

Master of Science Health Informatics and Analytics

(PHIA01)

FIRST YEAR SYALLBUS – FIRST SEMESTER

(w.e.f. 2022-23 admitted batch)

VISION

The Apollo University aspires to create global leaders of the future, preparing them for a constantly evolving world and empowering them to build a more inclusive society



MISSION

We plan to achieve this through transformative education developed at the intersection of healthcare, technology, and management having roots in Innovation & Research in an inclusive culture that fosters practical oriented knowledge, stimulates critical thinking and sustains our legacy of excellence.

THE APOLLO UNIVERSITY

MURUKAMBATTU

CHITTOOR (Dt) 517127

ANDHRA PRADESH

HIAT1501: INTRODUCTION TO HEALTH INFORMATICS

L T P C

4 0 0 4

COURSE DESCRIPTION

This course provides introduction to health informatics, the field devoted to the optimal use of data, information, and knowledge to advance individual health, health care, public health, and health-related research. Students will learn the application of informatics skills and knowledge to health-related problems.

LEARNING OBJECTIVES

- To interpret health policy and systems, with the ability to integrate policies into the healthcare agency.
- To analyze, design and develop information systems that enhance operational efficiencies and strategic goals of the organization.
- To analyze data and utilize analytic technologies to improve the organization efficiencies and operational effectiveness.

UNIT - 1

(10 Hours)

Overview of Health Informatics, Healthcare Data, Information and Knowledge, Healthcare Data Analytics, Electronic Health Records

UNI - 2

(12 Hours)

Health Information Exchange, Data Standards and Medical Coding, Architectures Of Information Systems, Health Information Privacy And Security, Health Informatics Ethics

UNIT - 3

(10 Hours)

Consumer Health Informatics, Mobile Technology, Online Medical Resources, Medical Information Retrieval

UNIT- 4

(14 Hours)

Evidence Based Medicine & Clinical Practice Guidelines, Disease Management and Disease Registries, Quality Improvement Strategies, Patient Safety and Health Information

UNIT- 5

(14 Hours)

Telemedicine, Medical Imaging Informatics, Bioinformatics, Public Health Informatics, E-Research

COURSE OUTCOMES –

Upon successful completion of the course student would be –

- Able to learn, appreciate, adapt and manage applications of information and communications technologies (ICT) applied to the healthcare sector and Digital Health.
- Able to understand the roles of informatics and analytics for better health and healthcare outcomes.
- Able to examine health informatics concepts for the management of health information
- Able to study compliance requirements throughout health-information life cycle
- Able to explore and focus on possible areas of further studies and jobs.

Text Books

1. Health Informatics, Practical Guide for Healthcare and Information Technology Professionals, Sixth Edition by Robert E. Hoyt and Ann K. Yoshihashi, 2014
2. Health Care Informatics: An Interdisciplinary Approach, S. P. Englehardt and R. Nelson, Mosby, 2002.

Reference Text Books

1. Health Informatics: A Socio-Technical Perspective, S. Wheton, Oxford Univ. Press, 2005
2. Health informatics: a systems perspective by Gordon D. Brown, Kalyan S. Pasupathy, Timothy B. Patrick, Second edition. Health Administration Press, 2019
3. Health Informatics: An Interprofessional Approach, by Ramona Nelson and Nancy Stagers, ISBN13: 978-0323402316, 2nd Edition

HIAT1502:

MEDICAL TERMINOLOGY

L T P C

4 0 0 4

COURSE DESCRIPTION

The purpose of this course is to further develop a student's understanding and use of medical terminology. There is a focus on spelling and pronunciation, abbreviations, analyzing words based on their root, prefix or suffix as well as identifying common mistakes within medical terminology.

LEARNING OBJECTIVES

- To understand medical terms by combining prefixes, suffixes and root words.
- To make the associate medical terms with specific body systems.
- To identify and interpret diagnostic and symptomatic terms related to the pathophysiology specific to each body system.
- To describe designated diagnostic testing procedures (laboratory, x-ray, surgical, pharmacy, etc.).
- To distinguish common medical abbreviations and acronyms.

UNIT - 1 (10 Hours)

Introduction to medical terminology, The Human body in health and disease

UNIT - 2 (12 Hours)

The Skeletal System, The Muscular System, The lymphatic and immune systems

UNIT - 3 (12 Hours)

The Respiratory System, The Circulatory System, The Digestive System, The Urinary System

UNIT - 4 (14 Hours)

The Nervous system, Special senses - Eyes and Ears, Skin - The Integumentary system

UNIT - 5 (12 Hours)

The Endocrine system, The Reproductive System, Diagnostic procedures, Nuclear Medicine and Pharmacology

COURSE OUTCOMES –

Upon successful completion of the course student would be –

- Able to Identify and interpret complex medical terms by breaking them into their component word parts in order to decipher their meaning.
- Able to describe common diseases and disorders of the body systems
- Able to identify the basic structure of medical words, including prefixes, suffixes, roots, combining forms, and plurals
- Able to identify medical terminology as it relates to the anatomy and physiology of the human body
- Able to identify the rules of building medical terms and a connection between the term and its relationship to anatomy and physiology

Text Books

1. Medical Terminology for Health Professions, 7th Edition by Ann Ehrlich; Carol L Schroeder, ISBN 13: 9781111543297, Published by Delmar Cengage Learning (2013)
2. Workbook for Ehrlich/Schroeder's Medical Terminology for Health Professions, 7th by Carol Schroeder, Ann Ehrlich Published by Delmar Cengage Learning; 7th edition, 2012, ISBN-13 : 978-1111543280

Reference Text Books

3. Quick and Easy Medical Terminology - With Access by Peggy C. Leonard, ISBN13: 978-0323595995, 9th Edition
4. Medical Terminology Systems: A Body Systems Approach - With Access by Barbara A. Gylys, ISBN13: 978-0803658677, 8th Edition
Understanding Medical Terminology by Agnes C. Frenay, ISBN13: 978-0697140586, 9th Edition

HIAT1503:

EPIDEMIOLOGY AND STATISTICS

L T P C

4 0 0 4

Course Description: The focus is on the use of classical statistical approaches to describe the health of populations visiting a health setting, appropriate summaries and data displays, and the principles and methods of epidemiologic inquiry. To enhance student competency in the use of software for information analysis and evaluation in the field of basic statistics. Besides employing the relevant statistical methods and by comprehending the idea of analytical statistics.

