC DISORDERS

1. Edema
2. Hemorrhage
3. Thrombosis
4. Embolism
5. Shock

UNIT-V

NEOPLASIA (TUMORS AND CANCER)

1. Benign vs. Malignant tumors
2. Carcinogenesis
3. Tumor Grading and Staging, Spreading

UNIT-VI

INFECTIOUS DISEASES IN PATHOLOGY

1. Bacterial Infection
2. Viral Infection
3. Fungal Infection
4. Parasitic Infections

UNIT-VII

SYSTEMIC PATHOLOGY

1. Cardiovascular System
2. Respiratory System
3. Gastrointestinal System
4. Renal system
5. Endocrine System
6. Nervous System

UNIT-VIII

FORENSIC PATHOLOGY

1. Autopsy
2. Trauma
3. Forensic Toxicology

UNIT-IX

MOLECULAR PATHOLOGY

1. Genetic Basis of Disease
2. Molecular Techniques in Pathology

Suggested References:

1. Latest edition standard textbook(s) prescribed by the Board of Studies for the course.
2. Relevant peer-reviewed journal articles and technical documentation (e.g., HL7/FHIR specifications, WHO/ABDM guidelines, vendor/tool documentation) as applicable to the topic.
3. Open-access datasets, MOOC modules (NPTEL/SWAYAM/Coursera) and case studies relevant to the unit content, as recommended by the course coordinator.

OCCUPATIONAL HEALTH

L/T/P/C
2/-/-/2

Course Outcomes (COs):

On completion of this course, students will be able to:

1. Explain the fundamental concepts of Introduction to Occupational Health.
2. Apply the principles of Workplace Hazards and Risk Assessment.
3. Analyse and evaluate Occupational Diseases and Injuries.
4. Design and develop solutions using Health and Safety Regulations.

UNIT-I

INTRODUCTION TO OCCUPATIONAL HEALTH

1. Covers the basics of occupational health, focusing on the relationship between work environments, health risks, and worker well-being

UNIT-II

WORKPLACE HAZARDS AND RISK ASSESSMENT

1. Teaches students how to identify and assess physical, chemical, biological, and ergonomic hazards in the workplace and their impact on health

UNIT-III

OCCUPATIONAL DISEASES AND INJURIES

1. Focuses on common occupational diseases (e.g., respiratory illnesses, musculoskeletal disorders) and how they are diagnosed, prevented, and managed

UNIT-IV

HEALTH AND SAFETY REGULATIONS

1. Explores international and national health and safety regulations, such as OSHA (Occupational Safety and Health Administration), and how they are applied in various industries.

UNIT-V

DIGITAL HEALTH IN OCCUPATIONAL SAFETY

1. Discusses how digital tools and technologies (wearable, health monitoring systems) can be applied to monitor and improve the health and safety of workers in different environments

Suggested References:

1. Latest edition standard textbook(s) prescribed by the Board of Studies for the course.
2. Relevant peer-reviewed journal articles and technical documentation (e.g., HL7/FHIR specifications, WHO/ABDM guidelines, vendor/tool documentation) as applicable to the topic.
3. Open-access datasets, MOOC modules (NPTEL/SWAYAM/Coursera) and case studies relevant to the unit content, as recommended by the course coordinator.

LANGUAGES FOR CODING (PYTHON & C)

L/T/P/C
3/-/-/3

Course Outcomes (COs):

On completion of this course, students will be able to:

1. Explain the fundamental concepts of Introduction to Python for Healthcare.
2. Apply the principles of Data Analysis with Python.
3. Analyse and evaluate Data Visualization in Healthcare.
4. Design and develop solutions using Machine Learning for Healthcare.

UNIT-I

INTRODUCTION TO PYTHON FOR HEALTHCARE

1. Teaches basic Python programming, focusing on its applications in analyzing and processing health data.

UNIT-II

DATA ANALYSIS WITH PYTHON

1. Covers using libraries like Pandas and Numpy to clean, manipulate, and analyze healthcare datasets, including patient records and clinical data.

UNIT-III

DATA VISUALIZATION IN HEALTHCARE

1. Focuses on creating healthcare-specific visualizations using libraries like Matplotlib and Seaborne to represent trends in health outcomes and disease data

UNIT-IV

MACHINE LEARNING FOR HEALTHCARE

1. Introduces machine learning techniques with Python, using libraries like Scikit-learn to develop models for disease prediction and treatment recommendations.

UNIT-V

HEALTHCARE DATA INTEGRATION AND AUTOMATION

1. Teaches how to use Python to integrate healthcare data from different sources (e.g., EHRs, sensors) and automate workflows in health systems.

UNIT-VI

INTRODUCTION TO C PROGRAMMING FOR HEALTHCARE

1. Covers the fundamentals of C programming, including syntax, variables, and functions, with applications in healthcare systems

UNIT-VII

DATA STRUCTURES IN HEALTHCARE

1. Focuses on implementing essential data structures (e.g., arrays, linked lists, stacks) in C to handle patient data, medical records, and health-related information

UNIT-VIII

C FOR HEALTHCARE APPLICATION DEVELOPMENT

1. Teaches how to use C to develop simple healthcare applications, such as patient management systems or scheduling tools

UNIT-IX

FILE HANDLING AND DATA MANAGEMENT IN HEALTHCARE

1. Explores how to use C to manage healthcare data through file handling, including reading and writing patient data to files or databases

UNIT-X

SYSTEM INTEGRATION AND OPTIMIZATION IN HEALTHCARE

1. Focuses on integrating C programming with healthcare systems, optimizing performance, and ensuring efficient data processing in medical applications

Suggested References:

1. Latest edition standard textbook(s) prescribed by the Board of Studies for the course.
2. Relevant peer-reviewed journal articles and technical documentation (e.g., HL7/FHIR specifications, WHO/ABDM guidelines, vendor/tool documentation) as applicable to the topic.
3. Open-access datasets, MOOC modules (NPTEL/SWAYAM/Coursera) and case studies relevant to the unit content, as recommended by the course coordinator.

INTRODUCTION TO GITHUB

L/T/P/C
1/-/-/1

Course Outcomes (COs):

On completion of this course, students will be able to:

1. Explain the fundamental concepts of Introduction — what are Git and GitHub?
2. Apply the principles of Installing Git.
3. Analyse and evaluate getting started on GitHub.
4. Design and develop solutions using Configuring Git.

UNIT-I

INTRODUCTION — WHAT ARE GIT AND GITHUB?

1. The problem: why version control matters
2. Centralized vs. distributed version control systems
3. What is Git? (snapshots, local operations, integrity)
4. What is GitHub? (hosting, collaboration, community)

UNIT-II

INSTALLING GIT

1. Checking if Git is already installed
2. Installing on Windows (Git for Windows, Git Bash)

UNIT-III

GETTING STARTED ON GITHUB

1. Creating a free GitHub account
2. Tour of the GitHub interface: dashboard, profile, repositories
3. Creating your first repository on GitHub (with README, .gitignore, license)

UNIT-IV

CONFIGURING GIT

1. Setting your identity: user.name and user.email (global vs. local scope)
2. Setting your default text editor (core.editor)
3. Configuring line endings (core.autocrlf) for cross-platform work
4. Creating command aliases for efficiency

UNIT-V

CREATING A GIT REPOSITORY

1. Initialising a new local repository (git init)
2. What lives inside the .git directory (the “database”)
3. Cloning an existing repository from GitHub (git clone)

UNIT-VI

CREATING AND EDITING FILES

1. Creating files from the command line (touch, echo, etc.)
2. Writing and editing files with a text editor (nano, Vim, VS Code)
3. Setting up a basic project structure (folders, source files, assets)

UNIT-VII

ADDING FILES TO YOUR GIT REPOSITORY

1. Checking the status of your working tree (git status)
2. Staging new and modified files (git add <file>, git add .)
3. Understanding the staging area (the index)

UNIT-VIII

FINDING OUT WHAT'S HAPPENING

1. Interpreting git status in detail (untracked, modified, staged)
2. Deep dive into git log: --oneline, --graph, --all, --decorate, --stat, -p
3. Comparing changes with git diff (unstaged vs. staged vs. last commit)

UNIT-IX

MAKING CHANGES AND TRACKING THEM

1. Modifying tracked files and viewing differences (git diff)
2. Staging and committing successive changes
3. Skipping the staging area with git commit -a

UNIT-X

SYNCHRONIZING YOUR LOCAL GIT REPOSITORY WITH GITHUB

1. Connecting to a remote: git remote add origin <url>
2. Listing and inspecting remotes (git remote -v, git remote show origin)

UNIT-XI

DELETING AND RENAMING FILES

1. Deleting a file and staging the removal (git rm)
2. Removing a file from Git tracking but keeping it locally (git rm --cached)

