Sensing, ArtiFicial intelligence, and Edge networking towards Rural Health monitoring (SAFE-RH)

Deliverable 1.3:

Design 3 Training Programs and Learning Materials

SAFE-RH Project no. 619483-EPP-1-2020-1-UK-EPPKA2-CBHE-JP

Table of Contents

Training Module and MS/PhD Elective Courses

1. Introduction

The deliverables of SAFE-RH project include pilot projects targeting elderly people, pregnant ladies and infants. Since the focus of project is remote health monitoring, so it involves IoT based medical equipment, communication technologies, remote medical examination and use of AI models for early prediction of emergency situations. All these activities will be backed up by a Patient Management Information System (MIS) that will be linking all components and stakeholders. Since the system involves concepts and technologies from medical and IT domains, different stakeholders specially patients and people from medical domain need proper training to be able to use the system. The trainings have been designed at two levels; short term one-day training modules and graduate level MS courses.

2. Elective Courses

The MS elective courses (T1 and T2) have been defined at different Pakistani universities and have been approved from relevant statuary bodies (BoS, BoF and Academic Council). Some of these courses will be offered as elective courses in MS(CS) programs in partners universities from Spring 2023 semester. In IUB one Elective Course is alraedu=y offered in MS(IT) and PhD (IT) in Fall-2022 session from 06th September 2022. It will prepare graduates in the domain of remote health monitoring that will support the usage and R&D activities in this critical domain. The training programs mentioned under T3 are short courses mainly designed for medical staff and patients. These people need proper training of IoT based medical gadgets and use MIS. These courses span 2 to 4 hours and different programs can be combined for the training of a specific group. Following are the details of training programs as defined in the project proposal:

2.1. (Tl) Smart components (MS Elective Courses)

Sr. No.	Title of Course	University	Credit Hours	Approved from	Offered as Elective
1.	Internet of Things for e-Health	IUB*, CUST**	3	BoS, BoF, AC	Spring 23
2.	Topics in Information Technology	IUB*	3	BoS, BoF, AC	Spring 23
3.	Embedded Systems for Digital Health	CUST**	3	BoS	Spring 23

2.2. (T2) Big Data and Data analytics (MS Elective Courses)

Sr. No.	Title of Course	University	Credit Hours	Approved from	May be Offered as Elective
1.	Data Mining for Health-Care Analysis	IUB*, CUST**	3	BoS, BoF, AC	Fall 22 (IUB)
2.	Introduction to Health-Care Analysis	IUB*	3	BoS, BoF, AC	From Spring 23
3.	Quantitative Analysis for decision making in healthcare systems	IUB*	3	BoS, BoF, AC	From Spring 23
4.	Applied Health-Care Statistics	IUB*	3	BoS, BoF, AC	From Spring 23
5.	Health-Care Data Acquisition and Management	IUB*, CUST**	3	BoS, BoF, AC	From Spring 23
6.	Applied Biotechnology	IUB*	3	BoS, BoF, AC	From Spring 23
7.	Artificial Intelligence in Healthcare	CUI***	3	BoS, BoF, AC	From Spring 23
8.	Security and Privacy in IoT-based Healthcare	CUI***	3	BoS, BoF, AC	From Spring 23

* Outlines and approval of these courses are attached in Annexure A
** Outlines and approval for these courses are attached in Annexure B
*** Outlines and approval for these courses are attached in Annexure C

3. Training Modules

Following Modules are designed for Medical Doctors, Patients, and Healthcare workers:

1. Introduction to Basic ICT (Information & Communication Technology)
2. Introduction to Assistive Technology
3. SAFE-RH Management Information System (MIS) for Remote Health Monitoring
4. Healthcare Data Analytics

3.1 (T3) Training Modules to develop health workers' skills (Short duration modules)

These modules have been designed to prepare people for the usage of assistive devices, like, BP operator, Oxymeter, Blood Glucose meter etc. and MIS developed under SAFE-RH. These modules involve training through powerpoint slides and also demo of different hardware and software. The modules have been defined in such a way that each one has a specific purpose, however, while providing training to a specific group, different modules will be combined as per the nature of audience. For example, for paramedics, a basic introduction to basic ICT would be given followed by use of Assistive Technologies and then the use of MIS. They would not be trained on predictive analytics. However, while training doctors, they will be trained on this part as well. Following is a short description of each of the four modules:

1- **Introduction to Basic ICT:** This module mainly targets to paramedics and patients with an assumption that they are very little or somewhat familiar with the IT concepts. So starting from very basic things, like PC, components, hardware and software, then followed by operating systems, windows, Microsoft office and finally use of web for searching or emails. This will help to remove the hesitation with the computer and use of I/O devices of computer

2- **Introduction to Assistive Technology:** This module focuses on use of IoT based medical equipment that would be used as part of SAFE-RH. The equipment like, BP apparatus would be used by patient or paramedic and the reading will be transferred to the fog-node installed near by and from there the reading would pass through AI model deployed on fog and from there the reading will move to IT lab or cloud server. The paramedics are most likely familiar with these medical equipment and their use but IoT based devices that are linked with the MIS and that transfer the reading to the system automatically might be new for them. This module will train them for the usage of such equipment.

