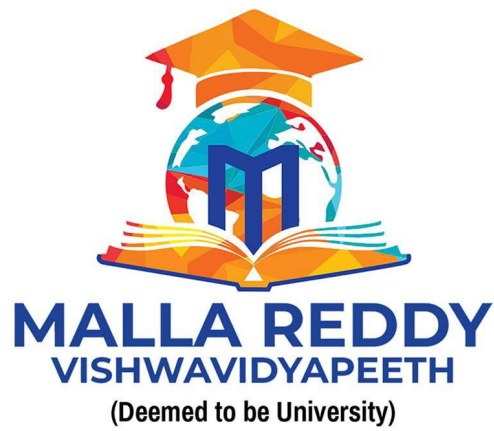




SCHOOL OF DIGITAL HEALTH SCIENCES & TECHNOLOGY

MASTER OF SCIENCE IN DIGITAL HEALTH

PROGRAM OUTCOMES (POs)

PO	Program Outcomes
PO-1	Expertise in Advanced Digital Health Analytics Acquiring skills in data analytics, predictive modelling, and forecasting for data-driven healthcare decision-making.
PO-2	Knowledge of Digital Health Technology Design and Development Designing and integrating digital health solutions through UI/UX, rapid prototyping, 3D printing, API integration, and mobile/web app development.
PO-3	Application and system integration of Emerging Digital Health Technologies Implementing and optimizing telemedicine, electronic health records (EHR), digital twins, and AR/VR/MR for enhanced healthcare delivery.
PO-4	Knowledge of Health care Regulatory, Ethical, and Market Insights Navigating healthcare regulations, national health programs, ABDM policies, and market research to drive compliance and innovation.
PO-5	Understanding of Digital Health Research & Innovation Conducting impactful research, developing critical thinking, and leading digital health projects to advance healthcare technology and policy.

Minimum Credit requirements to award Degree under each category as per UGC

S.No	Broad Category of Course	Minimum Credit Requirement
		2-Year PG
1.	Major (Core)	40
2.	Minor Stream	16
3.	Multidisciplinary	02
4.	Ability Enhancement Courses (AEC)	02
5.	Skill Enhancement Courses (SEC)	02
6.	Value Added Courses common for all UG	02
7.	Summer Internship	02-04
8.	Research Project / Dissertation	12
9.	Total	80

MALLA REDDY VISHWAVIDYAPEETH
(Deemed to be University)
School of Digital Health Sciences and Technology

M.Sc. Digital Health

COURSE STRUCTURE AND SYLLABUS

Effective from Academic Year 2025-26 Admitted Batch

Category Code: Major Core (MC), Minor Stream (MS), Multidisciplinary (MD), Ability Enhancement Courses (AEC), Skill Enhancement Courses (SEC), Value Added Courses (VAC), Summer Internship (SI), Research Project / Dissertation (RP), Practical Lab (PL)

SEMESTER – I							
Sl. No	Category	Course code	Name of the Subject/Practical	Contact Hours/week			Credits
				L	T	P	
1		MDH22614101	Introduction to Health Systems	2	-	-	2
2		MDH22614102	National Health Programs & ABDM	2	-	-	2
3		MDH22614103	Introduction to AYUSH	2	-	-	2
4		MDH22614104	Occupational health	2	-	-	2
5		MDH22614105	English & Communication Skills	2	-	-	2
6		MDH22614106	Computer Foundation	2	-	-	2
7		MDH22614107	Understanding Data- Source, Structure, preparation and Annotation	2	-	-	2
8		MDH22614108	Languages for Coding	2	-	-	2
9		MDH22614109	Introduction to Github	1	-	-	1
10		MDH22614110	Digital Health Terminology	2	-	-	2
11		MDH22614111	Practicals in Coding	-	-	2	1
Total				19	0	2	20

SEMESTER – II							
Sl. No	Category	Course code	Name of the Subject/Practical	Contact Hours/week			Credits
				L	T	P	
1		MDH22614201	Advanced data analytics (R/ SPSS/ STATA/ SAS)	3	-	-	3
2		MDH22614202	Design Thinking	2	-	-	2
3		MDH22614203	UI/UX for Healthcare	2	-	-	2
4		MDH22614204	Rapid Prototyping and 3D Printing	2	-	-	2
5		MDH22614205	Predictive Analytics (Prediction and Forecasting)	2	-	-	2
6		MDH22614206	Mobile Apps & Web Apps	2	-	-	2
7		MDH22614207	API, Plug-in Integration	2	-	-	2
8		MDH22614208	Database Features	1	-	-	1
9		MDH22614209	Practicals in advanced data analytics (R/ SPSS/ STATA/ SAS)	-	-	4	2
10		MDH22614210	Practicals in Predictive Analytics (Prediction and Forecasting)	-	-	4	2
Total				16	0	8	20

SEMESTER – III							
Sl. No	Category	Course code	Name of the Subject/Practical	Contact Hours/week			Credits
				L	T	P	
1		MDH2264301	Electronic Health Records (EHR)	3	-	-	3
2		MDH22614302	Telemedicine	3	-	-	3
3		MDH22614303	AR/ VR/ MR for Health Care	3	-	-	3
4		MDH22614304	Digital twins	3	-	-	3
5		MDH22614305	Market Research & Needs Assessment	2	-	-	2
6		MDH22614306	Practicals in AR/ VR/ MR for Health care	-	-	6	3
7		MDH22614307	Practicals in Internet of Medical Things (IoMT)	-	-	6	3
Total				14	0	12	20

SEMESTER – IV							
Sl. No	Category	Course code	Name of the Subject/Practical	Contact Hours/week			Credits
				L	T	P	
1		MDH22614401	Research Project/Thesis	-	-	-	12
2		MDH22614402	Review of Topics/Electives	8	-	-	8
Total				8	0	0	20