UNIT-XII

UNDOING CHANGES

1. Discarding unstaged modifications (git restore <file> / git checkout -- <file>)
2. Unstaging a file (git restore --staged <file> / git reset HEAD <file>)
3. Amending the most recent commit (git commit --amend)

UNIT-XIII

BRANCHING

1. What a branch really is (a lightweight movable pointer)

2. Listing, creating, and switching branches (git branch, git checkout, git switch)

UNIT-XIV

TAGS AND RELEASES

1. What are tags? (snapshot markers)
2. Lightweight vs. annotated tags (when to use each)
3. Creating tags: git tag v1.0 and git tag -a v1.0 -m "message"

UNIT-XV

DOWNLOADING A REPOSITORY

1. Cloning a repository from GitHub: git clone <url>
2. Choosing the right protocol: HTTPS vs. SSH vs. GitHub CLI
3. Cloning into a specific folder name (git clone <url> <folder>)
4. Shallow cloning for large repositories (--depth, --branch)

UNIT-XVI

MANAGING MULTIPLE COPIES OF A REPOSITORY

1. The need for multiple copies: contributing to open source, testing, experimentation
2. Forking a repository on GitHub (creating your own server-side copy)
3. Cloning your fork and setting up a remote for the original (upstream): git remote add upstream <url>
4. Keeping a fork in sync: fetching from upstream and merging into your local branch

UNIT-XVII

COMMAND SUMMARY

1. Setup and configuration: git config, git help, git version
2. Creating and cloning repositories: git init, git clone
3. Staging and committing: git add, git commit, git status, git diff

Suggested References:

1. Latest edition standard textbook(s) prescribed by the Board of Studies for the course.
2. Relevant peer-reviewed journal articles and technical documentation (e.g., HL7/FHIR specifications, WHO/ABDM guidelines, vendor/tool documentation) as applicable to the topic.
3. Open-access datasets, MOOC modules (NPTEL/SWAYAM/Coursera) and case studies relevant to the unit content, as recommended by the course coordinator.

ESSENTIALS OF RESEARCH DESIGN & LITERATURE REVIEWS

L/T/P/C

2/-/-/2

Course Outcomes (COs):

On completion of this course, students will be able to:

1. Explain the fundamental concepts of what is Research Design?
2. Apply the principles of Types of Research Designs.
3. Analyse and evaluate Key Components of Research Design.
4. Design and develop solutions using Importance of a Literature Review.

UNIT-I

WHAT IS RESEARCH DESIGN?

1. Definition
2. Purpose

UNIT-II

TYPES OF RESEARCH DESIGNS

1. Quantitative Research
2. Qualitative Research

UNIT-III

KEY COMPONENTS OF RESEARCH DESIGN

1. Research question
2. Sampling
3. Data Collection Methods
4. Analysis Plan

UNIT-IV

IMPORTANCE OF A LITERATURE REVIEW

1. Definition
2. Purpose

UNIT-V

CONDUCTING A LITERATURE REVIEW

1. Searching for sources
2. Evaluating Sources
3. Synthesizing Information

UNIT-VI

STRUCTURE OF A LITERATURE REVIEW

1. Introduction
2. Body

3. Conclusion

UNIT-VII

IMPORTANCE OF A GOOD LITERATURE REVIEW IN RESEARCH DESIGN

1. Identifies Knowledge Gaps
2. Guides Research Questions
3. Establishes Framework

UNIT-VIII

COMMON CHALLENGES IN RESEARCH DESIGN & LITERATURE REVIEWS

1. Bias in Literature Selection
2. Choosing the Right Methodology
3. Access to Resources

UNIT-IX

BEST PRACTICES IN RESEARCH DESIGN & LITERATURE REVIEWS

1. Clear Research questions
2. Use of Reliable Sources
3. Comprehensive Review

Suggested References:

1. Latest edition standard textbook(s) prescribed by the Board of Studies for the course.
2. Relevant peer-reviewed journal articles and technical documentation (e.g., HL7/FHIR specifications, WHO/ABDM guidelines, vendor/tool documentation) as applicable to the topic.
3. Open-access datasets, MOOC modules (NPTEL/SWAYAM/Coursera) and case studies relevant to the unit content, as recommended by the course coordinator.

ESSENTIAL BIOSTATISTICS

L/T/P/C
2/-/-/2

Course Outcomes (COs):

On completion of this course, students will be able to:

1. Explain the fundamental concepts of Introduction to Biostatistics.
2. Apply the principles of Probability and Distributions.
3. Analyse and evaluate Hypothesis Testing and Confidence Intervals.
4. Design and develop solutions using Correlation and Regression Analysis.

UNIT-I

INTRODUCTION TO BIOSTATISTICS

1. Foundation in basic statistical concepts, including types of data, measures of central tendency (mean, median, mode), and variability (range, variance, standard deviation).

UNIT-II

PROBABILITY AND DISTRIBUTIONS

1. Introduces probability theory and essential statistical distributions (e.g., normal, binomial), with applications in health data interpretation.

UNIT-III

HYPOTHESIS TESTING AND CONFIDENCE INTERVALS

1. Teaches methods for testing research hypotheses (e.g., t-tests, chi-square tests) and calculating confidence intervals to assess statistical significance.

UNIT-IV

CORRELATION AND REGRESSION ANALYSIS

1. Covers how to analyze relationships between variables, focusing on linear regression, correlation, and prediction models used in health outcomes.

UNIT-V

EPIDEMIOLOGY AND SURVIVAL ANALYSIS

1. Key techniques in epidemiology, including survival analysis methods (e.g., Kaplan-Meier) to study patient outcomes and disease progression over time.

Suggested References:

1. Latest edition standard textbook(s) prescribed by the Board of Studies for the course.
2. Relevant peer-reviewed journal articles and technical documentation (e.g., HL7/FHIR specifications, WHO/ABDM guidelines, vendor/tool documentation) as applicable to the topic.
3. Open-access datasets, MOOC modules (NPTEL/SWAYAM/Coursera) and case studies relevant to the unit content, as recommended by the course coordinator.

DIGITAL HEALTH TERMINOLOGY

L/T/P/C
2/-/-/2

Course Outcomes (COs):

On completion of this course, students will be able to:

1. Explain the fundamental concepts of Introduction to Digital Health Terminology.
2. Apply the principles of Health Information Systems and Standards.
3. Analyse and evaluate Clinical Informatics.
4. Design and develop solutions using Health Data and Analytics.

UNIT-I

INTRODUCTION TO DIGITAL HEALTH TERMINOLOGY

1. Covers the foundational terms and concepts used in digital health, including eHealth, mHealth, telemedicine, and telehealth.

UNIT-II

HEALTH INFORMATION SYSTEMS AND STANDARDS

1. Introduces key terminology related to health information systems (e.g., EHR, EMR) and health data standards (e.g., HL7, FHIR).

UNIT-III

CLINICAL INFORMATICS

1. Focuses on terminology related to the use of information technology in clinical settings, such as decision support systems, patient portals, and clinical workflows.

UNIT-IV

HEALTH DATA AND ANALYTICS

1. Explains terms related to health data types (e.g., structured, unstructured) and analytical methods (e.g., predictive modeling, data mining).

UNIT-V

REGULATIONS AND ETHICS IN DIGITAL HEALTH

1. Provides terminology related to data privacy laws (e.g., HIPAA, GDPR) and ethical considerations in using digital health technologies

Suggested References:

1. Latest edition standard textbook(s) prescribed by the Board of Studies for the course.
2. Relevant peer-reviewed journal articles and technical documentation (e.g., HL7/FHIR specifications, WHO/ABDM guidelines, vendor/tool documentation) as applicable to the topic.
3. Open-access datasets, MOOC modules (NPTEL/SWAYAM/Coursera) and case studies relevant to the unit content, as recommended by the course coordinator.

REGULATIONS AND ETHICS

L/T/P/C
2/-/-/2

Course Outcomes (COs):

On completion of this course, students will be able to:

1. Explain the fundamental concepts of Introduction to Healthcare Ethics.
2. Apply the principles of Data Privacy and Security.
3. Analyse and evaluate Informed Consent and Patient Rights.
4. Design and develop solutions using Ethical Issues in AI and Digital Health.

UNIT-I

INTRODUCTION TO HEALTHCARE ETHICS

1. Covers foundational ethical principles in healthcare such as autonomy, beneficence, non-malfeasance, and justice, with a focus on their application in digital health.

UNIT-II

DATA PRIVACY AND SECURITY

1. Focuses on regulations like HIPAA (Health Insurance Portability and Accountability Act) and GDPR (General Data Protection Regulation) that govern the handling of patient data.

