Uka Tarsadia University

B. Tech.

CSE / CSE (CC) / CE (SE)

Semester VII

Program Elective - V

ARTIFICIAL INTELLIGENCE IN HEALTHCARE

AI6017

EFFECTIVE FROM July-2024

Syllabus version: 1.00

Subject Code	Subject Title
AI6017	Artificial Intelligence in Health Care

Teaching Scheme				Examination Scheme				
Hours		Credits		Theory Marks		Practical Marks		Total Marks
Theory	Practical	Theory	Practical	Internal	External	Internal	External	
3	2	3	1	40	60	20	30	150

Objectives of the course:

- To understand the main applications of artificial intelligence in healthcare.
- To introduce artificial intelligence healthcare ecosystem from drug design, medical imaging, and surgery to data privacy, law, and ethics.

Course outcomes:

Upon completion of the course, the student shall be able to

CO1: To identify the role of artificial intelligence in healthcare.
CO2: To discover the applications of AI in drug discovery, molecular modeling, drug delivery, and pharmaceutical development.
CO3: To discover the applications of AI in cancer diagnosis and medical imaging.
CO4: To understand the role of AI in medical devices.
CO5: To illustrate security, privacy, and information-sharing aspects of healthcare artificial intelligence.
CO6: To understand ethical and legal challenges of artificial intelligence-driven healthcare.

Sr. No.	Topics	Hours
	Unit – I	
1	**Current Healthcare, Big Data, and Machine Learning:** Current healthcare practice, Value-based treatments and healthcare services, Increasing data volumes in healthcare, Analytics of healthcare data (machine learning and deep learning).	2
	The Rise of Artificial Intelligence in Healthcare Applications: The new age of healthcare, Precision medicine, Artificial intelligence and medical visualization, Intelligent personal health records, Robotics and artificial intelligence-powered devices, Ambient assisted living.	3
	Unit – II	
2	**Drug Discovery and Molecular Modeling using Artificial Intelligence:** The scope of artificial intelligence in drug discovery, Various types	4

	of machine learning in artificial intelligence, Molecular modeling and databases in artificial intelligence for drug molecules, Computational mechanics ML methods in molecular modeling, Drug characterization using isopotential surfaces, Drug design for neuroreceptors using artificial neural network techniques, Specific use of deep learning in drug design, Possible future artificial intelligence development in drug design and development.	
	Applications of Artificial Intelligence in Drug Delivery and Pharmaceutical Development: The evolving pharmaceutical field, Drug delivery and nanotechnology, Quality-by-design R&D, Artificial intelligence in drug delivery modeling, Artificial intelligence application in pharmaceutical product R&D, Landscape of AI implementation in the drug delivery industry.	4
Unit – III		
3	**Cancer Diagnostics and Treatment Decisions using Artificial Intelligence:** Artificial intelligence, machine learning, and deep learning in cancer, Artificial intelligence to determine cancer susceptibility, Artificial intelligence for enhanced cancer diagnosis and staging, Artificial intelligence to predict cancer treatment response, Artificial intelligence to predict cancer recurrence and survival, Artificial intelligence for personalized cancer pharmacotherapy.	4
	Artificial Intelligence for Medical Imaging: Outputs of artificial intelligence in radiology/medical imaging, Using artificial intelligence in radiology and overcoming its hurdles, X-rays and artificial intelligence in medical imaging—case 1 (Zebra medical vision), Ultrasound and artificial intelligence in medical imaging—case 2 (Butterfly iQ), application of artificial intelligence in medical imaging—case 3 (Arterys).	5
Unit – IV		
4	**Medical Devices and Artificial Intelligence:** The development of artificial intelligence in medical devices, Limitations of artificial intelligence in medical devices, The future frontiers of artificial intelligence in medical devices.	2
	Artificial Intelligence Assisted Surgery: Preoperative, Intraoperative, Postoperative.	2
Unit – V		
5	**Remote Patient Monitoring using Artificial Intelligence:** Introduction to remote patient monitoring, Deploying patient monitoring, The role of artificial intelligence in remote patient monitoring, Diabetes prediction and monitoring using artificial intelligence, Cardiac monitoring using artificial intelligence, Neural applications of artificial intelligence and remote patient	5

	monitoring.	
	Security, Privacy, and Information-Sharing Aspects of Healthcare Artificial Intelligence: Introduction to digital security and privacy, Security and privacy concerns in healthcare artificial intelligence, Artificial intelligence's risks and opportunities for data privacy, Addressing threats to health systems and data in the artificial intelligence age, Defining optimal responses to security, privacy, and information-sharing.	5
Unit – VI		
6	**The Impact of Artificial Intelligence on Healthcare Insurances:** Overview of the global health insurance industry, Key challenges facing the health insurance industry, The application of artificial intelligence in the health insurance industry, Case studies, Moral, ethical, and regulatory concerns regarding the use of artificial intelligence, The limitations of artificial intelligence, The future of artificial intelligence in the health insurance industry.	5
	Ethical and Legal Challenges of Artificial Intelligence-Driven Healthcare: Trends and strategies, Ethical challenges, Legal challenges.	4