- 1 Credit = 15 hours of Lecture/Tutorial or 30 hours of Practical
- Internship/Practical Training
- Dissertation/Project Work
- Seminar and Presentations
- Abbreviations: L-Lecture, T-Tutorial, P-Practical, C-Credit
- TOTAL CREDIT-80

SEMESTER I:**Course: Introduction to Health Systems**

S.No	Topics	COMMENTS
1	Evolution of Healthcare Systems (Global & Indian) • Historical perspectives • Key reforms in healthcare • Comparative global healthcare models	
2	Levels of Healthcare • Primary, Secondary, Tertiary Care • Role of different levels in disease prevention & management	
3	Healthcare Financing & Insurance Models • Universal Health Coverage (UHC) • Public & private insurance schemes • Challenges & future trends	
4	Public and Private Healthcare Systems • Structure and roles of public vs. private providers • Public-Private Partnerships (PPP) in healthcare	
5	Health Policy & Governance • National Health Policy • Regulatory bodies (WHO, MoHFW, NMC) • Health law & ethics	

References

1. Essentials of Global Health – Richard Skolnik
2. Health Policy and Systems Thinking – Thomas Rice
3. Public Health Administration: Principles for Population-Based Management – Leiyu Shi & James A. Johnson
4. Berman, P. (2011). Health Systems Analysis for Developing Countries. World Bank Publications.
5. WHO. (2007). Everybody's Business: Strengthening Health Systems to Improve Health Outcomes. [Link](#)
6. World Bank. (2018). The Role of the World Bank in Health Systems Development.

SEMESTER I:**Course: National Health Programs & ABDM (Ayushman Bharat Digital Mission)**

S.No	Topics	COMMENTS
1	Introduction to National Health Programs - Understanding the burden of communicable & non-communicable diseases in India - Role of government initiatives in public health improvement	
2	Key National Health Programs – objectives, structure and implementation of the programs - RNTCP (Revised National Tuberculosis Control Program) – TB control strategy. - NVBDCP (National Vector Borne Disease Control Program) – Malaria, Dengue, and other vector-borne diseases. - NLEP (National Leprosy Eradication Program) – Leprosy control and rehabilitation strategies.	
3	Overview of other National Health Programs - National AIDS Control Program (NACP) - National Programme for Prevention and Control of Cancer, Diabetes, Cardiovascular Diseases & Stroke (NPCDCS) - National Mental Health Programme (NMHP) - Maternal & Child Health Programs	
4	Ayushman Bharat Program - PMJAY (Health Insurance) - HWCs (Health & Wellness Centers)	
5	ABDM Architecture & Ecosystem - Digital health records - Data interoperability & exchange	

References

1. Park, K. (2021). Textbook of Preventive and Social Medicine (26th ed.). M/s Banarsidas Bhanot Publishers.
2. Goel, S. (2017). Public Health Policy and National Health Programs of India. Deep & Deep Publications.
3. Gupta, M. C., & Mahajan, B. K. (2018). Textbook of Preventive and Social Medicine. Jaypee Brothers Medical Publishers.
4. Dhruvajyoti Bhattacharya. (2013). Public Health Policy: Issues, Theories, and Advocacy. Jossey-Bass.

Additional Reading Material

1. Ministry of Health & Family Welfare (MoHFW), Government of India. (2022). National Health Mission Guidelines & Annual Reports. (<https://nhm.gov.in/>)

2. National Digital Health Mission (NDHM) / Ayushman Bharat Digital Mission (ABDM). (2022). Policy & Implementation Guidelines. (<https://abdm.gov.in/>)
3. World Health Organization (WHO). (2017). Primary Health Care Systems (PRIMASYS) India Report. WHO Publications.
4. World Bank. (2018). The Role of the World Bank in Health Systems Development.
5. WHO. (2007). Everybody's Business: Strengthening Health Systems to Improve Health Outcomes. WHO Publications.

SEMESTER I:**Course: Introduction to AYUSH**

S.No	Topics	COMMENTS
1	Introduction to Traditional Medicine • Definition and scope of traditional medicine • Historical context of different traditional medicine systems • Philosophical and theoretical foundations of Ayurveda, Traditional Chinese Medicine (TCM), and Unani • Cultural and social aspects of traditional medicine practices	
2	Key Principles of Major Traditional Systems • Core concepts, diagnostic approaches, and treatment principles of Ayurveda, Siddha, Unani, Yoga, Naturopathy, and Homeopathy.	
3	Clinical Application of Traditional Medicine • Common ailments treated with traditional medicine (digestive issues, respiratory problems, skin conditions, pain management) • Case studies and clinical applications of traditional medicine therapies	
4	Research in Traditional Medicine • Role of scientific validation and clinical trials in traditional medicine. • Understand how traditional medicine is integrated with modern healthcare through evidence-based practice.	

References

1. Mukherjee, P. K. (2015). Evidence-Based Validation of Herbal Medicine. Elsevier.
2. Sharma, P. V. (1995). History of Medicine in India. Indian National Science Academy.
3. Bhattacharya, N. (2012). Traditional Medicine in South East Asia and India. Springer.
4. Warrier, P. K. (1994). Indian Medicinal Plants: A Compendium of 500 Species. Orient Blackswan.
5. World Health Organization. (2013). WHO Traditional Medicine Strategy 2014-2023.