UNIT-III

INFORMED CONSENT AND PATIENT RIGHTS

1. Teaches the ethical principles behind obtaining informed consent, especially in digital health technologies and telemedicine.

UNIT-IV

ETHICAL ISSUES IN AI AND DIGITAL HEALTH

1. Examines ethical dilemmas related to AI, machine learning, and data analytics in healthcare, including bias, transparency, and accountability.

UNIT-V

REGULATORY FRAMEWORKS FOR DIGITAL HEALTH

1. Covers the legal and regulatory standards affecting digital health technologies, including FDA approval processes for health apps and devices.

Suggested References:

1. Latest edition standard textbook(s) prescribed by the Board of Studies for the course.
2. Relevant peer-reviewed journal articles and technical documentation (e.g., HL7/FHIR specifications, WHO/ABDM guidelines, vendor/tool documentation) as applicable to the topic.
3. Open-access datasets, MOOC modules (NPTEL/SWAYAM/Coursera) and case studies relevant to the unit content, as recommended by the course coordinator.

SEMESTER-III

ADVANCED DATA ANALYTICS (R/SPSS/STATA/SAS)

L/T/P/C
4/-/-/4

Course Outcomes (COs):

On completion of this course, students will be able to:

1. Explain the fundamental concepts of Introduction to R Programming.
2. Apply the principles of Data Import and Management in R.
3. Analyse and evaluate Descriptive Statistics in R.
4. Design and develop solutions using Basic Statistical Analysis with R.

UNIT-I

INTRODUCTION TO R PROGRAMMING

1. Covers the basics of R, including installation, syntax, and using the RStudio interface for data analysis

UNIT-II

DATA IMPORT AND MANAGEMENT IN R

1. Focuses on importing datasets, cleaning data, and handling missing values using R functions and packages

UNIT-III

DESCRIPTIVE STATISTICS IN R

1. Teaches how to calculate and interpret descriptive statistics such as mean, median, variance, and standard deviation using R

UNIT-IV

BASIC STATISTICAL ANALYSIS WITH R

1. Introduces inferential statistics, including t-tests, chi-square tests, and simple linear regression for analyzing healthcare data

UNIT-V

DATA VISUALIZATION IN R

1. Covers how to create visualizations like histograms, scatter plots, and box plots using R's ggplot2 package to represent healthcare data

UNIT-VI

INTRODUCTION TO STATA INTERFACE AND COMMANDS

1. Covers the basics of navigating STATA, understanding its interface, and using basic commands for data manipulation and analysis.

UNIT-VII

DATA MANAGEMENT IN STATA

1. Focuses on importing, cleaning, and managing healthcare datasets, including handling missing values and variable transformations

UNIT-VIII

DESCRIPTIVE STATISTICS IN STATA

1. Teaches students how to compute and interpret summary statistics like means, frequencies, and standard deviations for healthcare data

UNIT-IX

BASIC STATISTICAL ANALYSIS WITH STATA

1. Introduces inferential statistics such as t-tests, chi-square tests, and simple regression analysis, applying them to healthcare data

UNIT-X

DATA VISUALIZATION IN STATA

1. Teaches how to create graphs and charts in STATA to effectively present findings from healthcare research and data analysis.

UNIT-XI

INTRODUCTION TO SPSS SOFTWARE

1. Covers the basics of SPSS, including navigating the interface, data entry, and understanding data sets

UNIT-XII

DATA MANAGEMENT IN SPSS

1. Teaches how to import, clean, and organize healthcare data, including handling missing values and recoding variable

UNIT-XIII

DESCRIPTIVE STATISTICS WITH SPSS

1. Focuses on calculating and interpreting descriptive statistics, such as mean, median, standard deviation, and frequency distributions for healthcare data

UNIT-XIV

INFERENTIAL STATISTICS IN SPSS

1. Introduces basic statistical tests like t-tests, chi-square tests, and ANOVA to analyze healthcare data

UNIT-XV

DATA VISUALIZATION WITH SPSS

1. Teaches how to create charts, graphs, and tables in SPSS to effectively present healthcare data and research finding

UNIT-XVI

INTRODUCTION TO SAS PROGRAMMING

1. Covers the basics of SAS, including its interface, syntax, and data step processing, with an emphasis on healthcare data manipulation

UNIT-XVII

DATA IMPORT AND EXPORT IN SAS

1. Teaches how to import, export, and manage datasets from different formats (CSV, Excel, databases) for healthcare analysis

UNIT-XVIII

DATA CLEANING AND TRANSFORMATION

1. Focuses on using SAS to clean and preprocess healthcare data, including handling missing values, filtering, and transforming variables

UNIT-XIX

BASIC STATISTICAL ANALYSIS WITH SAS

1. Introduces key statistical procedures in SAS for analyzing healthcare data, such as descriptive statistics, t-tests, and regression analysis

UNIT-XX

DATA VISUALIZATION IN SAS

1. Teaches how to create visualizations like graphs and charts to present healthcare data insights using SAS's graphical capabilities

Suggested References:

1. Latest edition standard textbook(s) prescribed by the Board of Studies for the course.
2. Relevant peer-reviewed journal articles and technical documentation (e.g., HL7/FHIR specifications, WHO/ABDM guidelines, vendor/tool documentation) as applicable to the topic.
3. Open-access datasets, MOOC modules (NPTEL/SWAYAM/Coursera) and case studies relevant to the unit content, as recommended by the course coordinator.

DATA VISUALIZATION AND GIS

L/T/P/C
3/-/-/3

Course Outcomes (COs):

On completion of this course, students will be able to:

1. Explain the fundamental concepts of Introduction to Data Visualization in Healthcare.
2. Apply the principles of Types of Healthcare Data Visualizations.
3. Analyse and evaluate Design Principles for Effective Visualization.
4. Design and develop solutions using Tools for Data Visualization in Healthcare.

UNIT-I

INTRODUCTION TO DATA VISUALIZATION IN HEALTHCARE

1. Covers the importance of data visualization in healthcare, emphasizing how visual tools can help convey complex medical data clearly

UNIT-II

TYPES OF HEALTHCARE DATA VISUALIZATIONS

1. Teaches different types of visualizations, such as bar charts, line graphs, pie charts, and heat maps, used to represent healthcare data.

UNIT-III

DESIGN PRINCIPLES FOR EFFECTIVE VISUALIZATION

1. Focuses on principles such as simplicity, clarity, and accessibility in designing visuals that enhance decision-making in healthcare.

UNIT-IV

TOOLS FOR DATA VISUALIZATION IN HEALTHCARE

1. Introduces software and tools like Tableau, Excel, and R for creating healthcare-related visualizations.

UNIT-V

INTERPRETING HEALTHCARE VISUALIZATIONS

1. Teaches students how to read and interpret data visualizations in clinical settings to support evidence-based healthcare decisions

UNIT-VI

GEOGRAPHICAL INFORMATION SYSTEMS

1. Different GIS Functions
2. Trends in GIS applications
3. GIS and the internet

UNIT-VII

TYPES OF HEALTHCARE DATA VISUALIZATIONS

1. Field and object data

2. Types of spatial data
3. Tessellation and vector data models
4. Cartographic
5. Representation
6. Metadata

UNIT-VIII

MAPPING HEALTH INFORMATION

1. The mapping process
2. Representing Health information
3. Viewing Health information
4. Resources for geocoding &Mapping

UNIT-IX

SPATIAL CLUSTERING METHODS

1. Mapping Disease Rates
2. Spatial Clustering methods
3. Space time Clustering
4. Analyzing Data sets from India and abroad

UNIT-X

APPLICATION

1. Modelling Transmissions and diffusion of diseases
2. Detecting disease outbreaks - Locating Health Services
3. Analyzing environmental exposures and hazards
4. Mapping and studying health disparities

Suggested References:

1. Latest edition standard textbook(s) prescribed by the Board of Studies for the course.
2. Relevant peer-reviewed journal articles and technical documentation (e.g., HL7/FHIR specifications, WHO/ABDM guidelines, vendor/tool documentation) as applicable to the topic.
3. Open-access datasets, MOOC modules (NPTEL/SWAYAM/Coursera) and case studies relevant to the unit content, as recommended by the course coordinator.

EVIDENCE BASED MEDICAL TOOLS

L/T/P/C
2/-/-/2

Course Outcomes (COs):

On completion of this course, students will be able to:

1. Explain the fundamental concepts of Introduction to Evidence-Based Medicine (EBM).
2. Apply the principles of Key Tools in EBM.
3. Analyse and evaluate Critical Appraisal of Medical Literature.
4. Design and develop solutions using Evidence-Based Guidelines and Protocols.