3- **SAFE-RH Management Information System (MIS) for Remote Health Monitoring:** The backbone of SAFE-RH is the MIS system that is built under the project and that links all different components of the project, starting right from doctors, paramedical staff, patients, administrator, IoT devices, AI models, cloud and IT lab. The proper training of all stakeholders including medical staff and patients is essential to make full usage of the system. This training will train them through powerpoint slides and also through hands-on training with the system

4- **Healthcare Data Analytics:** The most unique feature of SAFE-RH system is the round the clock monitoring of patients through AI models that are being trained and are being

deployed in the system. With proper training, testing, deployment and runtime testing of this part of SFE-RH will really help to boost the health services anywhere in the world. This module explains the usage of predictive part of SAFE-RH project to the medical staff

The details of the training modules are as follows:

Sr.#	Training Module Name	Description	Target groups	Prerequisite	Resources Used during Training	Training Strategies	Starting Date/ Venue
1	Introduction to Basic ICT	Identify the relevant components of a computer	Doctors, paramedics, and Healthcare workers	This is the most basic ICT trainings which do not need any pre-requisite.	• PowerPoint Slides • Data projector • Computer • Resource manual	**Information Session** (1 hour): Basic Information **Practical Session** (2 hours): Individual sessions in front of a computer	31-10-2022 Shahida Islam Medical College, Bahawalpur (SIMC)
2	Introduction to Assistive Technology	Module focuses on the use of IoT based medical equipment that would be used as part of SAFE-RH.	Doctors, Healthcare workers, Patients	Basic Knowledge of ICT.	• PowerPoint Slides • Data projector • Computer • Resource manual	**Information Session** (1 hour): Basic Information **Practical Session** (2 hours): with diagnostic equipment	31-10-2022 Shahida Islam Medical College, Bahawalpur (SIMC)
3	SAFE-RH Management Information System (MIS) for Remote Health Monitoring:	MIS system links all different components of the project, starting right from doctors, paramedical staff, patients, administrator, IoT devices, AI models, cloud and IT lab.		Basic Knowledge of ICT.	• PowerPoint Slides • Data projector • Computer • Resource manual	**Information Session** (1 hour): Basic Information **Practical Session** (2 hours): Individual sessions in front of a computer	31-10-2022 Shahida Islam Medical College, Bahawalpur (SIMC)
The 4nd Training Module will be created after the diagnostic Equipment (watch) is fully functional and AI models that are being trained and are being deployed in the system.							
4	Healthcare Data Analytics	Describe the monitoring of patients through AI models that are being trained and are being deployed in the system	Doctors, and Healthcare workers	* Basic Knowledge of ICT. * Assistive Technology * SAFE-RH Management Information System (MIS)	• PowerPoint Slides • Data projector • Computer • Resource manual	**Information Session** (1 hour): Basic Information **Practical Session** (1 hours)	To Be Announced (TBA)

3.2 Trainings in Progress

Following two trainings have been designed and conducted and in Process so far:

S. No	Target Group	Description	Persons Trained	Date	Duration	Modules included
1.	Paramedics, Doctors	Working on 3 clinics for medical and personal data entry, and patients data entry	9	Multiple From Jan 2022	2 hrs	Parts of module 1, module 4
2.	Doctors, final year medical students	Shahida Islam Medical College, Bahawalpur (SIMC)	80	31/10/22	2 hrs	Parts of 1, 2, 3

3.3 Training Assessment

There are two questionnaires related to Kirkpatrick model for Training Assessment. Level 1 form has to be filled in after the training, and Level 2 form has to be filled in before and after the training (Prepared by CUST).

Annexure A

Post Graduate Level Course (IUB)

IUB has opted seven advance courses related to healthcare data management and handling, at Masters and PhD Level.

Sr. #	Course Code	Course Description	Credit Hours	Status
1.	INFT-31048	Introduction to health care analysis	03	Elective
2.	INFT-31049	Data Mining for health care Analysis	03	Elective
3.	INFT-31050	Applied health care statistics	03	Elective
4.	INFT-31051	Health care data acquisition and management	03	Elective
5.	INFT-31052	Quantitative methods and decision analysis.	03	Elective
6.	INFT-31053	Applied Biotechnology	03	Elective
7.	INFT-31054	Topics in Information Technology	03	Elective

The above Courses are approved from all statutory bodies (BoS, BoF, Academic Council and Syndicate) of the IUB for MS and PhD programs. After the approval from these bodies the case was submitted to HEC, Pakistan for NoC to launch these courses in above said programs. The detail is given below and course outlines are attached.

Sr. #	Post Graduate Leve	Statuary Bodies of IUB				NOC Received from HEC	Commencement of classes in Fall-2022 Semester
		Board of Studies	Board of Faculty	Academic Council	Syndicate		
1.	MS IT	08-03-2021	25-05-2021	19-06-2021	05-08-2021 [76th]	28-06-2022	05-09-2022
2.	PhD IT	08-03-2021	25-05-2021	19-06-2021	05-08-2021 [76th]	26-07-2022	05-09-2022

*Note: All relevant document available in the Department are attached in Annex-A. The remaining Documents are in Registrar Office of The IUB, which can be acquired on the request.

Commencement of Classes in Fall-2022 Semester (MS IT)

The course of "Data Mining for health care Analysis" is introduced in Fall-2022 Semester and the commencement of classes has started from 5th September, 2022.

Time Table and Class Enrolment sheet of MS-IT 1st Semester

MS IT 1st 1M Fall 2022-2024	
Day	**03:00 PM – 06:00 PM**
Wednesday	INFT-31002 Advanced Research Methodology Dr. Najia Saher
Thursday	INFT-31001 Advanced Theory of Computation Dr. Ali Nawaz
Friday	INFT-31025 Elective-I Distributed System Dr.Omer Riaz INFT-31057 Elective-I- Software Project Management Ms. Afsah Imtiaz Elahi
Saturday	INFT-31036 Elective II Information Retrieval Techniques Dr. Muhammad Saad Missen **INFT-31049** **Elective II- Data Mining for health care Analysis** **Dr. Dost Muhammad Khan**

The Islamia University of Bahawalpur
Department of Information Technology
Faculty of Computing, Baghdad-ul-Jadeed Campus, Bahawalpur.