SEMESTER I:**Course: Occupational Health**

S.No	Topics	COMMENTS
1	Introduction to Occupational Health - Definition, scope, and significance of occupational health - Historical evolution of workplace health and safety - Impact of workplace conditions on employee well-being and productivity	
2	Workplace Hazards and Risk Assessment - Types of workplace hazards (physical, chemical, biological, ergonomic, psychosocial) - Methods for hazard identification and risk assessment - Control measures and risk mitigation strategies	
3	Occupational Diseases and Injuries - Common occupational diseases (respiratory illnesses, musculoskeletal disorders, occupational cancers) - Workplace factors contributing to occupational illnesses and injuries - Prevention, treatment, and rehabilitation strategies	
4	Health and Safety Regulations - Overview of national and international occupational health regulations (OSHA, Factories Act, ESIC) - Employer and employee responsibilities in ensuring workplace safety - Compliance strategies and enforcement mechanisms	
5	Digital Health in Occupational Safety - Role of digital tools (wearables, IoT monitoring) in workplace safety - AI and predictive analytics for occupational health surveillance - Case studies on the effectiveness of workplace safety technologies	

References

1. Friis, R. H. (2015). Occupational Health and Safety for the 21st Century. Jones & Bartlett Learning.
2. LaDou, J., & Harrison, R. J. (2021). Current Occupational & Environmental Medicine (6th ed.). McGraw-Hill Education.
3. Levy, B. S., Wegman, D. H., Baron, S. L., & Sokas, R. K. (2017). Occupational and Environmental Health: Recognizing and Preventing Disease and Injury. Oxford University Press.

Additional Reading

1. International Labour Organization (ILO). (2021). Global Strategy on Occupational Safety and Health.
<https://www.ilo.org/>
2. National Institute for Occupational Safety and Health (NIOSH). (2022). Occupational Safety and Health Guidelines.
<https://www.cdc.gov/niosh/>
3. World Health Organization (WHO). (2018). Protecting Workers' Health: Global Perspectives. WHO Publications.
4. OSHA (Occupational Safety and Health Administration). (2021). Occupational Safety Standards and Guidelines.
<https://www.osha.gov/>

SEMESTER I:**Course: English & Communication Skills**

S.No	Topics	COMMENTS
1	Fundamentals of Communication - Definition and importance of communication in healthcare and professional settings - Types of communication (verbal, non-verbal, written, digital) - Barriers to effective communication and overcoming them	
2	Scientific & Technical Writing in Healthcare - Structure and format of scientific documents - Writing research papers, abstracts, and summaries - Citation styles and plagiarism prevention	
3	Grant & Proposal Writing - Basics of proposal writing for research and funding - Structure of grant proposals and common funding sources - Effective writing techniques for securing grants	
4	Communication for Healthcare Professionals - Effective patient communication and empathy in healthcare - Medical terminology and professional interactions - Ethical considerations in communication	
5	Presentation & Public Speaking Skills - Preparing and delivering impactful presentations - Body language, tone, and clarity in speech - Handling Q&A sessions confidently	

References

1. Bailey, S. (2018). Academic Writing: A Handbook for International Students. Routledge.
2. Alred, G. J., Brusaw, C. T., & Oliu, W. E. (2012). Handbook of Technical Writing. St. Martin's Press.
3. Huckin, T., & Olsen, L. (1991). Technical Writing and Professional Communication. McGraw-Hill.

Additional Readings

1. Turabian, K. L. (2018). A Manual for Writers of Research Papers, Thesis, and Dissertations. University of Chicago Press.
2. Guffey, M. E., & Loewy, D. (2018). Business Communication: Process and Product. Cengage Learning.
3. Chaturvedi, P. D., & Chaturvedi, M. (2011). Business Communication: Concepts, Cases, and Applications. Pearson Education.

SEMESTER I:

Course: Computer Foundation

S.No	Topics	COMMENTS
1	Definition of Computer • Characteristics of computer • Components of Computer Hardware – Input & Output devices • Memories – RAM and ROM – MB, GB their conversions • Software – Application Software and Systems software • Data and Information • Different computer languages – Number systems - Binary and decimal conversions.	
2	Typing text in MS Word • Manipulating text formatting text – using different font sizes, bold, italic – bullets, and numbering – Pictures • Aligning the text and justify – choosing paper size – adjusting margins – header and footer • Inserting page no's in a doc – printing a file with options – using spell check and grammar – find and replace – mail merge – insert tables in a document.	
3	Creating • MS Excel-Cell editing, using formulas and functions, manipulating data with Excel – using the sort function to sort numbers and alphabets – drawing graphs and charts using data in Excel. • MS PowerPoint slide transition and animation slides with sounds – inserting clip arts– Pictures, tables, and graphs.	
4	Introduction to • Computer Network Devices (Hubs, Switches, Routers, Gateway, Bridge, Modems, Wireless Access Points, Firewalls & NIC) • Types of Computer Networks (LAN, MAN & WAN), • Network Topologies (Star, Ring, Mesh, Tree, Hybrid Topologies) • Internet-Based Applications • Advantages & Disadvantages of Computer Networks, • E-Mail – Components of E-Mail, Attaching Files in E-mail, Different Search Engines.	
5	AI: • History of AI, Sub Areas of AI • Applications of AI in Healthcare • Benefits of AI in Health Care • Challenges of AI in Healthcare • Introduction to Machine Learning	

	• Applications of Machine Learning • Machine Learning Algorithms • Real-world Machine Learning Use Cases	
6	PRACTICALS: • Peripherals of Computer • MS Word • MS Excel • MS PowerPoint	

References

1. Computer Fundamentals by Goel, Anita Pearson
2. Computer Fundamentals: Concepts, Systems & Applications- 8th Edition by Priti Sinha, Pradeep K., Sinha
3. MS-Office 2010 Training Guide by Prof. Satish Jain, M. Geetha
4. Computer Networks, Andrews S Tanenbaum, 5th Edition, Pearson Education
5. Artificial Intelligence: A Modern Approach, Stuart J. Russell and Peter Norvig, Third Edition, Pearson Education
6. Hands-on Machine Learning with Scikit-Learn, Keras, and TensorFlow, Aurelien Geron- Oreilly, 2nd Edition.