UNIT-I

INTRODUCTION TO EVIDENCE-BASED MEDICINE (EBM)

1. Covers the principles of EBM, emphasizing the importance of integrating clinical expertise, patient values, and the best research evidence in decision-making.

UNIT-II

KEY TOOLS IN EBM

1. Teaches students how to use tools like Pub Med, Cochrane Library, and clinical decision support systems (CDSS) to access reliable medical evidence

UNIT-III

CRITICAL APPRAISAL OF MEDICAL LITERATURE

1. Focuses on evaluating the quality, relevance, and applicability of research articles, systematic reviews, and clinical trials in healthcare settings

UNIT-IV

EVIDENCE-BASED GUIDELINES AND PROTOCOLS

1. Explores how to apply clinical guidelines and protocols based on evidence to improve patient care and outcomes.

UNIT-V

DIGITAL TOOLS FOR EVIDENCE-BASED PRACTICE

1. Introduces mobile apps, databases, and software that support evidence-based decision-making in clinical practice and healthcare management

Suggested References:

1. Latest edition standard textbook(s) prescribed by the Board of Studies for the course.
2. Relevant peer-reviewed journal articles and technical documentation (e.g., HL7/FHIR specifications, WHO/ABDM guidelines, vendor/tool documentation) as applicable to the topic.
3. Open-access datasets, MOOC modules (NPTEL/SWAYAM/Coursera) and case studies relevant to the unit content, as recommended by the course coordinator.

HEALTH ALGORITHMS TO APPLICATION

L/T/P/C
2/-/-/2

Course Outcomes (COs):

On completion of this course, students will be able to:

1. Explain the fundamental concepts of Introduction to Health Algorithms.
2. Apply the principles of Core Components of Health Algorithms.
3. Analyse and evaluate Machine Learning in Healthcare.
4. Design and develop solutions using Introduction to Predictive Analytics in Healthcare.

UNIT-I

INTRODUCTION TO HEALTH ALGORITHMS

1. Overview of health Algorithms
2. Types of Algorithms

UNIT-II

CORE COMPONENTS OF HEALTH ALGORITHMS

1. Data Collection and Healthcare Data Types
2. Data Preprocessing
3. Features Selection and Engineering

UNIT-III

MACHINE LEARNING IN HEALTHCARE

1. Introduction to ML
2. Building Predictive Models
3. Common Application of ML

UNIT-IV

INTRODUCTION TO PREDICTIVE ANALYTICS IN HEALTHCARE

1. Concepts of Predictive Analytics
2. Healthcare Case Studies
3. Predictive Model Evaluation

UNIT-V

CLINICAL DECISION SUPPORT SYSTEMS (CDSS)

1. Introduction to CDSS
2. Building a simple Decision Support system
3. Case studies

UNIT-VI

IMPLEMENTING HEALTH ALGORITHMS INTO CLINICAL PRACTICE

1. From Algorithms to Application
2. User Interface and Experience

UNIT-VII

ETHICAL AND LEGAL CONSIDERATIONS IN HEALTH ALGORITHMS

1. Ethics of AI in Healthcare
2. Data Privacy and Security
3. Regulatory and Legal Framework

Suggested References:

1. Latest edition standard textbook(s) prescribed by the Board of Studies for the course.
2. Relevant peer-reviewed journal articles and technical documentation (e.g., HL7/FHIR specifications, WHO/ABDM guidelines, vendor/tool documentation) as applicable to the topic.
3. Open-access datasets, MOOC modules (NPTEL/SWAYAM/Coursera) and case studies relevant to the unit content, as recommended by the course coordinator.

MOBILE APPS & WEB APPS

L/T/P/C
3/-/-/3

Course Outcomes (COs):

On completion of this course, students will be able to:

1. Explain the fundamental concepts of Introduction to Mobile and Web Apps in Healthcare.
2. Apply the principles of Components of a Mobile App.
3. Analyse and evaluate Components of a Web App.
4. Design and develop solutions using Tools and Technologies for Development.

UNIT-I

INTRODUCTION TO MOBILE AND WEB APPS IN HEALTHCARE

1. What are Mobile Apps
2. What are Web Apps

UNIT-II

COMPONENTS OF A MOBILE APP

1. Frontend Components (UI/UX)
2. Backend Components
3. Mobile App Platforms

UNIT-III

COMPONENTS OF A WEB APP

1. Frontend Components (UI/UX)
2. Backend Components
3. Web App Deployment

UNIT-IV

TOOLS AND TECHNOLOGIES FOR DEVELOPMENT

1. Mobile App Development Tools
2. Web App Development Tools

UNIT-V

REAL-WORLD APPLICATIONS AND HANDS ON PROJECTS

1. Mobile App Project Ideas
2. Web App Project Ideas

Suggested References:

1. Latest edition standard textbook(s) prescribed by the Board of Studies for the course.
2. Relevant peer-reviewed journal articles and technical documentation (e.g., HL7/FHIR specifications, WHO/ABDM guidelines, vendor/tool documentation) as applicable to the topic.

3. Open-access datasets, MOOC modules (NPTEL/SWAYAM/Coursera) and case studies relevant to the unit content, as recommended by the course coordinator.

DATABASE FEATURES

L/T/P/C
2/-/-/2

Course Outcomes (COs):

On completion of this course, students will be able to:

1. Explain the fundamental concepts of Introduction to Mobile and Web Apps in Healthcare.
2. Apply the principles of Components of a Mobile App.
3. Analyse and evaluate Components of a Web App.
4. Design and develop solutions using Tools and Technologies for Development.

UNIT-I

INTRODUCTION TO MOBILE AND WEB APPS IN HEALTHCARE

1. What are Mobile Apps
2. What are Web Apps

UNIT-II

COMPONENTS OF A MOBILE APP

1. Frontend Components (UI/UX)
2. Backend Components
3. Mobile App Platforms

UNIT-III

COMPONENTS OF A WEB APP

1. Frontend Components (UI/UX)
2. Backend Components
3. Web App Deployment

UNIT-IV

TOOLS AND TECHNOLOGIES FOR DEVELOPMENT

1. Mobile App Development Tools
2. Web App Development Tools

UNIT-V

REAL-WORLD APPLICATIONS AND HANDS ON PROJECTS

1. Mobile App Project Ideas
2. Web App Project Ideas

Suggested References:

1. Latest edition standard textbook(s) prescribed by the Board of Studies for the course.
2. Relevant peer-reviewed journal articles and technical documentation (e.g., HL7/FHIR specifications, WHO/ABDM guidelines, vendor/tool documentation) as applicable to the topic.

3. Open-access datasets, MOOC modules (NPTEL/SWAYAM/Coursera) and case studies relevant to the unit content, as recommended by the course coordinator.

API & PLUG-IN INTEGRATION

L/T/P/C
2/-/-/2

Course Outcomes (COs):

On completion of this course, students will be able to:

1. Explain the fundamental concepts of Introduction to Mobile and Web Apps in Healthcare.
2. Apply the principles of Components of a Mobile App.
3. Analyse and evaluate Components of a Web App.
4. Design and develop solutions using Tools and Technologies for Development.

UNIT-I

INTRODUCTION TO MOBILE AND WEB APPS IN HEALTHCARE

1. What are Mobile Apps
2. What are Web Apps

UNIT-II

COMPONENTS OF A MOBILE APP

1. Frontend Components (UI/UX)
2. Backend Components
3. Mobile App Platforms

UNIT-III

COMPONENTS OF A WEB APP

1. Frontend Components (UI/UX)
2. Backend Components
3. Web App Deployment

UNIT-IV

TOOLS AND TECHNOLOGIES FOR DEVELOPMENT

1. Mobile App Development Tools
2. Web App Development Tools

UNIT-V

REAL-WORLD APPLICATIONS AND HANDS ON PROJECTS

1. Mobile App Project Ideas
2. Web App Project Ideas

Suggested References:

1. Latest edition standard textbook(s) prescribed by the Board of Studies for the course.
2. Relevant peer-reviewed journal articles and technical documentation (e.g., HL7/FHIR specifications, WHO/ABDM guidelines, vendor/tool documentation) as applicable to the topic.

3. Open-access datasets, MOOC modules (NPTEL/SWAYAM/Coursera) and case studies relevant to the unit content, as recommended by the course coordinator.

DASHBOARDS FOR HEALTHCARE

L/T/P/C
2/-/-/2

Course Outcomes (COs):

On completion of this course, students will be able to:

1. Explain the fundamental concepts of Introduction to Healthcare Dashboards.
2. Apply the principles of Key Features of Interactive Dashboards for Healthcare.
3. Analyse and evaluate Tools for Developing Interactive Dashboards.
4. Design and develop solutions using Key Metrics for Healthcare Dashboards.