Class: MS (IT) MORNING 1ST SEMESTER, SESSION 2022-2024 (FALL)

Subject: INFT-31049 Elective II- Data Mining for health care Analysis

Resource Person: Dost Muhammad Khan

FALL 2022 SEMESTER

Sr.	Roll No.	Student Name	Father's Name
1.	F22BINFT3M01019	Abdul Salam	Ghulam Mustafa
2.	F22BINFT3M01021	Jahan Zaib Hassan	Saif Ullah
3.	F22BINFT3M01022	Iqra Bibi	Ghulam Mustafa
4.	F22BINFT3M01023	Farooq Sattar	Abdul Sattar Shah
5.	F22BINFT3M01024	Wisha Anam	Rasheed Ahmad
6.	F22BINFT3M01025	Muhammad Zamad Qureshi	Khushi Muhammad
7.	F22BINFT3M01026	Rumysa Khalid	Khalid Javed
8.	F22BINFT3M01027	Muhammad Hashim	Muhammad Ajmal
9.	F22BINFT3M01028	Sehrish Ejaz	Muhammad Ejaz Khan
10.	F22BINFT3M01029	Shahid	Ghulam Muhammad
11.	F22BINFT3M01030	Tania Zulfiqar	Zulfiqar Ali
12.	F22BINFT3M01031	Shabbar Khan Saddozai	Abid Nawaz Khan
13.	F22BINFT3M01032	Razia Bibi	Khuda Bukhash
14.	F22BINFT3M01033	Hameed Ullah	Saeed Ul Hassan
15.	F22BINFT3M01034	Shaista Naseem	Kareem Dad
16.	F22BINFT3M01035	Shazia Akram	Muhammad Akram
17.	F22BINFT3M01036	Muhammad Ejaz	Muhammad Nawaz
18.	F22BINFT3M01039	Nabila Shaheen Rao	Shaheen Akhtar
19.	F22BINFT3M01040	Nashra Alvi	Riaz Akhtar
20.	PENDING	Rameen Fatima	Haroon Ur Rasheed
21.	PENDING	Awais Akhtar	Akhtar Razzaq
22.	PENDING	Salman Naveed	Naveed Akhtar
23.	PENDING	Muhammad Nauman	Muhammad Mukhtar Shaheen
24.	PENDING	Ali Hamza Jamil	Jameel Ur Rehman
25.	PENDING	Sheikh Muhammad Sarfraz	Sheikh Fazal Ahmad
26.	PENDING	Muhammad Zohaib Aslam	Muhammad Aslam

Teacher's Signature: _____

Commencement of Classes in Fall-2022 Semester (PhD IT)

The course of "Data Mining for health care Analysis" is introduced in Fall-2022 Semester and the commencement of classes has started from 5th September, 2022. Following is the **Time Table and Class Enrolment sheet of PhD 1st -2nd Semester**

PHD IT 2nd Fall 2021-2025	
Code	**03:00 PM – 06:00 PM**
Thursday	**INFT-31049** **Elective IV- Data Mining for health care Analysis** **Dr. Dost Muhammad Khan**
Friday	INFT-41027 Elective-V Parallel & Distributed Computing Dr.Omer Riaz
Saturday	INFT-41171 Elective VII Advanced Human Computer Interaction Dr. Muhammad Saad Missen

The Islamia University of Bahawalpur
Department of Information Technology
Faculty of Computing, Baghdad-ul-Jadeed Campus, Bahawalpur

Class: PHD (IT) MORNING 1ST SEMESTER, SESSION 2022-2024 (FALL)

Subject: INFT-31049 Elective II- Data Mining for health care Analysis

Resource Person: Dost Muhammad Khan

FALL 2022 SEMESTER

Sr.	Roll No.	Student Name	Father's Name
1.	S22BINFT4M01001	Nighat Naz	Muhammad Aslam
2.	S22BINFT4M01002	Mavara Malik	Allah Bukhsh
3.	S22BINFT4M01003	Salma Maqbool	Muhammad Maqbool
4.	S22BINFT4M01004	Muhammad Masood Ahmad	Muhammad Benyameen Khan
5.	F22BINFT4M01001	Abdul Rehman	Shoukat Ali
6.	F22BINFT4M02001	Hafiz Muhammad Arif	Ramooz Ahmed Khan
7.	F22BINFT4M02002	Humera Batool	Lal Din Gill
8.	F22BINFT4M02003	Asma Nadeem	Khadim Hussain
9.	F22BINFT4M02004	Meherwar Fatima	Ghulam Hussain
10.	F22BINFT4M02005	Ramisha Farrukh	Furrukh Rafiqe
11.	F22BINFT4M02006	Sonia Jamil	Jamil Fakhar
12.	F22BINFT4M02007	Sumair hameed	Hameed Ullah

Teacher's Signature: _____

Course Details

Introduction to Health-Care Analysis					
Credit Hours:	3	**Course Code:**	INFT-31048	**Prerequisites:**	
Course Contents:					
The Changing American Healthcare System, Technology Enabled Clinical Care, Modern Patient Management, Improvement Frameworks, Measuring Health System Performance, Enabling Healthcare Analytics, Introduction to Business Intelligence (BI), Comparing Healthcare Delivery, Forming a Healthcare Analytics Unit					
Teaching Methodology:					
Lectures, Power Point Slides, Interactive Sessions, Extra Material, Projects, Presentations					
Course Assessment:					
Midterm Exam, Quizzes, Home Assignments, Projects, Presentations, Final Exam					
Reference Material:					
Last Five years research papers of reputed journals and conferences.					

Data Mining for Health-Care Analysis					
Credit Hours:	3	**Course Code:**	INFT-31049	**Prerequisites:**	
Course Contents:					
SAS Sign On and Data Set, Introduction to Data Mining, Data Mining Standards and Process, Data Mining Barriers and Opportunities, Preparation for Data Mining Part 1, Preparation for Data Mining Part 2, Data Mining Techniques, Data Mining Techniques - Sampling of Categories, Algorithms, Training Data, and Models Part 1, Data Mining Techniques - Sampling of Categories, Algorithms, Training Data, and Models Part 2, Data Visualization and Reporting, Group Presentations, Data Infrastructures and Supporting Technologies					
Teaching Methodology:					
Lectures, Power Point Slides, Interactive Sessions, Extra Material, Projects, Presentations					
Course Assessment:					

Midterm Exam, Quizzes, Home Assignments, Projects, Presentations, Final Exam
Reference Material:
Last Five years research papers of reputed journals and conferences.