SEMESTER I:**Course: Understanding Data Sources & Structure**

S.No	Topics	COMMENTS
1	Healthcare Data Sources - Types of healthcare data (EHR, claims data, registries, surveys) - Public health databases and data repositories - Data collection methods and challenges	
2	Data Standards in Healthcare - HL7, FHIR, SNOMED, ICD coding systems - Interoperability and data exchange frameworks - Role of standards in digital health ecosystems	
3	Data Cleaning & Processing - Data quality assessment (missing data, inconsistencies) - Normalization and standardization techniques - Handling categorical and numerical variables	
4	Data Privacy & Security - HIPAA, GDPR, and other healthcare data regulations - Ethical considerations in data handling - Encryption, anonymization, and secure storage practices	

References

1. McDonald, C. J., & Huff, S. M. (2015). Health Data Standards: A Common Language for Data Exchange. Springer.
2. Raghupathi, W., & Raghupathi, V. (2014). Big Data Analytics in Healthcare: Promise and Potential. Health Information Science and Systems.
3. Benson, T., & Grieve, G. (2016). Principles of Health Interoperability: SNOMED CT, HL7, and FHIR. Springer.

SEMESTER I:**Course: Languages for Coding**

S.No	Topics	COMMENTS
1	Introduction to Programming Languages - Basics of Python: syntax, data types, and control structures - Importance of Python in healthcare analytics - Introduction to Jupyter Notebook and Google Collaboration - Handling medical datasets with Python	
2	Data Analysis with Python - Using Pandas for healthcare data processing - Data cleaning, filtering and manipulation techniques - Applying NumPy for numerical healthcare data analysis - Working with real-world health datasets (EHR, Patient records, Clinical Trials)	
3	Data Visualization in Healthcare - Creating charts and graphs using Matplotlib and Seaborn - Visualizing health trends, disease spread, and patient outcomes - Dashboard creation for healthcare reporting	
4	Machine Learning for Healthcare - Overview of machine learning in healthcare - Applying Scikit-learn for disease prediction - Building models for classification (e.g., diabetes prediction) and regression (e.g., patient risk scores) - Evaluating healthcare ML models using accuracy, precision, recall	
5	Healthcare Data Integration and Automation - Introduction to healthcare data interoperability - Extracting, transforming, and loading (ETL) healthcare data - Automating repetitive healthcare workflows using Python - Integration of APIs (FHIR, HL7) for health data exchange	

References

- Guttag, J. V. (2016). Introduction to Computation and Programming Using Python. MIT Press.
- McKinney, W. (2017). Python for Data Analysis: Data Wrangling with Pandas, NumPy, and IPython. O'Reilly Media.
- VanderPlas, J. (2016). Python Data Science Handbook. O'Reilly Media.

4. Raschka, S., & Mirjalili, V. (2019). Python Machine Learning. Packt Publishing.

Additional Readings

1. Bailey, M. (2021). Healthcare Analytics with Python. Springer.
2. Chakraborty, C., & Banerjee, A. (2020). Machine Learning Techniques for Healthcare Data Analytics. Springer.
3. Faur, D. (2020). Hands-On Healthcare Data: Analyzing Patient Data with Python and Pandas. Packt Publishing.

SEMESTER I:**Course: Introduction to GitHub**

S.No	Topics	COMMENTS
1	Version Control & Git Basics • Introduction to Git and installation • Git commands: init, add, commit, status, log • Importance of version control in software development	
2	Branching & Merging • Concept of branches and workflows • Creating and switching branches • Merging strategies and resolving conflicts	
3	Working with GitHub • Setting up a GitHub repository • Cloning, pushing, pulling, and forking repositories • Collaborating with teams using GitHub	
4	GitHub Actions & Automation • Introduction to GitHub Actions • Setting up CI/CD pipelines • Automating tasks with GitHub workflows	
5	Best Practices & Security • Writing good commit messages • Protecting branches and repository settings • Managing repository permissions and security	

References

1. Loeliger, J., & McCullough, M. (2012). Version Control with Git. O'Reilly Media.
2. Chacon, S., & Straub, B. (2019). Pro Git. Apress.
3. Torres, J. (2021). GitHub for Dummies. Wiley.

SEMESTER I:**Course: Digital Health Terminology**

S.No	Topics	COMMENTS
1	Introduction to Digital Health Terminology Foundational terms and concepts used in digital health, including eHealth, mHealth, telemedicine, and telehealth.	
2	Health Information Systems and Standards Introduction to key terminology related to health information systems (e.g., EHR, EMR) and health data standards (e.g., HL7, FHIR).	
3	Clinical Informatics Focus on terminology related to the use of information technology in clinical settings, such as decision support systems, patient portals, and clinical workflows.	
4	Health Data and Analytics Understand terms related to health data types (e.g., structured, unstructured) and analytical methods (e.g., predictive modeling, data mining).	
5	Regulations and Ethics in Digital Health: Understand terminology related to data privacy laws (e.g., HIPAA, GDPR) and ethical considerations in using digital health technologies	

References

1. Book: Digital Health: A Path to Validation by Homero Rivas and Katarzyna Wac
2. Book: Health Information Management: Concepts, Principles, and Practice by Kathleen M. LaTour and Shirley A. D. Thomas
3. Book: Clinical Informatics: A Practical Approach for Healthcare and Information Technology Professionals by Jon M. N. McCarthy and William L. Hersh