UNIT-I

INTRODUCTION TO HEALTHCARE DASHBOARDS

1. Patient Dashboards
2. Public Health Dashboards

UNIT-II

KEY FEATURES OF INTERACTIVE DASHBOARDS FOR HEALTHCARE

1. Data Visualization
2. Filters and Segmentation
3. Real-Time Updates
4. KPIs (Key Performances Indicators
5. User Interaction
6. Data Export

UNIT-III

TOOLS FOR DEVELOPING INTERACTIVE DASHBOARDS

1. Power BI/ Tableau/ Google Data Studio

UNIT-IV

KEY METRICS FOR HEALTHCARE DASHBOARDS

1. Patients data Dashboards
2. Public Health Dashboards
3. Operational Dashboards for Hospitals

UNIT-V

HANDS-ON PRACTICE

1. Case studies

Suggested References:

1. Latest edition standard textbook(s) prescribed by the Board of Studies for the course.
2. Relevant peer-reviewed journal articles and technical documentation (e.g., HL7/FHIR specifications, WHO/ABDM guidelines, vendor/tool documentation) as applicable to the topic.

3. Open-access datasets, MOOC modules (NPTEL/SWAYAM/Coursera) and case studies relevant to the unit content, as recommended by the course coordinator.

II year IV semester

S.NO	SUBJECT	L	T	P	C
1	Robotics Design Thinking	2	-	-	2
2	Human-Robot Interaction Design	3	-	-	3
3	Rapid Prototyping and 3D Printing for Robotics	2	-	-	2
4	Predictive Analytics for Robotic Healthcare Systems	3	-	-	3
5	AI/ML/Gen AI/Computer Vision for Robotics	3	-	-	3
6	Practicals in Human-Robot Interaction Design	-	-	2	1
7	Practicals in Rapid Prototyping and 3D Printing	-	-	4	2
8	Practicals in Predictive Analytics	-	-	2	1
9	Practicals in AI/ML/Gen AI	-	-	4	2
	TOTAL	**13**	**-**	**12**	**19**

SEMESTER-IV

ROBOTICS DESIGN THINKING

L/T/P/C
2/-/-/2

Learning Outcome:

1. Apply design-thinking methodology (empathise-define-ideate-prototype-test) to medical-robotics problems.
2. Conduct user (patient/clinician) needs-assessment for robotic-device design.
3. Develop and iterate low-fidelity prototypes of assistive/robotic solutions.
4. Present a design-thinking case study for a medical-robotics problem.

UNIT-I
DESIGN THINKING FUNDAMENTALS

Empathise, define, ideate, prototype, test framework.

UNIT-II
USER RESEARCH IN HEALTHCARE ROBOTICS

Needs-assessment methods with patients/clinicians.

UNIT-III
PROTOTYPING METHODS

Low-fidelity prototyping for robotics/assistive-device concepts.

UNIT-IV
CASE STUDIES

Applied design-thinking projects in medical robotics.

RECOMMENDED TEXT BOOKS

Standard Design Thinking textbooks (e.g., IDEO/Stanford d.school methodology) prescribed by the Board of Studies.

HUMAN-ROBOT INTERACTION DESIGN

L/T/P/C
3/-/-/3

Learning Outcome:

1. Explain principles of human-robot interaction (HRI) relevant to healthcare settings.
2. Design intuitive interfaces for patient- and clinician-facing robots.
3. Apply usability-testing methods to robotic-interface prototypes.
4. Evaluate safety and trust considerations in HRI for medical robots.

UNIT-I
HRI FUNDAMENTALS

Models of human-robot interaction, trust and acceptance.

UNIT-II
INTERFACE DESIGN

Visual, haptic and voice interfaces for patient/clinician-facing robots.

UNIT-III
USABILITY TESTING

Methods for evaluating robotic-interface usability.

UNIT-IV
SAFETY AND TRUST IN HRI

Designing for safety, transparency and trust in autonomous medical robots.

RECOMMENDED TEXT BOOKS

Standard Human-Robot Interaction textbooks and journal articles prescribed by the Board of Studies.

RAPID PROTOTYPING AND 3D PRINTING FOR ROBOTICS

L/T/P/C
2/-/-/2

Learning Outcome:

1. Explain additive-manufacturing processes (FDM/SLA) relevant to robotics components.
2. Design 3D-printable parts for robotic/assistive devices using CAD software.
3. Select appropriate materials for medical-grade 3D-printed robotic components.
4. Fabricate and test a simple 3D-printed robotic/assistive part.

UNIT-I
ADDITIVE MANUFACTURING FUNDAMENTALS

FDM, SLA and other 3D-printing processes.

UNIT-II
CAD DESIGN FOR PRINTING

Designing printable robotic components using SolidWorks/Fusion 360.

UNIT-III
MATERIALS SELECTION

Biocompatible and durable materials for medical/robotics applications.

UNIT-IV
FABRICATION AND TESTING

Printing, post-processing and functional testing of prototypes.

RECOMMENDED TEXT BOOKS

Standard Rapid Prototyping/Additive Manufacturing textbooks and CAD software documentation.

PREDICTIVE ANALYTICS FOR ROBOTIC HEALTHCARE SYSTEMS

L/T/P/C
3/-/-/3

Learning Outcome:

1. Apply predictive-modelling techniques to robotic sensor and clinical-outcome data.
2. Build regression/classification models for predicting patient-recovery or device-maintenance needs.
3. Evaluate predictive-model performance using standard metrics.
4. Apply predictive analytics to optimize robotics-assisted care pathways.

UNIT-I
PREDICTIVE-MODELLING FUNDAMENTALS

Regression and classification basics.

UNIT-II
FEATURE ENGINEERING

Deriving features from robotic sensor/clinical data.

UNIT-III
MODEL EVALUATION

Accuracy, precision/recall, ROC-AUC for healthcare-robotics predictions.

UNIT-IV
APPLICATIONS

Predictive maintenance of robots; predicting patient-recovery trajectories.

RECOMMENDED TEXT BOOKS

Standard Predictive Analytics/Machine Learning textbooks prescribed by the Board of Studies.

AI/ML/GEN AI/COMPUTER VISION FOR ROBOTICS

L/T/P/C
3/-/-/3

Learning Outcome:

1. Explain fundamental AI/ML and computer-vision concepts applicable to robotics.
2. Apply computer-vision techniques for object/obstacle detection in medical robots.
3. Apply generative-AI tools to robotics design and documentation tasks.
4. Evaluate AI-model performance for safety-critical robotic applications.

UNIT-I
AI/ML FUNDAMENTALS

Supervised/unsupervised learning basics.

UNIT-II
COMPUTER VISION FOR ROBOTICS

Image processing, object detection, segmentation.

UNIT-III
GENERATIVE AI APPLICATIONS

Use of generative-AI tools in robotics design/documentation.

UNIT-IV
AI SAFETY AND VALIDATION

Validating AI models for safety-critical medical-robotics use.

RECOMMENDED TEXT BOOKS

Standard AI/ML and Computer Vision textbooks prescribed by the Board of Studies.

PRACTICALS IN HUMAN-ROBOT INTERACTION DESIGN

L/T/P/C
-/-/2/1

Learning Outcome:

Students will prototype and usability-test a simple patient/clinician-facing robotic interface.

PRACTICALS IN RAPID PROTOTYPING AND 3D PRINTING

L/T/P/C
-/-/4/2

Learning Outcome:

Students will design, print and test a 3D-printed robotic/assistive-device component.

PRACTICALS IN PREDICTIVE ANALYTICS

L/T/P/C
-/-/2/1

Learning Outcome:

Students will build and evaluate a predictive model using robotic sensor/clinical datasets.

PRACTICALS IN AI/ML/GEN AI

L/T/P/C
-/-/4/2

Learning Outcome:

Students will implement a computer-vision or generative-AI pipeline for a robotics-perception task.

III year V semester

S.NO	SUBJECT	L	T	P	C
1	Autonomous Mobile Navigation for Medical Robots	3	-	-	3
2	Surgical & Rehabilitation Robotics	3	-	-	3
3	AR/VR/MR for Robotic Healthcare	3	-	-	3
4	Swarm and Multi-Robot Systems in Healthcare	3	-	-	3
5	Market Research & Needs Assessment	2	-	-	2
6	Practicals in AR/VR/MR for Robotic Healthcare	-	-	4	2
7	Practicals in Robotics Simulation	-	-	2	1
8	Internship	-	-	-	3
	TOTAL	**14**	**-**	**6**	**20**

SEMESTER-V

AUTONOMOUS MOBILE NAVIGATION FOR MEDICAL ROBOTS

L/T/P/C
3/-/-/3

Learning Outcome:

1. Explain principles of mobile-robot localisation and mapping (SLAM).
2. Apply path-planning and obstacle-avoidance algorithms in hospital/clinical environments.
3. Integrate LIDAR/ultrasonic/RADAR sensing for autonomous navigation.
4. Evaluate safety considerations for autonomous robots navigating around patients and staff.