Applied Health-Care Statistics					
Credit Hours:	3	**Course Code:**	INFT-31050	**Prerequisites:**	
Course Contents:					
Introduction and History, Epidemiology and Applications to Healthcare and Population Health, Observational Study Designs, Introduction to Statistical Models, Part 1 - Use and Interpretation, Introduction to Statistical Models, Part 2 - Use and Interpretation, Model Building and Diagnostics, Bias, Confounding, and Effect Modification, Techniques for Survival Analysis, Sample Size Planning & Other Miscellaneous Topics					
Teaching Methodology:					
Lectures, Power Point Slides, Interactive Sessions, Extra Material, Projects, Presentations					
Course Assessment:					
Midterm Exam, Quizzes, Home Assignments, Projects, Presentations, Final Exam					
Reference Material:					
Last Five years research papers of reputed journals and conferences.					

Health-Care Data Acquisition and Management					
Credit Hours:	3	**Course Code:**	INFT-31051	**Prerequisites:**	
Course Contents:					
Sources and Types of Healthcare Data, Data Selection and Querying, Data Harmonization/Integration, Continue to work on assignments from weeks 2 and 3, Common Data Representations in Healthcare Systems , Healthcare Data Models, Data Quality, Acquiring Complete Data, Ethics, Data Ownership, and Privacy, New Models of Data Organization and Analytics – Clinical Registries					

Teaching Methodology:
Lectures, Power Point Slides, Interactive Sessions, Extra Material, Projects, Presentations
Course Assessment:
Midterm Exam, Quizzes, Home Assignments, Projects, Presentations, Final Exam
Reference Material:
Last Five years research papers of reputed journals and conferences.

Quantitative Methods and Decision Analysis					
Credit Hours:	3	**Course Code:**	INFT-31052	**Prerequisites:**	
Course Contents:					
Methods I: Introduction, Quantitative Methods, and Decision Analysis, Methods II: Predictive Modeling and Visualization, Methods III: Clinical Identification Algorithms and Analytical Groupers, Utilization and Staffing: Forecasting Healthcare Demand, Risk Stratification: Targeting Interventions to Achieve Value, Population Health Management: Comparing Clinical Interventions, Quality: Profiling Providers, Measuring Adverse Events , Cost Containment: Readmissions and Super-Utilizers, Healthcare Finance: Fraud Detection, Synchronous Group Presentations and Wrap-Up					
Teaching Methodology:					
Lectures, Power Point Slides, Interactive Sessions, Extra Material, Projects, Presentations					
Course Assessment:					
Midterm Exam, Quizzes, Home Assignments, Projects, Presentations, Final Exam					
Reference Material:					
Last Five years research papers of reputed journals and conferences.					

Applied Biotechnology					
Credit Hours:	3	**Course Code:**	INFT-31053	**Prerequisites:**	

Course Contents:

Isolate, enumerate and identify microorganisms from many types of samples, Accurately calibrate and use instruments such as pH and BOD meters, gas chromatographs, spectrophotometers, HPLCs, centrifuges, PCR thermocyclers and gel electrophoresis equipment, Prepare media and reagents to culture pathogenic microbes, Design and perform advanced microbiology and microbial genetics experiments, Isolate DNA and perform gel electrophoresis and polymerase chain reaction (PCR) on samples, Perfect your aseptic techniques, Isolate, enumerate and identify microorganisms from many types of samples (the human body, water, soil, air, food, and pharmaceutical and cosmetic products), Accurately calibrate and use a range of instruments such as pH and BOD meters, gas chromatographs, spectrophotometers (regular/IR/UV), HPLCs, centrifuges, PCR thermocyclers and gel electrophoresis equipment, Prepare microbiological media and reagents, Culture pathogenic microbes, Design and perform advanced microbiology and microbial genetics experiments, Use microorganisms to assay pharmaceutical products.

Teaching Methodology:

Lectures, Power Point Slides, Interactive Sessions, Extra Material, Projects, Presentations

Course Assessment:

Midterm Exam, Quizzes, Home Assignments, Projects, Presentations, Final Exam

Reference Material:

Last Five years research papers of reputed journals and conferences.

Topics in Information Technology					
Credit Hours:	3	**Course Code:**	INFT-31027	**Prerequisites:**	

Course Learning Outcomes (CLOs):

At the end of the course, the students will be able to:

1. Develop skills in independent project work, research and Knowledge on the latest trends of information technology.
2. Understand broad research spectrum of Information Technology.
3. Design and argue about the validity of particular research idea.
4. Propose a contribution in particular research area.

Course Contents:

Specialized study within an area of Information Technology, guided by a supervisor. Topics include theoretical and applied aspects of Information Technology. Combines guided reading and research with a significant individual or group project component. Although, this course doesn't cover some specific topics. Rather course outline depends upon the availability of resources. In general, the special topics will focus on issues related to advance graduate topics with a research component. In addition to a broad grounding across the breadth of advanced Information Technology, the students will develop specialist knowledge in couple of the research area such as ERP, Requirement Engineering Tools and Methods, Simulation, Virtual Reality, IT project management, Internet Security, Data Warehousing and Mining, Geographic Information Systems, Telemedicine and Medical Informatics, Workflow Management, Quantitative and Qualitative Methods in Information Systems, Intelligent Agent Technology and Applications, Human Computer Interaction, Computer-Based Learning and Training, Philosophical Foundations of Information Systems, Organizational Learning and Collaborative Technologies, Understanding and Managing Information Users Behavior, Policy, Legal and Security Issues in IT, and Virtual Organizations.