SEMESTER II:**Course: Advanced data analytics (R/ SPSS/ STATA/ SAS)**

S.No	Topics	COMMENTS
1	Introduction to Data Analytics in Healthcare • Role of analytics in healthcare • Big data and digital health • Ethical considerations in health data analysis	
2	Overview of R, SPSS, STATA, and SAS • Introduction to software environments • Interface and functionalities • Choosing the right tool for specific analyses	
3	Data Importing, Cleaning & Transformation • Handling structured and unstructured data • Missing value imputation • Outlier detection • Data normalization	
4	Exploratory Data Analysis (EDA) • Descriptive statistics • Data visualization techniques • Identifying trends and anomalies in healthcare data	
5	Statistical Analysis & Regression Models • Hypothesis testing (T-tests, ANOVA, Chi-square) • Regression models (Linear, Logistic, Cox regression) • Time series analysis for patient data trends	

References

1. Data Analysis Using Regression and Multilevel/Hierarchical Models – Andrew Gelman, Jennifer Hill (Cambridge University Press, 2006) - Covers statistical modeling, regression analysis, and hierarchical models using R.
2. Discovering Statistics Using IBM SPSS Statistics – Andy Field (SAGE Publications, 2017) - A comprehensive guide on statistical analysis using SPSS with real-world examples.
3. A Handbook of Statistical Analyses Using Stata – Brian S. Everitt, Sophia Rabe-Hesketh (Chapman and Hall/CRC, 2014) - Introduces key statistical methods in Stata, including regression and multivariate analysis.
4. SAS Essentials: Mastering SAS for Data Analytics – Alan C. Elliott, Wayne A. Woodward (Wiley, 2019) - Provides practical applications of SAS for healthcare and business analytics.
5. The R Book – Michael J. Crawley (Wiley, 2012) - A detailed reference covering statistical computing, data visualization, and machine learning in R.

SEMESTER II:**Course: Design Thinking**

S.No	Topics	COMMENTS
1	Introduction to Design Thinking in Healthcare - Principles of design thinking - Human-centered design (HCD) in healthcare - Role of empathy in healthcare innovation	
2	Identifying Healthcare Challenges & User Needs - Conducting user research and ethnographic studies - Identifying pain points in patient journeys - Stakeholder mapping (patients, clinicians, administrators)	
3	Ideation and Concept Development - Brainstorming and creative problem-solving techniques - Convergent and divergent thinking - Co-designing with healthcare professionals and patients	
4	Prototyping Healthcare Solutions - Low-fidelity and high-fidelity prototyping - Rapid prototyping tools (paper prototypes, wireframes, 3D models) - Iterative design and feedback integration	
5	Implementing Design Thinking in Healthcare Systems - Case studies of design-driven healthcare innovations - Lean startup methodology for healthcare startups - Scaling design thinking in large health organizations	
6	Ethical & Regulatory Considerations - Ethical concerns in patient-centered design - Regulatory approval for healthcare innovation - Risk assessment and mitigation strategies	

References

1. Jeanne Liedtka & Tim Ogilvie – Design Thinking for the Greater Good: Innovation in the Social Sector (Columbia University Press, 2017)
2. Tim Brown – Change by Design: How Design Thinking Creates New Alternatives for Business and Society (Harper Business, 2009)
3. Bon Ku & Ellen Lupton – Health Design Thinking: Creating Products and Services for Better Health (MIT Press, 2020)
4. Marc Stickdorn et al. – This is Service Design Thinking (Wiley, 2012)
5. IDEO.org – Design Kit: The Human-Centered Design Toolkit (IDEO, 2015)

SEMESTER II:**Course: UI/UX for Healthcare**

S.No	Topics	COMMENTS
1	Fundamentals of UI/UX in Healthcare • Importance of UI/UX in medical applications • Difference between UI and UX • Role of cognitive psychology in healthcare UX	
2	User Research & Healthcare Personas • Conducting user research for healthcare products • Creating patient and provider personas • Understanding accessibility needs (elderly, disabled users)	
3	Principles of Healthcare UI Design • Color theory and visual hierarchy • Typography and readability in medical applications • Designing for different platforms (mobile, web, wearables)	
4	UX Design for Healthcare Applications • Wireframing and prototyping healthcare interfaces • Navigation and usability principles • Data visualization in health dashboards	
5	Testing & Evaluating UI/UX in Healthcare • Usability testing techniques • A/B testing and heuristic evaluation • Ensuring compliance with accessibility guidelines (WCAG, Section 508)	
6	Designing for Emerging Technologies • UX for telemedicine and remote patient monitoring • UI considerations for AI-powered diagnostics • Augmented reality (AR) and virtual reality (VR) UI design in healthcare • Preventing dark patterns in medical apps	
7	Hands-on Case Studies • Redesigning a hospital patient portal for better usability • Creating a telemedicine platform prototype • Improving the UI of an existing medical wearable app	

References

1. Deborah J. Mayhew – The UX Book: Agile UX Design for Healthcare Applications (Elsevier, 2016)
2. Ben Shneiderman – Designing the User Interface: Strategies for Effective Human-Computer Interaction (Pearson, 2016)
3. Aaron Marcus & Hyojin Kim – Design, User Experience, and Usability: UX Research and Design in Healthcare (Springer, 2017)

4. Jesmond Allen & James Chudley – Smashing UX Design: Foundations for Designing Online User Experiences (Wiley, 2012)
5. Patrick W. Jordan – Designing Pleasurable Products: An Introduction to the New Human Factors (CRC Press, 2002)