Sr. No.	Artificial Intelligence in Health Care (Practicals)	Hours
1	Study of AI tools and techniques for healthcare applications.	4
2	Healthcare application case study-1: Cancer diagnosis.	2
3	Healthcare application case study-2: Early diagnosis of fatal blood diseases.	2
4	Healthcare application case study-3: Customer Service Chatbots.	4
5	Healthcare application case study-4: Virtual Health Assistants.	2
6	Healthcare application case study-5: Treatment of Rare Diseases.	4
7	Healthcare application case study-6: Targeted Treatment.	2
8	Healthcare application case study-7: Automation of Redundant Healthcare Tasks.	2
9	Healthcare application case study-8: Management of Medical Records.	4
10	Healthcare application case study-9: Automated Image Diagnosis.	4

Text book:

1. Adam Bohr, Kaveh Memarzadeh – "Artificial Intelligence in Healthcare", Academic Press.

Reference books:

1. Parag Suresh Mahajan MD - "Artificial Intelligence in Healthcare", Dr Parag Suresh Mahajan Publication.
2. Ankur Saxena, Shivani Chandra - "Artificial Intelligence and Machine Learning in Healthcare", Springer.

3. Eric Topol - "Deep Medicine", Basic Books, Inc.

Course objectives and Course outcomes mapping:

- To understand the main applications of artificial intelligence in healthcare: CO1, CO2, CO3, and CO4.
- To introduce artificial intelligence healthcare ecosystem from drug design, medical imaging, and surgery to data privacy, law, and ethics: CO2, CO3, CO4, CO5, and CO6.

Course units and Course outcomes mapping:

Unit No.	Unit Name	Course Outcomes					
		CO1	CO2	CO3	CO4	CO5	CO6
1	Current healthcare, big data, and machine learning and The rise of artificial intelligence in healthcare applications.	✓					
2	Drug discovery and molecular modeling using artificial intelligence & Applications of artificial intelligence in drug delivery and pharmaceutical development.		✓				
3	Cancer diagnostics and treatment decisions using artificial intelligence and Artificial intelligence for medical imaging.			✓			
4	Medical devices and artificial intelligence and Artificial intelligence assisted surgery.				✓		
5	Remote patient monitoring using artificial intelligence & Security, privacy, and information-sharing aspects of healthcare artificial intelligence.					✓	
6	The impact of artificial intelligence on healthcare insurances & Ethical and legal challenges of artificial intelligence-driven healthcare.						✓

Programme outcomes:

PO 1: Engineering knowledge: An ability to apply knowledge of mathematics, science, and engineering.

PO 2: Problem analysis: An ability to identify, formulates, and solves engineering problems.

PO 3: Design/development of solutions: An ability to design a system, component, or process to meet desired needs within realistic constraints.

PO 4: Conduct investigations of complex problems: An ability to use the techniques, skills, and modern engineering tools necessary for solving engineering problems.

PO 5: Modern tool usage: The broad education and understanding of new engineering techniques necessary to solve engineering problems.

PO 6: The engineer and society: Achieve professional success with an understanding and appreciation of ethical behaviour, social responsibility, and diversity, both as individuals and in team environments.

PO 7: Environment and sustainability: Articulate a comprehensive world view that integrates diverse approaches to sustainability.

PO 8: Ethics: Identify and demonstrate knowledge of ethical values in non-classroom activities, such as service learning, internships, and field work.

PO 9: Individual and team work: An ability to function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10: Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give/receive clear instructions.

PO 11: Project management and finance: An ability to demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

PO 12: Life-long learning: A recognition of the need for, and an ability to engage in life-long learning.

Programme outcomes and Course outcomes mapping:

Programme Outcomes	Course Outcomes					
	CO1	CO2	CO3	CO4	CO5	CO6
PO1	✓					
PO2			✓	✓		
PO3		✓	✓	✓		
PO4						
PO5						
PO6					✓	✓
PO7						
PO8						✓
PO9						
PO10						
PO11						
PO12	✓	✓	✓	✓	✓	✓