UNIT-I
LOCALISATION AND MAPPING

SLAM fundamentals, occupancy grids.

UNIT-II
PATH PLANNING

Global and local path-planning algorithms.

UNIT-III
SENSOR INTEGRATION

LIDAR, ultrasonic and RADAR sensing for navigation.

UNIT-IV
SAFETY IN CLINICAL ENVIRONMENTS

Human-aware navigation and safety protocols for hospital-floor robots.

RECOMMENDED TEXT BOOKS

Standard Mobile Robotics/Autonomous Navigation textbooks prescribed by the Board of Studies.

SURGICAL & REHABILITATION ROBOTICS

L/T/P/C
3/-/-/3

Learning Outcome:

1. Explain the architecture and clinical workflow of teleoperated surgical-robot systems.
2. Describe rehabilitation-robot design principles for gait and upper-limb therapy.
3. Apply haptic-feedback concepts to surgical-robotics control.
4. Evaluate clinical outcomes associated with surgical/rehabilitation-robotics interventions.

UNIT-I
SURGICAL ROBOTICS ARCHITECTURE

Master-slave teleoperation, end-effector design.

UNIT-II
HAPTIC FEEDBACK

Force-feedback principles for surgical precision.

UNIT-III
REHABILITATION ROBOTICS

Gait-training and upper-limb rehabilitation-robot design.

UNIT-IV
CLINICAL OUTCOMES AND CASE STUDIES

Evaluating surgical/rehabilitation-robotics outcomes.

RECOMMENDED TEXT BOOKS

Standard Surgical and Rehabilitation Robotics textbooks and journal articles prescribed by the Board of Studies.

AR/VR/MR FOR ROBOTIC HEALTHCARE

L/T/P/C
3/-/-/3

Learning Outcome:

1. Explain AR/VR/MR technology fundamentals relevant to robotics training and surgical planning.
2. Design immersive simulations for robotic-surgery/rehabilitation training.
3. Integrate AR/VR overlays with robotic-system telemetry for clinician guidance.
4. Evaluate the effectiveness of AR/VR-based robotics training modules.

UNIT-I
AR/VR/MR FUNDAMENTALS

Hardware and software platforms (HoloLens, VR headsets).

UNIT-II
SIMULATION DESIGN

Building immersive robotics-training/surgical-planning simulations.

UNIT-III
INTEGRATION WITH ROBOTIC TELEMETRY

Overlaying real-time robot data on AR/VR interfaces.

UNIT-IV
EVALUATION

Assessing training effectiveness and clinical usability of AR/VR robotics tools.

RECOMMENDED TEXT BOOKS

Standard AR/VR/MR in Healthcare textbooks and vendor SDK documentation.

SWARM AND MULTI-ROBOT SYSTEMS IN HEALTHCARE

L/T/P/C
3/-/-/3

Learning Outcome:

1. Explain principles of swarm intelligence and multi-robot coordination.
2. Apply coordination algorithms to multi-robot healthcare-logistics scenarios.
3. Simulate swarm-robotics behaviour for hospital-delivery or disinfection tasks.
4. Evaluate scalability and fault-tolerance of multi-robot systems in healthcare settings.

UNIT-I
SWARM INTELLIGENCE FUNDAMENTALS

Decentralised control, emergent behaviour.

UNIT-II
MULTI-ROBOT COORDINATION

Task allocation and communication protocols.

UNIT-III
HEALTHCARE APPLICATIONS

Multi-robot delivery, disinfection and logistics in hospitals.

UNIT-IV
SCALABILITY AND FAULT TOLERANCE

Designing resilient multi-robot healthcare systems.

RECOMMENDED TEXT BOOKS

Standard Swarm Robotics/Multi-Agent Systems textbooks prescribed by the Board of Studies.

MARKET RESEARCH & NEEDS ASSESSMENT

L/T/P/C
2/-/-/2

Learning Outcome:

1. Conduct market research for medical-robotics products.
2. Perform clinical-needs assessment with hospital stakeholders.
3. Analyse competitor landscape in medical-robotics markets.
4. Prepare a needs-assessment report supporting a robotics-product concept.

UNIT-I
MARKET RESEARCH METHODS

Primary/secondary research, surveys, interviews.

UNIT-II
CLINICAL NEEDS ASSESSMENT

Engaging clinicians/patients to identify unmet needs.

UNIT-III
COMPETITIVE ANALYSIS

Landscape analysis of medical-robotics products/companies.

UNIT-IV
REPORTING

Structuring a needs-assessment report for a robotics product concept.

RECOMMENDED TEXT BOOKS

Standard Market Research/Needs Assessment textbooks prescribed by the Board of Studies.

PRACTICALS IN AR/VR/MR FOR ROBOTIC HEALTHCARE

L/T/P/C
-/-/4/2

Learning Outcome:

Students will build a simple AR/VR simulation module for robotics-assisted training or surgical planning.

PRACTICALS IN ROBOTICS SIMULATION

L/T/P/C
-/-/2/1

Learning Outcome:

Students will simulate autonomous navigation or multi-robot coordination scenarios using robotics-simulation software.

INTERNSHIP

L/T/P/C
-/-/-/3

Learning Outcome:

Students will gain field exposure to medical-robotics/med-tech industry or clinical-engineering settings, applying classroom learning to real-world robotics-healthcare workflows, and will submit a supervised internship report.

III year VI semester

S.NO	SUBJECT	L	T	P	C
1	Digital Twins for Medical Robotics	3	-	-	3
2	Robotics for Bedside Patient Monitoring	2	-	2	3
3	Robotics for Emergency and ICU Care	2	-	2	3
4	Robotics for Home-Based Healthcare	2	-	-	2
5	Assistive & Wearable Robotics for Elderly Care	2	-	-	2
6	Exoskeletons and Prosthetic Robotics	2	-	-	2
7	Healthcare Logistics & Robotic Automation	2	-	-	2
8	Healthcare E-Commerce	2	-	-	2
9	Finance for Healthcare Robotics Ventures	2	-	-	2
	TOTAL	**19**	**-**	**4**	**21**

SEMESTER-VI

DIGITAL TWINS FOR MEDICAL ROBOTICS

L/T/P/C
3/-/-/3

Learning Outcome:

1. Explain digital-twin concepts and their application to robotic-system design and monitoring.
2. Build a digital-twin model of a robotic subsystem (e.g., robotic arm, exoskeleton joint).
3. Use digital twins for predictive maintenance of medical robots.
4. Evaluate digital-twin fidelity against real robotic-system performance.

UNIT-I
DIGITAL TWIN FUNDAMENTALS

Concepts, architecture and data pipelines.

UNIT-II
MODELLING ROBOTIC SUBSYSTEMS

Building digital twins of robotic arms/joints.

UNIT-III
PREDICTIVE MAINTENANCE

Using digital twins to anticipate robotic-component failure.

UNIT-IV
VALIDATION

Comparing digital-twin predictions with real-world robot performance.

RECOMMENDED TEXT BOOKS

Standard Digital Twin textbooks and industry white papers prescribed by the Board of Studies.

ROBOTICS FOR BEDSIDE PATIENT MONITORING

L/T/P/C
2/-/2/3

Learning Outcome:

1. Explain robotic-platform design for continuous bedside vital-sign monitoring.
2. Integrate wearable/bedside sensors with robotic monitoring platforms.
3. Implement alert/escalation logic for abnormal vital-sign detection.
4. Evaluate reliability and patient-safety aspects of robotic bedside-monitoring systems.

UNIT-I
BEDSIDE MONITORING ROBOTICS

Platform architecture for continuous vital-sign monitoring.

UNIT-II
SENSOR INTEGRATION

Wearable and bedside sensor integration.

UNIT-III
ALERT AND ESCALATION SYSTEMS

Logic design for abnormal-parameter detection and clinician alerts.

UNIT-IV
RELIABILITY AND SAFETY

Fail-safe design for bedside robotic-monitoring systems.

RECOMMENDED TEXT BOOKS

Standard Patient Monitoring Systems/Biomedical Instrumentation textbooks prescribed by the Board of Studies.

ROBOTICS FOR EMERGENCY AND ICU CARE

L/T/P/C
2/-/2/3

Learning Outcome:

1. Explain the role of robotics in emergency-response and ICU workflows.
2. Describe robotic systems for rapid triage support and remote ICU monitoring.
3. Integrate robotic devices with ICU alarm and information systems.
4. Evaluate safety-critical design requirements for emergency/ICU robotics.