SEMESTER II:**Course: Rapid Prototyping and 3D Printing**

S.No	Topics	COMMENTS
1	Basics of 3D Printing • Introduction to Additive Manufacturing • Types of 3D Printing Technologies: Fused Deposition Modeling (FDM), Stereolithography (SLA), Selective Laser Sintering (SLS) • Differences between additive and subtractive manufacturing	
2	3D Printing Materials • Thermoplastics: PLA, ABS, PETG • Biocompatible Resins & Medical-Grade Polymers • Metal & Ceramic 3D Printing	
3	3D Modelling & Design • Introduction to CAD Software (AutoCAD, SolidWorks, Fusion 360) • Creating STL, OBJ file formats for 3D printing • Optimizing designs for printability and reducing material waste	
4	Prototyping & Testing in Healthcare • 3D Printed Medical Applications: Prosthetic limbs, Dental implants, Orthotic devices • Bioprinting & Tissue Engineering: Emerging trends • Quality assessment and strength testing of printed models	
5	Post-Processing & Finishing Techniques • Support Removal, Surface Smoothing, Sterilization Techniques • Coating and painting for biocompatibility • Sterilization processes in medical applications	
6	Industry Applications & Future Trends • 3D Printing in Surgery & Implants • Use in Custom Prosthetics & Assistive Devices • Future of Bioprinting and Organ Printing	

References

1. Gibson, I., Rosen, D. W., & Stucker, B. (2021). Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing (2nd Ed.). Springer.
2. Bártolo, P. J. (2011). Stereolithography: Materials, Processes, and Applications. Springer.
3. Chua, C. K., Leong, K. F., & Lim, C. S. (2010). Rapid Prototyping: Principles and Applications (3rd Ed.). World Scientific.
4. Singh, R. (2018). 3D Printing in Biomedical Engineering. Woodhead Publishing.

5. Murr, L. E. (2016). Metallurgy and Design of Alloys with Hierarchical Microstructures. Elsevier.

SEMESTER II:**Course: Predictive Analytics (Prediction and Forecasting)**

S.No	Topics	COMMENTS
1	Introduction to Predictive Analytics in Healthcare • Role of AI & ML in healthcare • EHR (Electronic Health Record) integration for prediction • Use cases: Disease risk prediction, readmission forecasting, epidemic spread modelling	
2	Data Preprocessing & Feature Engineering • Handling missing data (mean, median imputation, KNN imputation) • Data normalization and standardization • Feature selection techniques (PCA, LASSO, Recursive Feature Elimination)	
3	Machine Learning Models for Prediction • Regression models (Linear, Logistic, Cox Regression) • Decision trees, Random Forests, Gradient Boosting (XGBoost) • Neural Networks & Deep Learning for time series forecasting	
4	Predictive Modeling Applications in Healthcare • Predicting chronic disease risks (Diabetes, Cardiovascular Diseases, etc.)	
5	Model Deployment & Interpretability • Deploying ML models with Flask, FastAPI • Model explainability tools (SHAP, LIME) • Ethical considerations in AI-driven healthcare	

References

1. Kelleher, J. D., Mac Namee, B., & D'Arcy, A. (2020). Fundamentals of Machine Learning for Predictive Data Analytics. MIT Press.
2. Provost, F., & Fawcett, T. (2013). Data Science for Business: What You Need to Know about Data Mining and Data-Analytic Thinking. O'Reilly Media.
3. Lantz, B. (2019). Machine Learning with R (2nd Ed.). Packt Publishing.
4. Chicco, D., & Jurman, G. (2021). Machine Learning for Biomedical Applications. Springer.
5. Aggarwal, C. C. (2018). Neural Networks and Deep Learning: A Textbook. Springer.

SEMESTER II:**Course: Mobile Apps & Web Apps**

S.No	Topics	COMMENTS
1	Introduction to Frontend & Backend Development • Overview of full-stack development • Frontend and Backend in healthcare applications • Introduction to React (Web) and Flutter/Kotlin (Mobile)	
2	Authentication & Security Features • OAuth, JWT, Firebase authentication • Role-based access control (RBAC) • HIPAA compliance for mobile & web apps	
3	Database Integration • Connecting Firebase, PostgreSQL, MySQL • Real-time database synchronization • NoSQL vs. SQL in healthcare	
4	Push Notifications & Offline Capabilities • FCM (Firebase Cloud Messaging) for notifications • Implementing offline-first applications • Optimizing battery and performance for mobile apps	
5	Deployment of Web & Mobile Apps • App Store (iOS) & Play Store (Android) deployment • Containerization with Docker & Kubernetes • CI/CD pipelines for healthcare applications	

References

1. Pettit, J. (2021). Flutter for Beginners (2nd Ed.). Packt Publishing.
2. Gupta, A. (2020). Full-Stack Web Development with React and Firebase. O'Reilly Media.
3. Fain, Y., & Rasputnis, V. (2019). Modern Web Development with Kotlin. Manning Publications.
4. Steele, K. (2020). The Mobile Application Hacker's Handbook. Wiley.
5. Dimitris, K. (2018). Building Secure and HIPAA-Compliant Healthcare Applications. Springer.

