



**GUJARAT TECHNOLOGICAL UNIVERSITY**

**Integrated Master of Science (Biotechnology)**

**Semester: 7**

**Subject Name: Artificial Intelligence and Big Data in Healthcare**

**Subject Code: 1370408**

**Prerequisite:** Students should have a fundamental understanding of biotechnology, healthcare systems, and basic computational tools. Familiarity with machine learning, bioinformatics, and medical data analysis is beneficial.

**Rationale:** This course explores the role of artificial intelligence (AI) and big data analytics in healthcare and medical biotechnology. It covers machine learning algorithms, predictive modeling, clinical decision support systems, and AI applications in drug discovery, diagnostics, and personalized medicine. Emphasis is placed on healthcare data security, ethical considerations, and real-world applications of AI-driven technologies.

**Course Scheme:**

Teaching Scheme			Total Credits	Assessment Pattern and Marks				Total Marks
L	T	PR		Theory		Practical		
			ESE (E)	PA(M)	ESE (V)	PA (I)		
4	0	0	4	70	30	0	0	100

**Course Content:**

Sr. No.	Course Content	No. of Hours	% of Weightage
1	<p><b>Unit 1: Introduction to AI and Big Data in Healthcare</b></p> <ul style="list-style-type: none"> <li>Fundamentals of Artificial Intelligence in Healthcare</li> <li>Types of AI: Machine Learning (ML), Deep Learning (DL), and Natural Language Processing (NLP)</li> <li>Big Data in Healthcare: Sources, Collection, and Processing               <ul style="list-style-type: none"> <li>Electronic Health Records (EHR), Wearable Devices, Imaging Data</li> </ul> </li> <li>AI vs Traditional Healthcare Systems: Advantages and Limitations</li> <li>Ethical, Legal, and Social Implications (ELSI) of AI in Healthcare</li> </ul>	12	20
2	<p><b>Unit 2: Machine Learning and Predictive Analytics in Healthcare</b></p> <ul style="list-style-type: none"> <li>Supervised, Unsupervised, and Reinforcement Learning in Healthcare</li> <li>AI Algorithms for Disease Prediction and Diagnosis</li> </ul>	12	20



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	<ul style="list-style-type: none"> <li>○ Decision Trees, Neural Networks, Support Vector Machines, Random Forest</li> <li>● Deep Learning for Medical Image Analysis (MRI, CT, X-ray, Pathology Slides)</li> <li>● Predictive Analytics for Patient Monitoring and Early Disease Detection</li> <li>● AI-Driven Personalized Medicine and Patient Stratification</li> </ul>		
<b>3</b>	<p><b>Unit 3: AI in Medical Diagnostics and Drug Discovery</b></p> <ul style="list-style-type: none"> <li>● AI in Radiology and Pathology           <ul style="list-style-type: none"> <li>○ AI-based Image Recognition for Cancer Detection, COVID-19 Screening</li> </ul> </li> <li>● AI in Genomics and Precision Medicine           <ul style="list-style-type: none"> <li>○ AI for Whole Genome Sequencing and Variant Interpretation</li> </ul> </li> <li>● AI in Drug Discovery and Development           <ul style="list-style-type: none"> <li>○ Virtual Screening, Molecular Docking, AI-Guided Drug Repurposing</li> </ul> </li> <li>● AI in Clinical Trials: Digital Twins, Patient Recruitment, and Biomarker Discovery</li> <li>● Challenges and Limitations of AI in Healthcare Decision-Making</li> </ul>	12	20
<b>4</b>	<p><b>Unit 4: Big Data Analytics and Healthcare Informatics</b></p> <ul style="list-style-type: none"> <li>● Big Data Technologies: Hadoop, Spark, Cloud Computing in Healthcare</li> <li>● Electronic Health Records (EHR) and AI-Driven Decision Support Systems</li> <li>● Real-Time Health Monitoring Using AI and IoT Devices</li> <li>● Blockchain in Healthcare: Data Security and Patient Privacy</li> <li>● Data Integration and Interoperability in Global Health Informatics</li> </ul>	12	20
<b>5</b>	<p><b>Unit 5: Future Trends and AI-Powered Healthcare Innovations</b></p> <ul style="list-style-type: none"> <li>● AI for Mental Health and Neurological Disorders           <ul style="list-style-type: none"> <li>○ Chatbots, Digital Therapists, AI for Alzheimer's and Parkinson's Disease</li> </ul> </li> </ul>	12	20



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	<ul style="list-style-type: none"> <li>• AI in Pandemic Prediction and Public Health Surveillance</li> <li>• AI in Robotic Surgery and Virtual Healthcare Assistants</li> <li>• Digital Twins and AI-Enabled Healthcare Personalization</li>   <li>• Future Challenges and Opportunities in AI and Big Data for Healthcare</li> </ul>		
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**Reference Books:**

1. Artificial Intelligence in Healthcare – Adam Bohr, Kaveh Memarzadeh
2. Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again – Eric Topol
3. Big Data in Healthcare: Statistical and Computational Methods – Farrokh Alemi
4. Machine Learning in Healthcare – Sandeep Reddy
5. Blockchain in Healthcare: Innovations That Empower Patients, Providers, and Payers – Stanislaw Sroka

**Course Outcome:**

After Completion of the Course, Student will able to:

Sr. No	Course Outcomes	RBT Level
1	Explain the fundamentals of AI, machine learning, and big data in healthcare.	UN, RM, AP
2	Apply AI techniques in medical diagnostics, personalized medicine, and drug discovery.	UN, RM, AP
3	Analyze the role of big data analytics and decision support systems in healthcare.	AP, AN, CR
4	Evaluate ethical, legal, and security challenges associated with AI-driven healthcare.	AN, EL, CR
5	Integrate AI and big data applications into predictive healthcare systems.	AP, CR

\*RM: Remember, UN: Understand, AP: Apply, AN: Analyze, EL: Evaluate, CR: Create

**List of Experiments: NA**