UNIT-I
EMERGENCY-CARE ROBOTICS

Triage-support robots, rapid-response platforms.

UNIT-II
TELE-ICU AND REMOTE MONITORING ROBOTICS

Robotic platforms for remote ICU rounding/monitoring.

UNIT-III
INTEGRATION WITH CLINICAL SYSTEMS

Interfacing robots with ICU alarm/EHR systems.

UNIT-IV
SAFETY-CRITICAL DESIGN

Redundancy and fail-safe requirements for emergency/ICU robotics.

RECOMMENDED TEXT BOOKS

Standard Critical-Care Technology and Emergency-Medicine Robotics literature prescribed by the Board of Studies.

ROBOTICS FOR HOME-BASED HEALTHCARE

L/T/P/C
2/-/-/2

Learning Outcome:

1. Explain the design considerations for home-deployable healthcare robots.
2. Describe robotic solutions for medication reminders, fall detection and remote check-ins.
3. Evaluate usability of home-care robots for non-technical users.
4. Assess connectivity and data-privacy requirements for home-based robotic care.

UNIT-I
HOME-CARE ROBOTICS FUNDAMENTALS

Design constraints for unstructured home environments.

UNIT-II
APPLICATIONS

Medication-reminder robots, fall-detection systems, remote check-in platforms.

UNIT-III
USABILITY FOR NON-TECHNICAL USERS

Human-centred design for elderly/patient users.

UNIT-IV
CONNECTIVITY AND PRIVACY

Home-network integration and data-privacy safeguards.

RECOMMENDED TEXT BOOKS

Standard Assistive Technology/Home Healthcare Robotics literature prescribed by the Board of Studies.

ASSISTIVE & WEARABLE ROBOTICS FOR ELDERLY CARE

L/T/P/C
2/-/-/2

Learning Outcome:

1. Explain design principles of assistive and wearable robots for elderly care.
2. Describe fall-prevention and mobility-assistance robotic devices.
3. Evaluate comfort, safety and adoption factors for wearable elderly-care robotics.
4. Assess the societal impact of assistive robotics on elderly independence.

UNIT-I
ASSISTIVE ROBOTICS FUNDAMENTALS

Categories of assistive devices for elderly care.

UNIT-II
WEARABLE ROBOTICS FOR MOBILITY

Fall-prevention and mobility-assistance devices.

UNIT-III
COMFORT AND SAFETY DESIGN

Ergonomics and safety for wearable elderly-care robots.

UNIT-IV
SOCIETAL IMPACT

Independence, dignity and adoption considerations.

RECOMMENDED TEXT BOOKS

Standard Assistive and Wearable Robotics literature prescribed by the Board of Studies.

EXOSKELETONS AND PROSTHETIC ROBOTICS

L/T/P/C
2/-/-/2

Learning Outcome:

1. Explain the mechanical and control-system design of exoskeletons and robotic prosthetics.
2. Describe actuation and sensing strategies for lower-limb and upper-limb devices.
3. Evaluate gait/motion outcomes with exoskeleton-assisted rehabilitation.
4. Assess fitting, comfort and biomechanical-safety considerations.

UNIT-I
EXOSKELETON DESIGN FUNDAMENTALS

Mechanical structure, actuation strategies.

UNIT-II
PROSTHETIC ROBOTICS

Upper/lower-limb robotic prosthetic design.

UNIT-III
CONTROL STRATEGIES

EMG-based and gait-adaptive control.

UNIT-IV
FITTING AND SAFETY

Biomechanical safety, fitting and comfort evaluation.

RECOMMENDED TEXT BOOKS

Standard Exoskeleton and Prosthetics Engineering textbooks prescribed by the Board of Studies.

HEALTHCARE LOGISTICS & ROBOTIC AUTOMATION

L/T/P/C
2/-/-/2

Learning Outcome:

1. Explain the role of robotics in hospital-logistics automation (supply delivery, sterilisation transport).
2. Design workflows for robotic automation in hospital supply chains.
3. Evaluate cost-benefit of robotics-enabled healthcare logistics.
4. Assess integration challenges of automation with existing hospital operations.

UNIT-I
HEALTHCARE LOGISTICS FUNDAMENTALS

Hospital supply-chain and materials-management basics.

UNIT-II
ROBOTIC AUTOMATION IN LOGISTICS

Automated guided vehicles (AGVs) for supply/sterile-item delivery.

UNIT-III
WORKFLOW DESIGN

Designing robotics-enabled logistics workflows.

UNIT-IV
COST-BENEFIT AND INTEGRATION

Evaluating ROI and integration challenges.

RECOMMENDED TEXT BOOKS

Standard Healthcare Operations/Logistics Management textbooks prescribed by the Board of Studies.

HEALTHCARE E-COMMERCE

L/T/P/C
2/-/-/2

Learning Outcome:

1. Explain e-commerce models applicable to medical-device and robotics sales/service.
2. Describe digital-marketing strategies for medical-robotics products.
3. Evaluate online distribution channels for assistive and robotic devices.
4. Assess regulatory considerations for e-commerce sale of medical devices.

UNIT-I
E-COMMERCE FUNDAMENTALS

Business models applicable to medical-device sales.

UNIT-II
DIGITAL MARKETING

Marketing strategies for robotics/assistive-device products.

UNIT-III
DISTRIBUTION CHANNELS

Online platforms and logistics for medical-device delivery.

UNIT-IV
REGULATORY CONSIDERATIONS

Compliance for e-commerce sale of regulated medical devices.

RECOMMENDED TEXT BOOKS

Standard Healthcare E-Commerce/Digital Marketing textbooks prescribed by the Board of Studies.

FINANCE FOR HEALTHCARE ROBOTICS VENTURES

L/T/P/C
2/-/-/2

Learning Outcome:

1. Explain basic financial concepts relevant to medical-robotics ventures.
2. Prepare a simple financial model/budget for a robotics start-up concept.
3. Evaluate funding options (grants, venture capital, and medical-device incubators) for robotics ventures.
4. Assess financial risk and return considerations for healthcare-robotics investments.

UNIT-I
FINANCIAL FUNDAMENTALS

Basic accounting and financial-statement concepts.

UNIT-II
FINANCIAL MODELLING

Budgeting and simple financial models for start-ups.

UNIT-III
FUNDING OPTIONS

Grants, venture capital, incubators/accelerators for med-tech robotics.

UNIT-IV
RISK AND RETURN

Assessing financial risk in healthcare-robotics ventures.

RECOMMENDED TEXT BOOKS

Standard Healthcare Finance/Entrepreneurial Finance textbooks prescribed by the Board of Studies.

IV year VII semester

S.NO	SUBJECT	L	T	P	C
1	Digital Transformation of Healthcare Robotics	3	-	-	3
2	Medical Robotics Project Management	3	-	-	3
3	Wearable Diagnostics & Robotic Sensors	2	-	2	3
4	Exoskeletons & Humanoid Robots for Healthcare	2	-	2	3
5	Drones & UAVs in Healthcare Robotics	2	-	2	3
6	Social Media in Healthcare	2	-	-	2
7	Cyber-Physical Security for Medical Robots	2	-	-	2
8	Research Project Design (Proposal)	-	-	4	2
	TOTAL	**16**	**-**	**10**	**21**

SEMESTER-VII

DIGITAL TRANSFORMATION OF HEALTHCARE ROBOTICS

L/T/P/C
3/-/-/3

Learning Outcome:

1. Explain digital-transformation strategies for healthcare-robotics adoption in hospital systems.
2. Analyse organisational-change management for robotics-enabled care pathways.
3. Evaluate the integration of robotics with hospital information systems and EHRs.
4. Design a digital-transformation roadmap for a robotics-enabled department.

UNIT-I
DIGITAL TRANSFORMATION FUNDAMENTALS

Frameworks for technology adoption in healthcare organisations.

UNIT-II
CHANGE MANAGEMENT

Managing clinician/staff adoption of robotics-enabled workflows.

UNIT-III
SYSTEMS INTEGRATION

Integrating robotics with EHR/hospital information systems.

UNIT-IV
ROADMAP DESIGN

Building a digital-transformation roadmap for robotics adoption.

RECOMMENDED TEXT BOOKS

Standard Digital Health Transformation textbooks prescribed by the Board of Studies.

MEDICAL ROBOTICS PROJECT MANAGEMENT

L/T/P/C
3/-/-/3

Learning Outcome:

1. Apply project-management frameworks to medical-robotics development projects.
2. Plan and schedule robotics-development projects using standard tools.
3. Manage risk, quality and stakeholder communication in robotics projects.
4. Evaluate project outcomes against defined success criteria.

UNIT-I
PROJECT MANAGEMENT FUNDAMENTALS

Scope, schedule, cost, quality management.