Course Objectives

- To distinguish the roles and relationships between epidemiology and statistics in the improvement of health.
- To compute basic descriptive statistics and explore data analytic methods.
- To understand the basic concepts in biostatistics
- To determine the proper method to be used in study design and analyzing data
- To identify appropriate sources of data

UNIT - 1

(8 Hours)

Dynamics of Disease Transmission, Definition of health and disease, Spectrum of diseases, Determinants of health and disease, Natural history of disease, Causation, Epidemiological triad, Modes of transmission, Epidemic, Endemic and Pandemic

UNIT - 2

(10 Hours)

Measures of frequency of diseases or disease occurrence, Measures of morbidity: incidence, prevalence, rate, ratio, proportions, , Relationship between incidence and prevalence, Measures of Risk, Risk Ratio, Odds Ratio, Measures of mortality : mortality rates: death rates, crude death rate, specific death rate, birth rate, infant mortality rate, maternal mortality, case fatality rate, proportional mortality, standardization.

UNIT - 3

(12 Hours)

Introduction, Basic concepts of biostatistics, Definition, scope and uses, Definition and types of data: Qualitative and Quantitative, Variable and types, Measurement and

measurement scale, Methods of data collection, its merits and demerits, Tools for data collection, Tabulation of data, Frequency distribution, Multiple classification

UNIT - 4

(16 Hours)

Introduction to Sampling, Sampling Distribution, Population, Sample, Criteria for a good sample, Application of sampling in Health setting, Sampling techniques, Convenience sampling, Simple random sampling, Systematic sampling, stratified random sampling, cluster sampling, Calculation of sample, Comparing sample estimates, estimation Versus Hypothesis testing, Point estimates, Confidence intervals. STUDY DESIGNS: - Observational Studies, Cross Sectional Studies, Descriptive Studies, Cohort Studies, Case Control Studies, Before – after Studies, Historical Prospective Studies, Making international comparisons, Experimental Studies, The Randomized Control trial, Allocation alternative, Maneuver – Measurement including blinding Compliance, contamination, co intervention, Adverse events, Stopping rules- Analysis, Diagnostic tests, Measurement issues, qualitative research ,Mixed designs, Ecological Studies, Space time cluster studies, Familial aggregation studies

UNIT - 5

(14 Hours)

Basics of Hypothesis testing, Sampling variation, Null and Alternative hypothesis, Concepts and steps in testing of hypothesis, Type I and Type II errors, Parametric tests, Paired comparisons- paired-t test, Two population mean- unpaired t test, Analysis of Variance, Analysis of Co-variance, Introduction to Non-Parametric Tests, Chi Squared Test of homogeneity.

COURSE OUTCOMES / Competencies gained

Upon successful completion of this subject, students would be:

- Able to understand the basic concepts Epidemiological traits and data visualization
- Able to recognize the assumptions associated with construction of a life table.
- Able to understand the basic concepts in biostatistics
- Able to Determine the proper method to be used in analyzing data sets
- Able to Identify appropriate sources of data

Text Books

- Rao NSN, Applied statistics in health sciences, JP publishers
- Mahajan B.K, Methods of biostatistics, Kothari book depot, A.D Marg, Bombay

Reference Text Books

- K.Park's Textbook of Preventive and social medicine M/S Banarasidas Bhanot publishers
- Wayne W. Daniel and Chad L. Cross, Biostatistics: A Foundation for Analysis in the Health Sciences, JohnWiley & Sons, Inc
- Oleckno, William, Essential Epidemiology: Principles and Applications, Waveland Press, Inc., 2002

HIAT1504:

HEALTHCARE DATA SCIENCE

L T P C

4 0 0 4

COURSE DESCRIPTION

In this course, the student will learn about some of the different types of data and computational methods involved in stratified healthcare and precision medicine.

LEARNING OBJECTIVE

This course will introduce students to the collection, preparation, analysis, modelling and visualization of data, covering both conceptual and practical issues. Examples and case studies from diverse fields will be presented, and hands-on use of statistical and data manipulation tools will be included.

UNIT - 1

(12 Hours)

Defining Data Science and Big data, Benefits and Uses, facets of Data, Data Science Process.

The Data Science Process: Overview of the Data Science Process-Setting the research goal, Retrieving Data, Data Preparation, Exploration, Modeling, data Presentation and Automation.