Teaching Methodology:

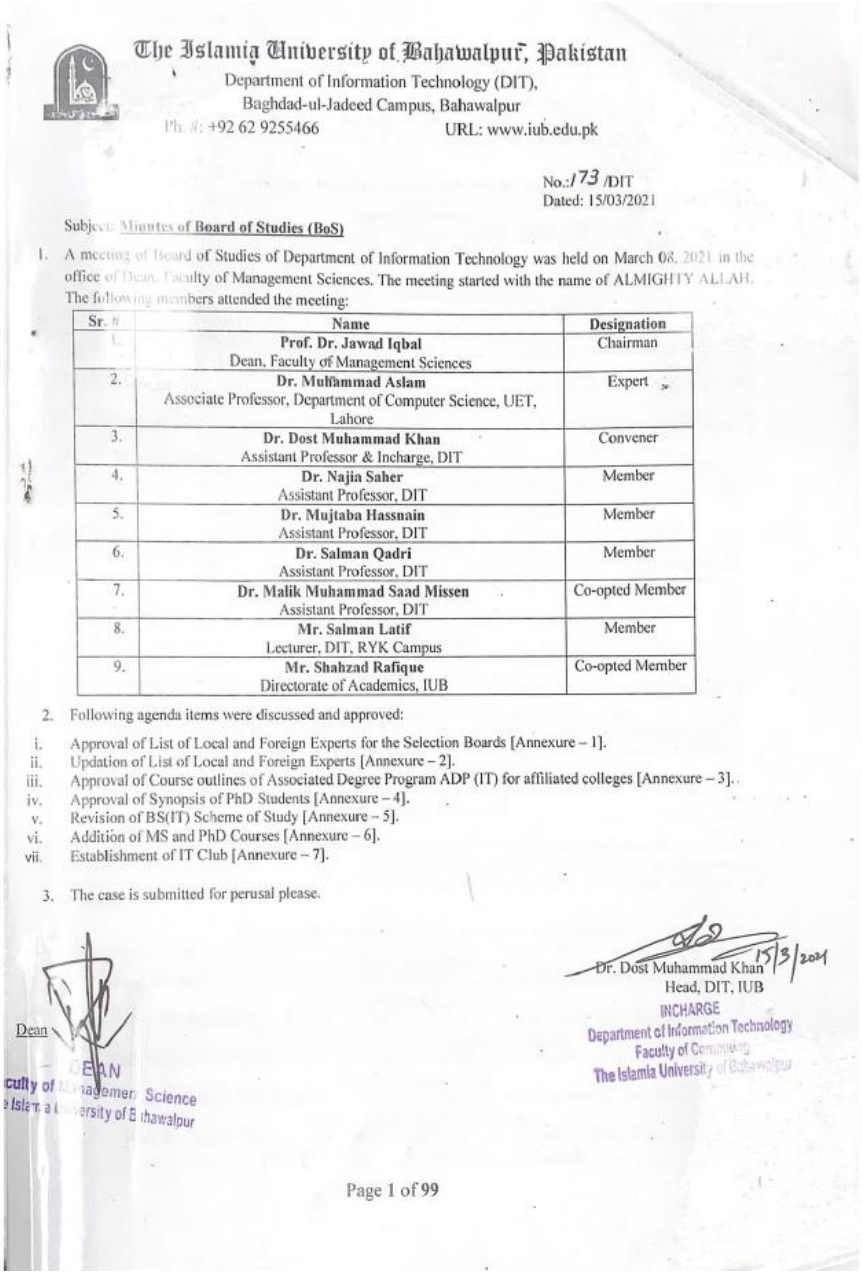
Lectures, Power Point Slides, Interactive Sessions, Extra Material, Projects, Presentations

Course Assessment:

Midterm Exam, Quizzes, Home Assignments, Projects, Presentations, Final Exam

Reference Material:

1. Senft, Sandra, Frederick Gallegos, and Aleksandra Davis. Information technology control and audit. Auerbach publications, 2016, ISBN-10: 1439893209
2. Selective Journals of IEEE / Springer / ACM / Elsevier.



The Islamia University of Bahawalpur, Pakistan
Department of Information Technology (DIT),
Baghdad-ul-Jadeed Campus, Bahawalpur
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No.: 173 /DIT
Dated: 15/03/2021

Subject: Minutes of Board of Studies (BoS)

1. A meeting of Board of Studies of Department of Information Technology was held on March 08, 2021 in the office of Dean, Faculty of Management Sciences. The meeting started with the name of ALMIGHTY ALLAH. The following members attended the meeting:

Sr. #	Name	Designation
1.	**Prof. Dr. Jawad Iqbal** Dean, Faculty of Management Sciences	Chairman
2.	**Dr. Muhammad Aslam** Associate Professor, Department of Computer Science, UET, Lahore	Expert
3.	**Dr. Dost Muhammad Khan** Assistant Professor & Incharge, DIT	Convener
4.	**Dr. Najia Saher** Assistant Professor, DIT	Member
5.	**Dr. Mujtaba Hassnain** Assistant Professor, DIT	Member
6.	**Dr. Salman Qadri** Assistant Professor, DIT	Member
7.	**Dr. Malik Muhammad Saad Missen** Assistant Professor, DIT	Co-opted Member
8.	**Mr. Salman Latif** Lecturer, DIT, RYK Campus	Member
9.	**Mr. Shahzad Rafique** Directorate of Academics, IUB	Co-opted Member

2. Following agenda items were discussed and approved:

i. Approval of List of Local and Foreign Experts for the Selection Boards [Annexure – 1].
ii. Updation of List of Local and Foreign Experts [Annexure – 2].
iii. Approval of Course outlines of Associated Degree Program ADP (IT) for affiliated colleges [Annexure – 3].
iv. Approval of Synopsis of PhD Students [Annexure – 4].
v. Revision of BS(IT) Scheme of Study [Annexure – 5].
vi. Addition of MS and PhD Courses [Annexure – 6].
vii. Establishment of IT Club [Annexure – 7].