SEMESTER II:**Course: API, Plug-in Integration**

S.No	Topics	COMMENTS
1	Fundamentals of APIs (REST, SOAP) • REST vs. SOAP architecture • JSON & XML-based API responses • GraphQL introduction	
2	API Authentication & Security • OAuth 2.0, API Keys, JWT (JSON Web Token) • Role-based access control (RBAC) • HIPAA, GDPR compliance in API security	
3	Building API Requests & Responses • GET, POST, PUT, DELETE methods • Handling API responses and error codes • API documentation using Swagger/OpenAPI	
4	Integrating Third-Party APIs • Google Maps API for hospital locations • Firebase API for real-time health data storage • HL7 & FHIR standards for health data exchange	
5	Webhooks & Event-Driven Architectures • Webhooks vs. polling methods • Using event-driven APIs in telemedicine • Asynchronous API requests for real-time monitoring	
6	Error Handling & Rate Limiting • API error handling best practices • Throttling and rate-limiting strategies • Logging API requests for debugging	
7	API Security & Compliance in Healthcare • Token-based authentication for secure transactions • Data encryption (TLS, SSL) in API calls • Ensuring API compliance with global health data regulations	

References

1. Meddeb, A. (2018). REST API Development with Node.js. Packt Publishing.
2. Allamaraju, S. (2010). RESTful Web Services Cookbook. O'Reilly Media.
3. Rubino, A. (2021). Hands-on Healthcare API Design with HL7 FHIR. Packt Publishing.
4. Richardson, L., & Amundsen, M. (2020). RESTful Web APIs. O'Reilly Media.
5. Graham, M. (2022). API Security in Action. Manning Publications.

SEMESTER II:**Course: Database Features**

S.No	Topics	COMMENTS
1	Database Fundamentals (SQL & NoSQL) - SQL (PostgreSQL, MySQL) vs. NoSQL (MongoDB, Firebase) - Relational vs. non-relational databases - Choosing the right database for healthcare applications	
2	Healthcare Data Models & EMR Integration - Electronic Medical Record (EMR) database design - Normalization and de-normalization in healthcare - FHIR and HL7 data exchange standards	
3	Query Optimization & Indexing - Indexing strategies for large medical datasets - SQL query optimization techniques - Joins, Views, and Stored Procedures for health data analysis	
4	Cloud Databases (AWS, Google Cloud, Azure) - Introduction to cloud-based database solutions - AWS RDS, Google Firebase, Microsoft Azure SQL	
5	Security & Privacy in Health Data Management - Data encryption at rest and in transit - Access control and user authentication in databases - Regulatory compliance (HIPAA, GDPR) in database management	

References

1. Elmasri, R., & Navathe, S. (2017). Fundamentals of Database Systems (7th Ed.). Pearson.
2. Kumar, V. (2018). Big Data Analytics and Machine Learning in Healthcare. Springer.
3. Redmond, E. (2017). Introduction to NoSQL Databases. O'Reilly Media.
4. Ritchie, B. (2021). SQL for Data Analytics (2nd Ed.). Packt Publishing.
5. Gates, R. (2020). Cloud Databases: Deploying Scalable Data Storage Solutions. Wiley.

SEMESTER III:**Course: Electronic Health Records (HER)**

S.No	Topics	COMMENTS
1	Introduction to EHR - Definition, Scope and Importance of EHR - Evolution of health records - Transition from paper to digital	
2	Computer Hardware and Enabling Technologies - Basic Computer Architecture for HER - Sever vs. Cloud-Based EHR Systems - Data Storage and Retrieval Mechanisms - Network Infrastructure and Cybersecurity in EHR	
3	Databases, Data Warehouses, and Data Repositories - Basics of Healthcare Databases (SQL, NoSQL) - Data Warehousing Concepts in EHR - Electronic Data Interchange (EDI) and HL7 Integration - Real-time Data Processing in EHR	
4	Internet and Intranet Technologies - Cloud Computing in EHR - Web-based and Mobile EHR Solutions - Telemedicine Integration with EHR - Security Concerns in Internet-based EHR	
5	Health Informatics Standards - Standardization Bodies (HL7, SNOMED CT, ICD, DICOM) - Interoperability and Data Exchange Standards - Regulatory Compliance (HIPAA, GDPR, ONC)	
6	Understanding Clinical Processes & EHR Workflow - Patient Data Entry and Management - Electronic Prescriptions and Medication Management - Physician Order Entry (CPOE) and Integration with Labs - Role of EHR in Patient Monitoring and Telehealth	
7	Project Management in EHR Implementation - Planning and Budgeting for EHR Deployment - Risk Assessment and Change Management - Training Healthcare Professionals on EHR - Case Study: Large-scale EHR Implementations	

References

- Electronic Health Records: Understanding and Using Computerized Medical Records – Richard Garte, Pearson (2016) - Covers EHR systems, data management, security, and interoperability.

2. Health Informatics: Practical Guide – William R. Hersh, Lulu.com (2021) - Discusses EHR implementation, clinical decision support, and digital health systems.
3. Biomedical Informatics: Computer Applications in Health Care and Biomedicine – Edward H. Shortliffe, James J. Cimino, Springer (2021) - Focuses on EHR integration, AI applications, and ethical considerations.
4. Electronic Health Records for Dummies – Trenor Williams, Anita Samarth, Wiley (2010) - Beginner-friendly guide on EHR fundamentals and healthcare regulations.
5. Clinical Informatics Study Guide: Text and Review – John T. Finnell, Brian E. Dixon, Springer (2022) - Covers clinical informatics, EHR design, interoperability, and patient safety.

SEMESTER III:**Course: Telemedicine**

S.No	Topics	COMMENTS
1	Introduction to Telemedicine • Definition & History • Understanding the role of telehealth • Benefits & Limitations	
2	Technologies in Telemedicine • Communication Networks and Services • Wireless networks • Outdoor operating environment	
3	Wireless Telemedicine System Deployment • Planning and deployment considerations • Scalability to support future growth • Integration with existing IT infrastructure • Evaluating IT service and solution provider • Quality measurement	
4	Wireless Technologies in Patient Monitoring • Body area networks • Emergency and disaster monitoring • In-hospital monitoring	
5	Technologies in medical information processing • Collecting data from patients • Bio signal transmission and processing • Decision support systems	
6	Telemedicine's Impact on Health Care Delivery • Cost of Care • Quality of Care • Access to care • Relationship with health care providers • Market for telehealth services	
7	Regulations & Compliance – Guidelines for electronic flow of health information and records • Licensing & reimbursement policies • Data security & HIPAA compliance	
8	Future Trends in Telemedicine • AI & machine learning in telehealth • 5G & IoT integration	

References

1. Telemedicine: Technology and Applications (MHealth, TeleHealth and EHealth) – R.S. Khandpur, PHI Learning (2017) - Covers fundamentals of telemedicine, remote diagnostics, and mHealth applications.
2. Telemedicine Technologies: Information Technologies in Medicine and Telehealth – Hemanth D. Jude, Elsevier (2019) - Focuses on emerging telemedicine technologies, AI integration, and security aspects.