UNIT - 2

(12 Hours)

Python: Introduction and Environment Why Learn Python, Installing Python, Installing Anaconda Distribution, Running the Jupyter Notebook, The Building Blocks of Programs, Errors in Python

UNIT - 3

(12 Hours)

Basic Python Programming, Datatypes and Operators, Variables, Strings, Lists and Tuples, Dictionary in Python, Conditional Statements, Loops in Python, Functions Classes and Objects File Handling in Python

UNIT - 4

(12 Hours)

Biopython, Introduction, Installing Biopython, Biopython Seq Class, Parsing Sequence Files, Writing Files, Pairwise Sequence Alignment, BLAST with Biopython, Multiple Sequence Alignment, Construction of a Phylogenetic Tree, Handling PDB Files

UNIT – 5

(12 Hours)

Python for Data Analysis, Introduction, NumPy, NumPy Arrays versus Lists, Two-Dimensional Matrices, Matrix Operations, Comparing Matrices, Generating Data Using NumPy, Speed Test, “Pandas” Data frame, Selecting Rows and Columns, Conditional Filtering in Data frame, Writing CSV Files from Pandas Data frame, Apply() Function, Concatenating and Merging

COURSE OUTCOMES –

Upon successful completion of the course student would be able to –

- Recognize the various discipline that contribute to a successful data science effort
- Understand the processes of data science identifying the problem to be solved, data collection, preparation, modelling, evaluation and visualization.
- Be aware of the challenges that arise in data sciences.
- Be able to identify the application of the type of algorithm based on the type of the problem.
- Be comfortable using commercial and open source tools such as the R/python language and its associated libraries for data analytics and visualization

Text Books

1. Python for Data Science, by Ethan Williams, ISBN13: 978-1687159106
2. Hands on data science for biologists using Python by Yasha Hasija and Rajkumar Chakraborty, First edition. CRC Press, 2021, ISBN 13: 978-0367546786

Reference Text Books

1. Fundamentals of Python: Data Structures, by Kenneth Lambert ISBN13: 978-0357122754, 2nd Edition
2. Data Structures and Algorithms With Python, by Kent D. Lee, ISBN13: 978-3319130712
3. Python Scripting for Computational Science, by Hans Petter Langtangen, ISBN13: 978-3540739159, 3rd Edition

HIAT1505:

STANDARDS OF DIGITAL HEALTH

L T P C

4 0 0 4

COURSE DESCRIPTION

This course will help the student to know how to lead digital health projects in public health and the healthcare sector.

LEARNING OBJECTIVES

- To bridge the knowledge gap between healthcare and computing,
- To gain a critical understanding of advanced theoretical knowledge, methods and concepts of relevant digital health technologies required for supporting healthcare and social care services and products
- To develop specialized technical knowledge and practical skills to take a professional approach to the planning, design and management of digital health products to address real-world healthcare and social care problems

UNIT – 1

(12 Hours)

Exchange of Health Information: Introduction to healthcare delivery system, Emerging Technologies, National Health Program, Health scenario of India- past, present, and future, Demography, Role of Standards for achieving interoperability; Health Information Exchange (HIE); Different types of HIE.

UNIT – 2

(12 Hours)

Categories of Standards: information model, terminology, content, and communication standards, Identifiers; Transport Standards; Vocabulary Standards; Content Exchange Standards; Standards for Security; Privacy and Security, Patient Safety and Data Quality.

UNIT – 3

(12 Hours)

Commonly used Standards: ICT, NCDPD, IHTSTO, CDISC, Terminology Standards, Data interchange formats, terminologies, Message format standards, UHID, Role of XML and JSON; ICD Family, SNOMED CT, and LOINC; HL7 v2, v3, HL7 RIM, HL7 CDA, DICOM, and FHIR; HIPPA, Standards recommended for use in India.

UNIT – 4

(12 Hours)

Standards Development, Testing, and Implementation: Standards Development Organizations (SDOs); standards-setting organization (SSO), CMS standards, NSQHS, HIT Functionalities, Implementation of Standards for HIT; ASC-X12, IEEE, UMLS, Implementation of Standards compliant EHR system in a healthcare setup.

UNIT – 5

(12 Hours)

Integration and Harmonization: Need for integration, Data harmonization, integrated and Interoperable systems, and Interoperable technologies in support of the health workforce, harmonization in primary healthcare, IHE Profiles, and FHIR Implementation Guidelines; Continua Design Guidelines (CDG), PCHA, Integration, and harmonization of devices and services.

COURSE OUTCOMES –

Upon successful completion of the course, student would be –

- Able to List the common standards used for the exchange of health information and digital health (Cognitive Domain – Knowledge)
- Able to Describe the HIT (Health Information Technology) standardization processes and entities (Cognitive Domain – Knowledge)
- Able to Perform Teamwork for specific public health and/or healthcare domain (Psychomotor Domain – Manipulation)
- Able to Tabulate the efforts towards Integration and harmonization of some of the diverse standards used for digital health (Affective Domain – Organization)
- Able to Value the role of Digital Literacy and Health Data Literacy for diverse Digital Health applications

Text books

1. Benson Tand Grieve G (2016).Principles of Health Interoperability: SNOMED CT, HL7 and FHIR, Springer-Verlag, London, UK, ISBN: 978-3-319-30368-0
2. Managing Health Care Information Systems, Karen Wager, Frances Lee and John Glaser, Jossy-bass, 2005

Reference Text books

1. Ethical, Legal and Social Issues in Medical Informatics, Penny Duquenoy, Carlisle George and Kai Kimppa, Medical Information Science Reference (an imprint of IGI global), 2008
2. Digital Health Revolution, by Kevin Perea, ISBN13: 978-0578409726
3. Consumer Informatics and Digital Health, by Margo Edmunds, Christopher Hass and Erin Eds. Holve, ISBN13: 978-3319969046

List of experiments

1. Creation of a Virtual Machine for healthcare
2. A thorough study on biometrics of the AIMS Teaching Hospital
3. PUBMED Data search for a disease
4. KPI Dashboard for disease data of Chittoor General Hospital
5. KPI Dashboard for equipment data of Chittoor General Hospital
6. KPI Dashboard for healthcare professional's data of Chittoor General Hospital
7. The use of computerized provider order entry in relation to patient mortality from cancer
8. Downloading and/or installation of WEKA data mining toolkit.
9. Analysis of Weka Data Mining Techniques for Heart Disease Prediction System
10. Implementing Disease classification system for pediatric patients and coding in SNOMED, ICD-10 and UMLS