3. The case is submitted for perusal please.

Dr. Dost Muhammad Khan 15/3/2021
Head, DIT, IUB
INCHARGE
Department of Information Technology
Faculty of Computing
The Islamia University of Bahawalpur

Dean
DEAN
Faculty of Management Science
The Islamia University of Bahawalpur

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Item 6: Addition of MS and PhD Courses **Annexure – 6**

The BoS approves to add following courses in MS and PhD course list:

Sr.#	Course Code	Course Name	Category
1.	INFT-6151	Introduction to Health-Care Analysis	Elective
2.	INFT-6152	Data Mining for Health-Care Analysis	Elective
3.	INFT-6153	Applied Health-Care Statistics	Elective
4.	INFT-6154	Health-Care Data Acquisition and Management	Elective
5.	INFT-6155	Quantitative Methods and Decision Analysis	Elective
6.	INFT-6156	Applied Biotechnology	Elective
7.	INFT-6157	Internet of Things (IoTs)	Elective
8.	INFT-6158	Topics in Information Technology	Elective

Course Contents

The course content of above courses is given below:

Introduction to Health-Care Analysis					
Credit Hours:	3	**Course Code:**	INFT-6151	**Prerequisites:**	
Course Contents:					
The Changing American Healthcare System , Technology Enabled Clinical Care, Modern Patient Management, Improvement Frameworks, Measuring Health System Performance , Enabling Healthcare Analytics, Introduction to Business Intelligence (BI), Comparing Healthcare Delivery, Forming a Healthcare Analytics Unit					
Teaching Methodology:					
Lectures, Power Point Slides, Interactive Sessions, Extra Material, Projects, Presentations					
Course Assessment:					
Midterm Exam, Quizzes, Home Assignments, Projects, Presentations, Final Exam					
Reference Material:					
1. Last Five years research papers of reputed journals and conferences.					

Data Mining for Health-Care Analysis					
Credit Hours:	3	**Course Code:**	INFT-6152	**Prerequisites:**	
Course Contents:					

SAS Sign On and Data Set, Introduction to Data Mining, Data Mining Standards and Process, Data Mining Barriers and Opportunities, Preparation for Data Mining Part 1, Preparation for Data Mining Part 2, Data Mining Techniques, Data Mining Techniques - Sampling of Categories, Algorithms, Training Data, and Models Part 1, Data Mining Techniques - Sampling of Categories, Algorithms, Training Data, and Models Part 2, Data Visualization and Reporting, Group Presentations, Data Infrastructures and Supporting Technologies
Teaching Methodology:
Lectures, Power Point Slides, Interactive Sessions, Extra Material, Projects, Presentations
Course Assessment:
Midterm Exam, Quizzes, Home Assignments, Projects, Presentations, Final Exam
Reference Material:
1. Last Five years research papers of reputed journals and conferences.

Applied Health-Care Statistics					
Credit Hours:	3	**Course Code:**	INFT-6153	**Prerequisites:**	
Course Contents:					
Introduction and History, Epidemiology and Applications to Healthcare and Population Health, Observational Study Designs, Introduction to Statistical Models, Part 1 - Use and Interpretation, Introduction to Statistical Models, Part 2 - Use and Interpretation, Model Building and Diagnostics, Bias, Confounding, and Effect Modification , Techniques for Survival Analysis, Sample Size Planning & Other Miscellaneous Topics					
Teaching Methodology:					
Lectures, Power Point Slides, Interactive Sessions, Extra Material, Projects, Presentations					
Course Assessment:					
Midterm Exam, Quizzes, Home Assignments, Projects, Presentations, Final Exam					
Reference Material:					
1. Last Five years research papers of reputed journals and conferences.					

Health-Care Data Acquisition and Management					
Credit Hours:	3	**Course Code:**	INFT-6154	**Prerequisites:**	
Course Contents:					
Sources and Types of Healthcare Data, Data Selection and Querying, Data Harmonization/Integration, Continue to work on assignments from weeks 2 and 3, Common Data Representations in Healthcare Systems , Healthcare Data Models, Data Quality, Acquiring Complete Data, Ethics, Data Ownership, and Privacy, New Models of Data Organization and Analytics – Clinical Registries					

Teaching Methodology:
Lectures, Power Point Slides, Interactive Sessions, Extra Material, Projects, Presentations
Course Assessment:
Midterm Exam, Quizzes, Home Assignments, Projects, Presentations, Final Exam
Reference Material:
1. Last Five years research papers of reputed journals and conferences.

Quantitative Methods and Decision Analysis					
Credit Hours:	3	**Course Code:**	INFT-6155	**Prerequisites:**	
Course Contents:					
Methods I: Introduction, Quantitative Methods, and Decision Analysis, Methods II: Predictive Modeling and Visualization, Methods III: Clinical Identification Algorithms and Analytical Groupers, Utilization and Staffing: Forecasting Healthcare Demand, Risk Stratification: Targeting Interventions to Achieve Value, Population Health Management: Comparing Clinical Interventions, Quality: Profiling Providers, Measuring Adverse Events , Cost Containment: Readmissions and Super-Utilizers, Healthcare Finance: Fraud Detection, Synchronous Group Presentations and Wrap-Up					
Teaching Methodology:					
Lectures, Power Point Slides, Interactive Sessions, Extra Material, Projects, Presentations					
Course Assessment:					
Midterm Exam, Quizzes, Home Assignments, Projects, Presentations, Final Exam					
Reference Material:					
1. Last Five years research papers of reputed journals and conferences.					

Applied Biotechnology					
Credit Hours:	3	**Course Code:**	INFT-6156	**Prerequisites:**	
Course Contents:					
Isolate, enumerate and identify microorganisms from many types of samples, Accurately calibrate and use instruments such as pH and BOD meters, gas chromatographs, spectrophotometers, HPLCs, centrifuges, PCR thermocyclers and gel electrophoresis equipment, Prepare media and reagents to culture pathogenic microbes, Design and perform advanced microbiology and microbial genetics experiments, Isolate DNA and perform gel electrophoresis and polymerase chain reaction (PCR) on samples, Perfect your aseptic techniques, Isolate, enumerate and identify microorganisms from many types of samples (the human body, water, soil, air, food, and pharmaceutical and cosmetic products), Accurately calibrate and use a range of instruments such as pH and BOD meters, gas chromatographs, spectrophotometers (regular/IR/UV), HPLCs, centrifuges, PCR thermocyclers and gel electrophoresis equipment, Prepare microbiological media and reagents, Culture					

pathogenic microbes, Design and perform advanced microbiology and microbial genetics experiments, Use microorganisms to assay pharmaceutical products.
Teaching Methodology:
Lectures, Power Point Slides, Interactive Sessions, Extra Material, Projects, Presentations
Course Assessment:
Midterm Exam, Quizzes, Home Assignments, Projects, Presentations, Final Exam
Reference Material:
1. Last Five years research papers of reputed journals and conferences.