UNIT-II
PLANNING TOOLS

Gantt charts, agile/scrum methods for robotics-development teams.

UNIT-III
RISK AND STAKEHOLDER MANAGEMENT

Managing technical/clinical risk and stakeholder communication.

UNIT-IV
EVALUATION

Measuring project success and post-project review.

RECOMMENDED TEXT BOOKS

Standard Project Management textbooks (PMBOK-aligned) prescribed by the Board of Studies.

WEARABLE DIAGNOSTICS & ROBOTIC SENSORS

L/T/P/C
2/-/2/3

Learning Outcome:

1. Explain design principles of wearable diagnostic sensors integrated with robotic platforms.
2. Interface wearable biosensors with robotic-monitoring systems.
3. Evaluate accuracy and reliability of wearable-diagnostic data streams.
4. Apply wearable-sensor data to robotic decision-support systems.

UNIT-I
WEARABLE SENSOR FUNDAMENTALS

ECG, SpO2, motion and temperature wearable sensors.

UNIT-II
INTEGRATION WITH ROBOTIC SYSTEMS

Data pipelines linking wearables to robotic-monitoring platforms.

UNIT-III
ACCURACY AND RELIABILITY

Validation methods for wearable-diagnostic data.

UNIT-IV
DECISION SUPPORT

Using wearable data to drive robotic alerting/decision-support systems.

RECOMMENDED TEXT BOOKS

Standard Wearable Health Technology textbooks prescribed by the Board of Studies.

EXOSKELETONS & HUMANOID ROBOTS FOR HEALTHCARE

L/T/P/C
2/-/2/3

Learning Outcome:

1. Explain the design and control of humanoid robots for healthcare-assistance roles.
2. Compare exoskeleton and humanoid-robot approaches to patient-assistance tasks.
3. Evaluate balance, locomotion and manipulation challenges in humanoid healthcare robots.
4. Assess deployment considerations for humanoid robots in clinical/care settings.

UNIT-I
HUMANOID ROBOTICS FUNDAMENTALS

Bipedal locomotion, balance control.

UNIT-II
EXOSKELETON VS HUMANOID APPROACHES

Comparative design for patient-assistance tasks.

UNIT-III
MANIPULATION AND INTERACTION

Humanoid-robot manipulation for care tasks.

UNIT-IV
DEPLOYMENT CONSIDERATIONS

Safety, cost and acceptance for clinical humanoid-robot deployment.

RECOMMENDED TEXT BOOKS

Standard Humanoid Robotics textbooks and review articles prescribed by the Board of Studies.

DRONES & UAVS IN HEALTHCARE ROBOTICS

L/T/P/C
2/-/2/3

Learning Outcome:

1. Explain UAV/drone system architecture relevant to medical-delivery applications.
2. Design flight-planning and payload systems for medical-supply delivery drones.
3. Evaluate regulatory and airspace considerations for healthcare-UAV operations.
4. Assess reliability and safety requirements for medical-delivery drone systems.

UNIT-I
UAV SYSTEM ARCHITECTURE

Airframe, propulsion, flight-control basics.

UNIT-II
PAYLOAD AND FLIGHT PLANNING

Medical-supply payload design and route planning.

UNIT-III
REGULATORY CONSIDERATIONS

Airspace regulation and compliance for healthcare-UAV operations.

UNIT-IV
RELIABILITY AND SAFETY

Fail-safe design for medical-delivery drones.

RECOMMENDED TEXT BOOKS

Standard UAV/Drone Systems textbooks and civil-aviation regulatory guidance.

SOCIAL MEDIA IN HEALTHCARE

L/T/P/C
2/-/-/2

Learning Outcome:

1. Explain the role of social media in healthcare communication and robotics-product awareness.
2. Design a social-media communication strategy for a health-tech/robotics initiative.
3. Evaluate ethical and privacy considerations of social media in healthcare contexts.
4. Assess the impact of social media on public perception of medical robotics.

UNIT-I
SOCIAL MEDIA FUNDAMENTALS

Platforms and healthcare-communication use cases.

UNIT-II
STRATEGY DESIGN

Building a communication strategy for robotics/health-tech products.

UNIT-III
ETHICS AND PRIVACY

Patient-privacy and ethical considerations in healthcare social media.

UNIT-IV
PUBLIC PERCEPTION

Managing public perception and misinformation about medical robotics.

RECOMMENDED TEXT BOOKS

Standard Digital/Social Media Marketing in Healthcare textbooks prescribed by the Board of Studies.

CYBER-PHYSICAL SECURITY FOR MEDICAL ROBOTS

L/T/P/C
2/-/-/2

Learning Outcome:

1. Explain cyber-physical security threats specific to networked medical robots.
2. Apply secure-coding and communication-encryption practices to robotic control software.
3. Evaluate vulnerability of robotic systems to sensor-spoofing and network attacks.
4. Design basic security controls for a medical-robotics deployment.

UNIT-I
CYBER-PHYSICAL SECURITY FUNDAMENTALS

Threat models specific to networked/actuated medical devices.

UNIT-II
SECURE COMMUNICATION AND CODING

Encryption, authentication, secure-coding practices.

UNIT-III
VULNERABILITY ASSESSMENT

Sensor-spoofing, network-attack scenarios for medical robots.

UNIT-IV
SECURITY CONTROLS DESIGN

Designing layered security controls for robotics deployments.

RECOMMENDED TEXT BOOKS

Standard Cybersecurity for Medical Devices/IoT Security textbooks prescribed by the Board of Studies.

RESEARCH PROJECT DESIGN (PROPOSAL)

L/T/P/C
-/-/4/2

Learning Outcome:

Students will formulate a research question, conduct a literature review, and prepare a defensible research/start-up proposal in medical robotics for execution in Semester VIII, evaluated through periodic review presentations and a proposal document/viva as per Section 11.3.

IV year VIII semester

S.NO	SUBJECT	L	T	P	C
1	Research Project / Dissertation	-	-	20	10
2	Review of Topics/Electives	2	-	-	2
3	Critical Thinking in Healthcare Robotics	2	-	-	2
4	Medical Robotics Start-up Pathway	2	-	-	2
	TOTAL	**6**	**-**	**20**	**16**

SEMESTER-VIII

RESEARCH PROJECT / DISSERTATION

L/T/P/C
-/-/20/10

Learning Outcome:

Students will execute the approved Semester VII research/start-up proposal, design and validate a medical-robotics prototype or research study, analyse results, and defend the work through a written dissertation and open viva-voce before a committee including an external expert, as per Section 11.3 and Section 13.

REVIEW OF TOPICS/ELECTIVES

L/T/P/C
2/-/-/2

Learning Outcome:

Students will consolidate and critically review advanced elective topics from the programme (robotics, AI, clinical applications), synthesising cross-cutting themes relevant to their capstone project.

CRITICAL THINKING IN HEALTHCARE ROBOTICS

L/T/P/C
2/-/-/2

Learning Outcome:

1. Apply critical-thinking frameworks to evaluate claims about medical-robotics technologies.
2. Analyse case studies of robotics-adoption successes and failures in healthcare.
3. Evaluate evidence quality behind robotics-enabled clinical claims.
4. Construct well-reasoned arguments regarding robotics-technology adoption decisions.

UNIT-I
CRITICAL THINKING FRAMEWORKS

Logical reasoning, argument analysis.

UNIT-II
CASE STUDIES

Successes and failures in medical-robotics adoption.

UNIT-III
EVIDENCE EVALUATION

Assessing evidence quality in robotics-healthcare claims.

UNIT-IV
ARGUMENTATION

Constructing and defending technology-adoption arguments.

RECOMMENDED TEXT BOOKS

Standard Critical Thinking textbooks prescribed by the Board of Studies.

MEDICAL ROBOTICS START-UP PATHWAY

L/T/P/C
2/-/-/2

Learning Outcome:

1. Develop a business-model canvas for a medical-robotics product/venture.
2. Apply lean-start-up principles to medical-robotics product validation.
3. Prepare a pitch deck for a medical-robotics start-up concept.
4. Evaluate funding, regulatory and go-to-market pathways for medical-robotics start-ups.

UNIT-I
BUSINESS MODEL DESIGN

Business-model canvas for medical-robotics ventures.

UNIT-II
LEAN START-UP METHODS

Validated learning and MVP development for robotics products.

UNIT-III
PITCHING AND FUNDRAISING

Preparing and delivering a start-up pitch deck.

UNIT-IV
REGULATORY AND GO-TO-MARKET PATHWAYS

Navigating regulatory approval and market entry for medical-robotics start-ups.

RECOMMENDED TEXT BOOKS

Standard Lean Start-up/Health-Tech Entrepreneurship textbooks prescribed by the Board of Studies.