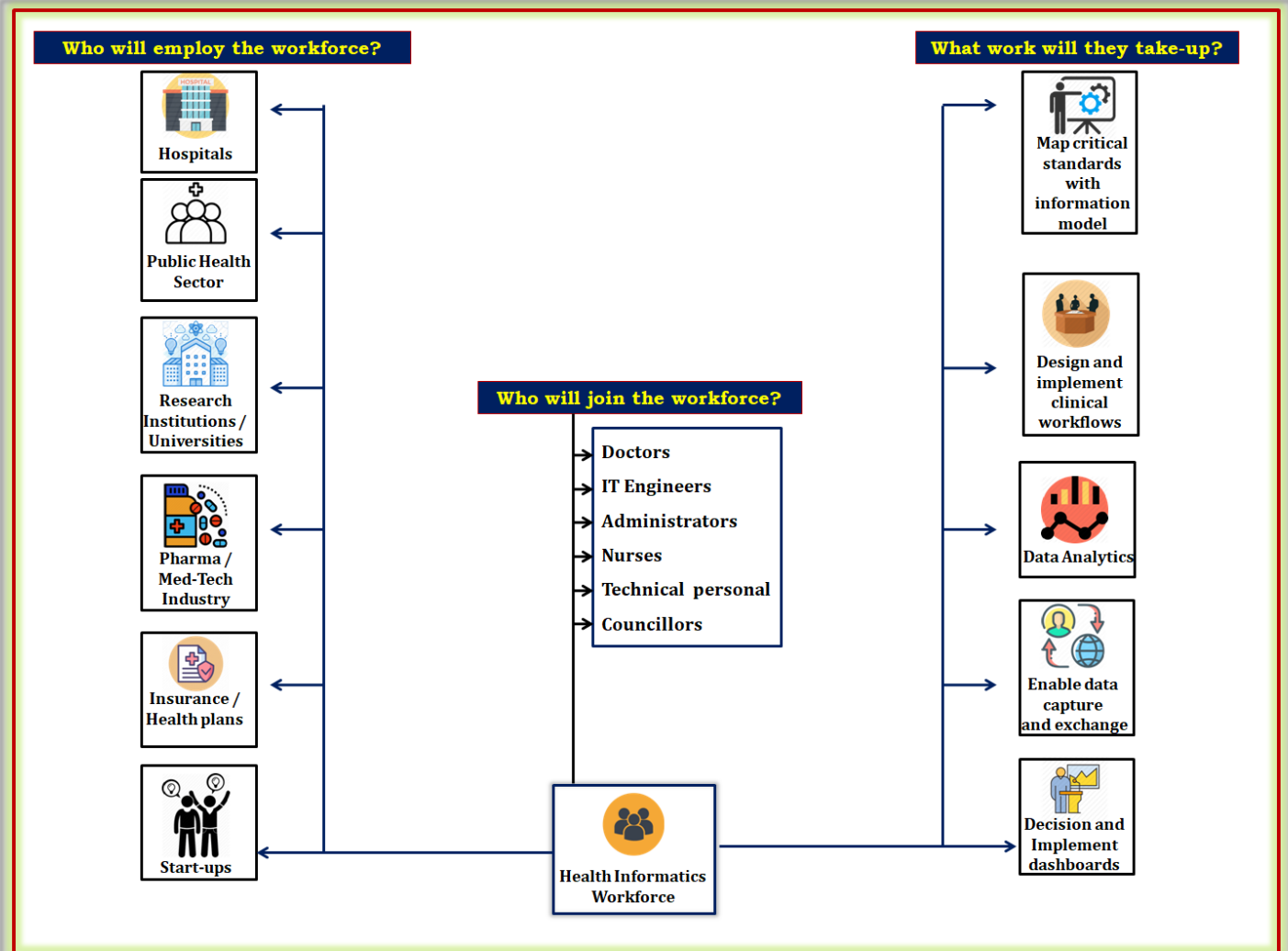
STHIA1- L2: BASIC PROGRAMMING FOR HEALTH DATA ANALYTICS LAB

L T P C

0 0 4 2

1. Study of data analysis using MS-Excel
2. Study of basic Syntaxes in PYTHON
3. Implementation of vector data objects operations
4. Implementation of matrix, array and factors and perform in PYTHON
5. Implementation and use of data frames in PYTHON
6. Create Sample (Dummy) Data in PYTHON and perform data manipulation with PYTHON
7. Study and implementation of various control structures in PYTHON
8. Data Manipulation with PYTHON
9. Study and implementation of Data Visualization with PYTHON
10. Study and implementation data transpose operations in PYTHON

Capacity Building in Health Informatics





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Master of Science Health Informatics and Analytics

(PHIA01)

FIRST YEAR SYALLBUS – SECOND SEMESTER

(w.e.f. 2022-23 admitted batch)

VISION

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MISSION

We plan to achieve this through transformative education developed at the intersection of healthcare, technology, and management having roots in Innovation & Research in an inclusive culture that fosters practical oriented knowledge, stimulates critical thinking and sustains our legacy of excellence.

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ANDHRA PRADESH

HIAT1506:

CLINICAL INFORMATICS

L T P C

4 0 0 4

COURSE DESCRIPTION

The course provides an overview of the theory, processes and applications of information systems and how they relate to health policy and management. It also provides a basic understanding of data standards and requirements, and the critical concepts and practice in mapping and interpreting health information.