3. Understanding Telehealth – Karen Schulder Rheuban, Elizabeth Krupinski, McGraw Hill (2017) - Explains clinical applications, legal considerations, and telehealth implementation.
4. Digital Health: Scaling Healthcare to the World – Homero Rivas, Katarzyna Wac, Springer (2018) - Discusses telehealth scalability, patient engagement, and IoT applications.
5. Telemedicine and E-Health Law – L. Camille Hébert, Bloomberg Law (2020) - Covers legal, ethical, and policy frameworks governing telemedicine practices.

SEMESTER III:**Course: AR/VR/MR for Health Care**

S.No	Topics	COMMENTS
1	Introduction to AR, VR and MR • AR • VR • MR	
2	Applications of AR/VR/MR: • Medical Training and Education • Pain Management and Therapy • Mental Health Treatment • Patient Engagement and Education • Remote Consultation and Monitoring	
3	Software for AR/VR/MR: • AR (Microsoft HoloLens Development Studio, Unity 3D) • VR (Oculus SDK, Engage VR) • MR (Holo Anatomy, Microsoft Dynamics 365 Remote Assist)	
4	Hardware for AR/VR/MR • AR (Microsoft HoloLens2, Google Glass Enterprise Edition) • VR (Oculus Rift S/ Oculus Quest 2, HTC Vive Pro) • MR (Microsoft HoloLens 2, Oculus Quest 2)	
5	Types of Data sets for AR/VR/MR: • EMR Data sets • Sensing data sets • Image data sets • Video data set	

References

1. Augmented Reality in Healthcare: Applications, Technologies, and Challenges by Amir H. Alavi and Seyedali S. Jafari
2. Virtual Reality and Augmented Reality: Myths and Realities by Steven A. Brown
3. Mixed Reality and 3D Technologies in Medicine by André Biedenkapp, Javier García, and Eduardo R. P. de Souza

SEMESTER III:**Course: Digital Twins**

S.No	Topics	COMMENTS
1	Concept of Digital Twins • Definition & evolution • Components of Digital Twin	
2	Applications in Healthcare • Patient Monitoring and Management • Medical Simulations and Training • Hospital Digital Twins	
3	Data Sources for Digital Twins • IoT-enabled devices • EHR Data, Radiological Images	
4	Challenges & Ethical Concerns • Data security • Ethical dilemmas in predictive modeling	
5	Future of Digital Twins in Healthcare • AI & deep learning integration • Next-gen predictive models	

References

1. Digital Twin Technologies and Smart Cities – Mokhtar Awang, Asif Iqbal, CRC Press (2021) - Covers digital twin fundamentals, applications in healthcare, and real-world implementations.
2. Digital Twin: The Next Wave of Digital Transformation – Rajiv Ranjan, Pethuru Raj, Springer (2022) - Explores digital twin concepts, AI integration, and use cases in medicine.
3. Digital Twin Technologies for Healthcare 4.0 – Sukanta Kumar Barik, P. V. Suresh, Springer (2023) - Focuses on digital twins for predictive healthcare, diagnostics, and personalized medicine.
4. Healthcare Digital Twins: The Convergence of Digital Health, AI, and IoT – Carmelo Ardito, Springer (2023) - Discusses digital twins for patient monitoring, disease modeling, and telemedicine applications.
5. The Digital Twin Paradigm for Smarter Systems and Environments: The Industry Use Cases – Hassan Raja, Elsevier (2020) - Covers industrial and medical applications of digital twins, including remote patient monitoring.

SEMESTER III:**Course: Market Research & Needs Assessment**

S.No	Topics	COMMENTS
1	Introduction to Market Research - Types of market research - Importance in digital health	
2	Data Collection & Analysis - Surveys & focus groups - Statistical analysis	
3	Needs Assessment in Healthcare - Identifying gaps in Healthcare - Evaluating patient & provider needs	
4	Competitive Analysis & Business Models - Analyzing existing digital health solutions - Business strategies in healthcare	
5	Trends & Future Scope - Emerging technologies - Investment trends in digital health	

References

1. Essentials of Marketing Research – William G. Zikmund, Barry J. Babin (Cengage Learning, 2018) - Covers qualitative and quantitative research methods, data collection, and analysis techniques.
2. Marketing Research: An Applied Orientation – Naresh K. Malhotra (Pearson, 2019) - A comprehensive guide on market research methodologies, survey design, and consumer insights.
3. The Handbook of Market Research for Life Science Companies – Jean-Francois Denault (Springer, 2021) - Focuses on market research strategies for healthcare, biotech, and life sciences industries.
4. Marketing Research for the Health Sector: Insights and Innovations – John Whittaker (Routledge, 2020) - Discusses market research methods specific to healthcare products, medical devices, and pharmaceuticals.
5. Needs Assessment: Analysis and Prioritization – David Royse, Thomas Badger (Oxford University Press, 2019) - Covers needs assessment frameworks, stakeholder engagement, and data-driven decision-making in healthcare and social services.

SEMESTER IV:

Course:

S.No	Topics	COMMENTS
1	Research Project / Thesis	
2	Review of Topics/Electives	