ہائیر ایجوکیشن کمیشن

HIGHER EDUCATION COMMISSION

Government of Pakistan, Islamabad

office of the
ASSISTANT DIRECTOR
Quality Assurance Division (QAD)

Sector H-9
Islamabad, Pakistan
www.hec.gov.pk

1-63/2022/QAD-NOC/HEC/IUB/ 364
Dated: June 28, 2022

Subject: No Objection Certificate for Launch of Master of Science (MS) Information Technology at The Islamia University of Bahawalpur

Reference your application on the subject matter, it is to inform that as per information provided by the university, **MS Information Technology** is in line with the minimum requirements devised by the Higher Education Commission of Pakistan for launch of **Level-7** degree programs. Therefore, I am pleased to inform that HEC has no objection on start of **MS Information Technology** by **The Islamia University of Bahawalpur**. The following faculty members have been designated by the University to launch the said program:

1. Dr. Malik Muhammad Saad Missen, Associate Professor
2. Dr. Mujtaba Husnain, Associate Professor

The University is advised to strictly comply with HEC policies prescribed for MS/MPhil/PhD equivalent programs including minimum standards for faculty, program duration, credit hours and semester guidelines, as notified by HEC from time to time.

HEC reserves the right to withdraw the issued NOC in case the University is found unable to demonstrate its ability and commitment of meeting the minimum HEC criteria.

28/6/22

(MOHAMMAD SOHAIL)

The Vice Chancellor
The Islamia University of Bahawalpur,
University Chowk, Bahawalpur

Copy for information to:

- Registrar, The Islamia University of Bahawalpur
- Director (QEC), The Islamia University of Bahawalpur
- Director General (QAD), Higher Education Commission, Islamabad
- Director General (QAA), Higher Education Commission, Islamabad
- PS to Advisor (A&C), Higher Education Commission, Islamabad
- Office Copy

ہائیر ایجوکیشن کمیشن

HIGHER EDUCATION COMMISSION

Government of Pakistan, Islamabad
Quality Assurance Division
H9, Islamabad (Pakistan) Phone: 051-90802700
Email: aqeelkhan@hec.gov.pk

Office of the
Director (QA)

1-63/2022/QAD-NOC/HEC/IUB/1410
Dated: July 26, 2022

Subject: **No Objection Certificate for Launch of Doctor of Philosophy (PhD) Information Technology at The Islamia University of Bahawalpur**

Reference your application on the subject matter, it is to inform that as per information provided by the university **PhD Information Technology program** is in line with the minimum requirements devised by the Higher Education Commission of Pakistan for launching of **Level-8** degree programs. Therefore, I am pleased to inform that HEC has no objection on start of **PhD Information Technology** by **The Islamia University of Bahawalpur.** The following relevant faculty members have been designated by the University to launch and execute the said program:

i. Dr. Dost Muhammad Khan, Professor
ii. Dr. Arif Mehmood, Associate Professor
iii. Dr. Omer Riaz, Assistant Professor

2. The University is advised to strictly comply with HEC policies prescribed for MS/MPhil/PhD equivalent programs including minimum standards for faculty, program duration, credit hours and semester guidelines, as notified by HEC from time to time.

3. HEC reserves the right to withdraw the issued NOC in case the University is found unable to demonstrate its ability and commitment of meeting the minimum HEC criteria.

4. This issues with the approval of Director General (QA)

26/7/2022
(Aqeel Akhtar Khan)

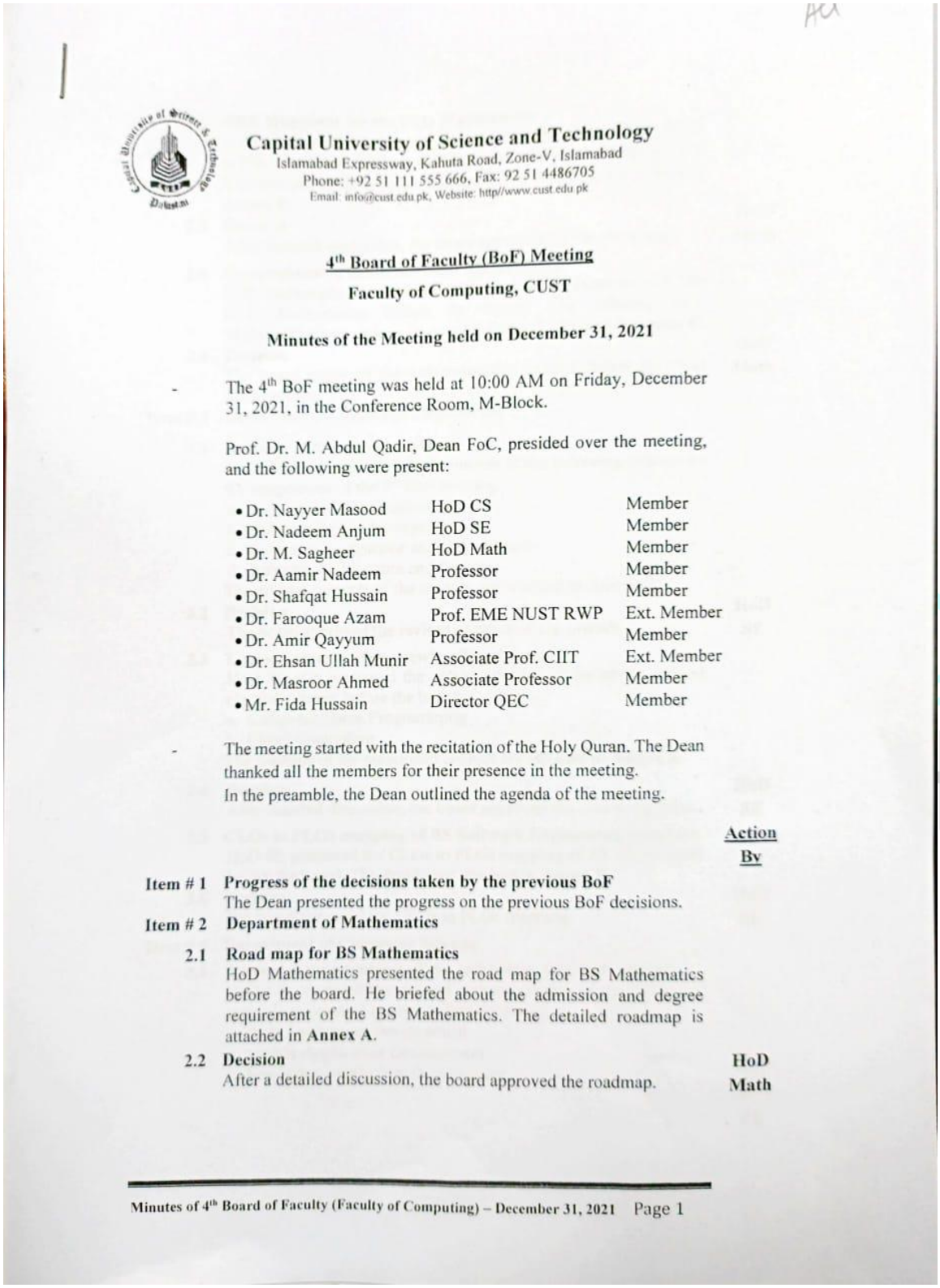
The Vice Chancellor
The Islamia University of Bahawalpur,
Abbasia Campus, University Chowk, Bahawalpur