LEARNING OBJECTIVES

- To understand the role of IT in clinical management
- To familiarize with the latest developments in technology with relevance to hospitals
- To develop the mobile based applications to improve patient care

UNIT - 1

(12 Hours)

Clinical Informatics: Emergence of a New Profession, The Indian Health System, Clinical Informatics Policy and Regulations

UNIT - 2

(12 Hours)

Clinical Decision Making/Care Process Improvement – Clinical Decision-Making, Evidence Based Health Care, Clinical Decision Support, Clinical Workflow Analysis, Process Redesign and Quality Improvement

UNIT - 3

(12 Hours)

Health Information Systems - Information Technology Systems, Health Information Systems and Applications, Healthcare Data Standards and Exchange, Information System Lifecycles in Health Care, Human Factors Engineering and Human-Computer Interaction: Supporting User Performance and Experience

UNIT - 4

(12 Hours)

Leading and Managing Change - Leadership Models, Processes, and Practices, Effective Interdisciplinary Teams, Project Management, Strategic and Financial Planning for

Clinical Information Systems, Change Management for the Successful Adoption of Clinical Information Systems

UNIT – 5

(12 Hours)

Beyond Clinical Informatics - Consumer Health Informatics: Engaging and Empowering Patients and Families, Public Health Informatics

COURSE OUTCOMES –

Upon successful completion of the course student would be –

- Able to Know about Clinical Informatics and mobile Apps related to healthcare
- Able to Understand the Fundamentals of Clinical Informatics
- Able to solve problems as teams for implementing change in a clinical environment
- Able to Understand and solve problems in the implementation of Hospital Information Systems (HIS)
- Able to Explore the different types of clinical decision support methodologies and applications.

Text Books

1. Clinical Informatics Study Guide Text and Review, by John T. Finnell and Brian E. Dixon, Springer International Publishing AG Switzerland, ISBN 978-3-319-22753-5
2. Managing Health Care Information Systems, Karen Wager, Frances Lee and John Glaser, Jossy-bass, 2005

Reference Text Books

1. Analysis, Design and Implementation of Information System, Locus, McGraw-Hill, 1985
2. Clinical Decision Support Systems - Theory and Practice, Second Edition, Eta S. Berner, Springer International Publishing AG Switzerland, ISBN-13: 978-0387-33914-6
3. Ramona Nelson and Nancy Staggers. "Health Informatics: An Interprofessional Approach."2nd Edition.

HIAT1507: CLINICAL DECISION SUPPORT SYSTEMS

L T P C

4 0 0 4

COURSE DESCRIPTION

This course is designed to provide knowledge in clinical decision support systems for students and it is a comprehensive course which applies computers in medicine.

LEARNING OBJECTIVES

- To verbalize a clear definition and purpose of Clinical Decision Support Systems (CDSS) tools
- To explore various CDSS tools and recognize application in nursing examples
- To describe how CDSS tools impact quality care and patient safety
- To demonstrate CDSS use through simulation/role play scenario

UNIT - 1

(12 Hours)

Overview of Clinical Decision Support Systems, Mathematical Foundations of Decision Support Systems

UNIT - 2

(12 Hours)

Data Mining and Clinical Decision Support Systems, Design and Implementation Issues, Diagnostic Decision Support Systems, Ethical and Legal Issues in Decision Support

UNIT - 3

(12 Hours)

Clinical Trials of Information Interventions, Clinical Decision Support at Intermountain Healthcare, Case Study - Clinical Decision Support Within the Regenstrief Medical Record System

UNIT - 4

(12 Hours)

Decision Support During Inpatient Care Provider Order, Entry: The Vanderbilt Experience, Decision Support for Patients



UNIT – 5

(12 Hours)

Clinical Decision Support Systems Mobile Apps, Optimizing Care Processes with Operational Excellence & Process Mining, Value-Based Health Care Supported by Data Science

COURSE OUTCOMES –

Upon successful completion of the course student would be –

- Able to develop a detailed understanding of the history of Knowledge-based systems and clinical decision support and how it's currently implemented at Apollo Hospitals and at other institutions.
- Able to Become familiar with evidence-based medicine and the use of clinical guidelines and quality of care metrics to support provider decision-making
- Able to Understand the use and importance of controlled vocabularies in building clinical decision support tools
- Able to Demonstrate design and usability principles as it relates to the use of clinical decision support tools
- Able to Employ classical and machine learning models in clinical decision support systems

Text Books

1. Clinical Decision Support Systems: Theory and Practice, Eta S Berner, Springer, 1998
2. Clinical Decision Support System: An Effective Pathway to Reduce Medical Errors and Improve Patient Safety, Chiang S. Jao and Daniel B. Hier, InTech, 2010

Reference Text Books

1. Decision Support System, by Herasymowych, ISBN13: 978-0980881523, 2nd Edition
2. Decision Support Systems for Business Intelligence, by Vicki Lynn Sauter, ISBN13: 978-0470433744, 2nd Edition
3. Foundations of Clinical Research: Applications to Evidence-Based Practice, by Leslie G. Portney, ISBN13: 978-0803661134, 4th Edition

COURSE DESCRIPTION

This course will provide a rigorous, yet easy to follow, introduction to the main concepts underlying machine learning in healthcare and quantification of the resources needed to learn a given concept.

LEARNING OBJECTIVES

1. How to tell a story from data
2. How to marshal the data for storyline
3. The ability to develop visualization to tell the story
4. The focus is on analysis of data using visualization as a tool

UNIT – 1**(12 Hours)**

Introduction to Data Sciences: Concepts of business intelligence and business analytics, Simple data retrieval vs data processing, Role of data scientists vs data analysts, Hidden facts in data, unearthing the facts, Evolution of data science, popular techniques & algorithms, Concepts of predictive and prescriptive analytics, Concepts of data clusters, data distribution, time series data, text processing

UNIT – 2**(12 Hours)**

Python for Data Visualization Introduction, Matplotlib, Matplotlib Functional Method, Matplotlib Object-Oriented Method, Resolution and Saving Figures, Legend, Customization of the Plot Appearance, Scatterplot, Histogram Boxplot, Seaborn, Distribution Plots, Joint Plots, Pairplot, Barplot, Boxplot, Violin Plot, Heatmaps, Cluster Maps, Regression Plot, Plotly – Interactive Data Visualization Geographical Plotting

UNIT – 3**(12 Hours)**

Principal Component Analysis, Introduction, Variance as Information, Data Transformation, Case Study, PCA: Step-by-Step, Standardization of the Features, Obtain the Eigenvectors and Eigenvalues, Choosing Axes with Maximum Variance, Programing Drive

Hands-On Exercises on Differential Gene Expression Analysis, Quality Control, Normalization, Differential Expression Analysis, Cluster Map, Gene Enrichment Analysis, SNP Analysis,

UNIT – 4

(12 Hours)

Machine Learning and Linear Regression, Introduction to Machine Learning and Its Applications in Biology, Types of Machine Learning Systems Optimization of Models, Challenges in Machine Learning Projects, Linear Regression, General Workflow of a Machine Learning Project, Implementation of Linear Regression Using Scikit-Learn Loading Dataset, Train-Test Split, Training Model, Model Evaluation, Predicting Child Height Based on Parents Height, Predicting the Height of Sons, Predicting the Height of Daughters

UNIT – 5

(12 Hours)

Logistic Regression, Introduction Implementation of Logistic Regression Using Sklearn, Train-Test Split, Training the Logistic Regression Model, Evaluation of Model, Retrieving Intercept and Coefficient, Data Scaling, Predicting a New Result, Breast Cancer Prediction Using Logistic Regression, Model Evaluation

COURSE OUTCOMES –

Upon successful completion of the course student would be –

- Able to Discuss the difference between descriptive, predictive and prescriptive analytics
- Able to Outline the characteristics of “Big Data”
- Able to Enumerate the necessary skills for a worker in the data analytics field
- Able to List several limitations of healthcare data analytics
- Able to learn about the application of visualization tools for health data

Text Books

1. Data Analytics in Healthcare Research - With Access, by David Marc, ISBN13: 978-1584264439

2. Healthcare Data Analytics, edited by Chandan K. Reddy, Charu C. Aggarwal, CRC Press, first edition

Reference Text Books

1. Healthcare Data Analytics and Management, edited by Nilanjan Dey, Amira S. Ashour, Simon James Fong, Chintan Bhatt, Academic Press, Vol. 2

2. Python for data science for dummies by John Paul Mueller, Luca Massaron, Wiley Publishers

3. Programming through Python by M. T. Savaliya, R. K. Maurya, G. M. Magar, STAREDU Solutions

HIAT1509:**ARTIFICIAL INTELLIGENCE AND CLOUD COMPUTING FOR HEALTH INFORMATICS**

L T P C

4 0 0 4

Course Description:

This course will introduce students to the concepts of Artificial Intelligence (AI) and Cloud Computing in the field of Health Informatics. The course will cover the basics of machine learning, natural language processing, and computer vision as applied to healthcare.

Students will also learn about cloud computing, including cloud architecture, deployment models, and services such as Infrastructure as a Service (IaaS), Platform as a Service (PaaS), and Software as a Service (SaaS). The course will focus on the applications of AI and Cloud Computing in healthcare, such as predictive modelling, clinical decision support, population health management, and data analytics.

Course Objectives:

- Understand the fundamental concepts of Artificial Intelligence and Cloud Computing in healthcare
- Apply AI and Cloud Computing techniques to healthcare data to solve real-world problems
- Evaluate the benefits and risks of using AI and Cloud Computing in healthcare
- Develop skills in data analysis, machine learning, and cloud deployment
- Analyse the ethical and legal implications of AI and Cloud Computing in healthcare

Course Outline:

Unit 1: Introduction to AI and Cloud Computing in Healthcare 07 Hours

- Overview of Health Informatics
- Introduction to Artificial Intelligence and Cloud Computing
- Healthcare data and challenges
- Introduction to language models

Unit 2: Cloud Computing for Health Informatics and Big Data Analytics. 15 Hours

- Cloud architecture and deployment models
- Cloud services: IaaS, PaaS, and SaaS
- Cloud security and compliance
- Data warehousing and data mining
- Predictive modelling and decision support
- Population health management

Unit 3: Machine Learning and Natural Language Processing for Health Informatics

15 Hours

- Supervised and unsupervised learning
- Data pre-processing and feature extraction
- Model evaluation and selection
- Natural language processing (NLP) for machine learning in healthcare
- Text classification and sentiment analysis
- Named Entity Recognition (NER)
- Applications of language models in healthcare

Unit 4: Computer Vision for Health Informatics 15 Hours

- Image processing and feature extraction
- Object detection and recognition
- Medical imaging analysis

Unit 5: AI and Cloud Computing Applications in Healthcare and Ethical and Legal Issues

8 Hours

- Clinical decision support systems
- Electronic Health Records (EHR) and telemedicine
- Precision medicine and genomics
- Privacy, security, and confidentiality
- Bias and fairness
- Regulatory and compliance issues



Text book:

1. Adam Cheyer and Emily A. Cooper, "AI for Healthcare: A Navigational Guide for Beginners," O'Reilly Media, 2019.

Reference Text Books:

- Eric Topol, "Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again," Basic Books, 2019.
- Joseph Kvedar, "The Internet of Healthy Things," The MIT Press, 2015.
- Ozlem Uzuner and Rebecca S. Crowley, "Natural Language Processing for Clinical Data: A Guide to Systems and Applications," Springer, 2019.

HIAT1510:

LEGAL AND ETHICAL ASPECTS OF HEALTH INFORMATICS

L T P C

3 1 0 4

COURSE DESCRIPTION

This course introduces students to the workings of the Global legal system and concepts and theories of ethics, examines the legal, ethical, and regulatory issues that impact the protection of confidentiality and integrity of patient information, and, on the other hand, the improvement of accessibility of patient information to enable healthcare providers to make informed decision based on complete patient data.

LEARNING OBJECTIVES

- To Identify a complete health record according to organizational policies, external regulations and standards.
- To Apply system security policies according to departmental and organizational data/information standards.
- To Apply policies and procedures surrounding issues of access and disclosure of protected health information.

UNIT – 1

(12 Hours)

ETHICS IN BIOMEDICAL AND HEALTH INFORMATICS: USERS, STANDARDS, AND OUTCOMES

Ethical Issues in Biomedical and Health Informatics, Health-Informatics Applications: Appropriate Use, Users, and Contexts, Privacy, Confidentiality, and Data Sharing, Social Challenges and Ethical Obligations, Legal and Regulatory Matters

UNIT – 2

(12 Hours)

AN OVERVIEW OF ETHICS

Ethical Standards, Ethical Decisions and Challenges, Bioethics Issues

UNIT - 3

(12 Hours)

LEGAL AND ETHICAL ISSUES CENTRAL TO HEALTH INFORMATION MANAGEMENT



Patient Record Requirements, Confidentiality and Informed Consent, Access to Health Information, Specialized Patient Records

UNIT – 4

(12 Hours)

SPECIALIZED AREAS OF CONCERN IN HEALTH INFORMATION MANAGEMENT

Risk Management, Quality Management, and Utilization Management, Information Systems, Health Care Fraud and Abuse, Law and Ethics in the Workplace

UNIT – 5

(12 Hours)

Professional ethics for Public health practitioners: Developing empathy, resolving conflicts and building consensus, conflict of interest, issues of integrity, transparency and accountability, communication skills, etc

COURSE OUTCOMES –

Upon successful completion of the course student would be –

- Able to Maintain user access logs/systems to track access to and disclosure of identifiable patient data.
- Able to Explain the HIPAA privacy standards and rules with regard to health information use and disclosure.
- Able to Apply confidentiality and security measures to protect paper-based and electronic health information.

Text Books

1. Legal and Ethical Aspects of Health Information, by Dana C. Mcway, ISBN13: 978-1285867380, 4th Edition
2. Ethical Health Informatics, by Laurinda Beebe Harman, ISBN13: 978-1284053708, 3rd Edition

Reference Text Books

1. Legal and Ethical Aspects of Health Information Management, by Dana C. McWay, ISBN13: 978-0357361542, 5th Edition

2. Fundamentals of Law for Health Informatics and Information Management, Brodник, McCain, Rinehart-Thompson, and Reynolds, American Health Information Management Association, 2009.

3. Health Information Management Technology: An Applied Approach, ed. by Merida L. Johns, PhD, RHIA, American Health Information Management Association, current edition.

List of experiments

1. Write a Python code to calculate the statistical values, such as mean, median, standard deviation, skewness, and kurtosis of a Health care Data Set.
2. Write a Python code to extract the ECG signal features utilizing continuous wavelet transform (CWT).
3. Write a Python code to extract the EEG signal features utilizing discrete wavelet transform (DWT) with 6-level decomposition
4. Write a Python code to extract the ECG signal features utilizing stationary wavelet transform (SWT) with 5-level decomposition
5. Write a program to implement the naïve Bayesian classifier for a sample patient data set stored as a .CSV file.
6. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. Use Java/Python ML library classes/API.
7. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of CKD patients using standard Renal Disease Data Set. Use Java/Python ML library classes/API.
8. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of Malignant Cancer patients using standard Breast Cancer Data Set. Use Java/Python ML library classes/API.
9. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of Diabetes patients using standard Medical Data Set. Use Java/Python ML library classes/API.
10. Write a program to plot a dendrogram of amino acid sequence of human genes. Use divisive clustering in Java/Python ML library classes/API

List of experiments

1. Familiarizing with Anaconda and Jupyter for importing modules and dependencies for ML
2. Familiarization with NumPy, Panda and Matplotlib by Loading Dataset in Python
3. Implement and demonstrate the FIND-S algorithm for finding the most specific hypothesis based on a given set of training data samples. Read the training data from a .CSV file.
4. For a given set of training data examples stored in a .CSV file, implement and demonstrate the Candidate-Elimination algorithm to output a description of the set of all hypotheses consistent with the training examples.
5. Write a program to demonstrate the working of the decision tree based ID3 algorithm. Use an appropriate data set for building the decision tree and apply this knowledge to classify a new sample.
6. Build an Artificial Neural Network by implementing the Back propagation algorithm and test the same using appropriate data sets.
7. Write a program to implement the naïve Bayesian classifier for a sample training dataset stored as a .CSV file. Compute the accuracy of the classifier, considering few test data sets
8. Assuming a set of documents that need to be classified, use the naïve Bayesian Classifier model to perform this task. Built-in Java classes/API can be used to write the program. Calculate the accuracy, precision, and recall for your data set.
9. Write a program to construct a Bayesian network considering medical data. Use this model to demonstrate the diagnosis of heart patients using standard Heart Disease Data Set. You can use Java/Python ML library classes/API.
10. Apply EM algorithm to cluster a set of data stored in a .CSV file. Use the same data set for clustering using k-Means algorithm. Compare the results of these two algorithms and comment on the quality of clustering. You can add Java/Python ML library classes/API in the program.

11. Write a program to implement k-Nearest Neighbour algorithm to classify the iris data set. Print both correct and wrong predictions. Java/Python ML library classes can be used for this problem.
12. Implement the non-parametric Locally Weighted Regression algorithm in order to fit data points. Select appropriate data set for your experiment and draw graphs.
13. Find procedure to run the virtual machine of different configuration. Check how many virtual machines can be utilized at particular time.
14. Find procedure to attach virtual block to the virtual machine and check whether it holds the data even after the release of the virtual machine.
15. Install a C compiler in the virtual machine and execute a sample program.
16. Show the virtual machine migration based on the certain condition from one node to the other.
17. Find procedure to install storage controller and interact with it.
18. Find procedure to set up the one node Hadoop cluster.
19. Mount the one node Hadoop cluster using FUSE.
20. Write a program to use the API's of Hadoop to interact with it.

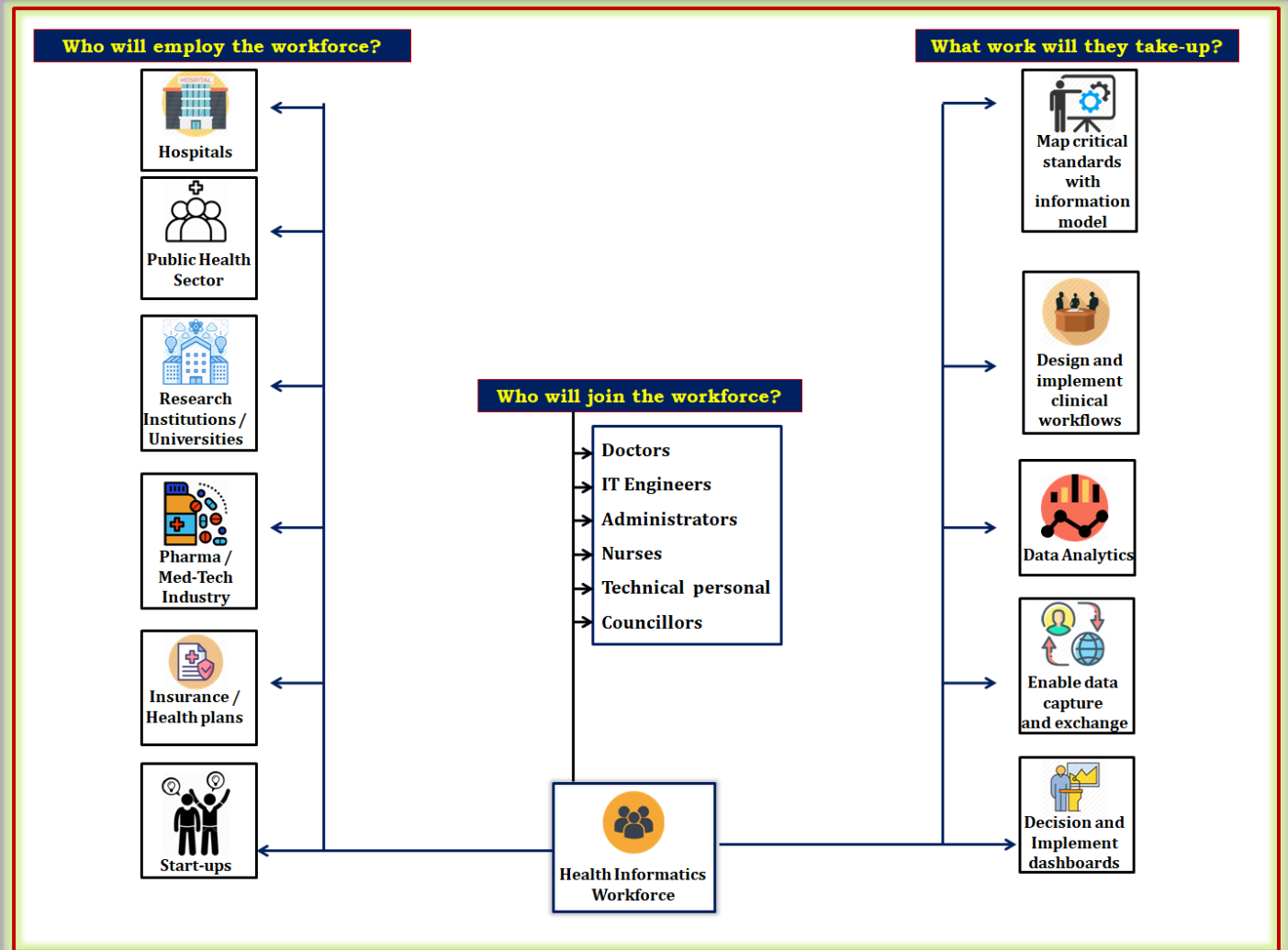
Mini Project

Guidelines

1. Mini Project may be a theoretical analysis, modelling & simulation, experimentation & analysis, prototype design, fabrication of new equipment, correlation and analysis of data, software development, applied research and any other related activities.
2. Project can be for one or two semesters based on the completion of required number of credits as per the academic regulations.
3. Can be individual work or a group project, with a maximum of 3 students.
4. In case of group projects, the individual project report of each student should specify the individual's contribution to the group project.
5. Carried out inside or outside the university, in any relevant industry or research institution.
6. Publications in the peer reviewed journals / International Conferences will be an added advantage



Capacity Building in Health Informatics





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