Copy for information to:

- Director (QEC), The Islamia University of Bahawalpur
- PS to Director General (QA), Higher Education Commission, Islamabad
- Office Copy

Annexure B

Post Graduate Level Course (CUST)



Capital University of Science and Technology
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Phone: +92 51 111 555 666, Fax: 92 51 4486705
Email: info@cust.edu.pk, Website: http//www.cust.edu.pk

4th Board of Faculty (BoF) Meeting

Faculty of Computing, CUST

Minutes of the Meeting held on December 31, 2021

- The 4th BoF meeting was held at 10:00 AM on Friday, December 31, 2021, in the Conference Room, M-Block.

Prof. Dr. M. Abdul Qadir, Dean FoC, presided over the meeting, and the following were present:

• Dr. Nayyer Masood	HoD CS	Member
• Dr. Nadeem Anjum	HoD SE	Member
• Dr. M. Sagheer	HoD Math	Member
• Dr. Aamir Nadeem	Professor	Member
• Dr. Shafqat Hussain	Professor	Member
• Dr. Farooque Azam	Prof. EME NUST RWP	Ext. Member
• Dr. Amir Qayyum	Professor	Member
• Dr. Ehsan Ullah Munir	Associate Prof. CIIT	Ext. Member
• Dr. Masroor Ahmed	Associate Professor	Member
• Mr. Fida Hussain	Director QEC	Member

- The meeting started with the recitation of the Holy Quran. The Dean thanked all the members for their presence in the meeting.
In the preamble, the Dean outlined the agenda of the meeting.

Action By

Item # 1 **Progress of the decisions taken by the previous BoF**
The Dean presented the progress on the previous BoF decisions.

Item # 2 **Department of Mathematics**

2.1 **Road map for BS Mathematics**
HoD Mathematics presented the road map for BS Mathematics before the board. He briefed about the admission and degree requirement of the BS Mathematics. The detailed roadmap is attached in **Annex A**.

2.2 **Decision** — **HoD Math**
After a detailed discussion, the board approved the roadmap.

Minutes of 4th Board of Faculty (Faculty of Computing) – December 31, 2021 Page 1

2.3 OBE Mappings for the PhD Mathematics

HoD Mathematics presented the mapping of RLOs to PLOs, PLOs to PEOs, and then PEOs to PhD Program mission to Department of Mathematics mission before the board. The mapping is available at **Annex B.**

2.4 Decision — **HoD Math**

After detailed discussion, the board approved all the mappings.

2.5 Comprehensive Exam for Ph.D Mathematics

HoD Mathematics presented the comprehensive exam syllabus for Ph.D Mathematics before the board. The detailed Ph.D Mathematics comprehensive exam syllabus is attached in **Annex C.**

2.6 Decision — **HoD Math**

The board approved the comprehensive exam syllabus for Ph.D Mathematics.

Item # 3 Department of Software Engineering

3.1 Revision of the course contents

HoD SE presented the revised contents of the following courses on the suggestions of the 5th BoS meeting.

a. Software Quality Engineering
b. Software Project Management
c. Software Construction and Development
d. Software Architecture and Design

The revised contents of the courses are attached in **Annex D.**

3.2 Decision — **HoD SE**

The board approved the revised contents of the courses.

3.3 Course contents of the newly offered courses

HoD SE also presented the course contents of the newly offered elective courses before the board.

a. Computer Game Programming
b. Cloud Computing

The contents of the mentioned courses are attached in **Annex E.**

3.4 Decision — **HoD SE**

After detailed discussion, the board approved the course contents.

3.5 CLOs to PLOs mapping of BS Software Engineering Program

HoD SE presented the CLOs to PLOs mapping of BS SE program before the board. The details are attached in **Annex F.**

3.6 Decision — **HoD SE**

The board approved the CLOs to PLOs mapping.

Item # 4 Department of Computer Science

4.1 Revised course contents of the technology oriented courses

HoD CS presented the revised course contents of the following technology oriented courses before the board.

a. Web Application Development
b. Mobile Application Development
c. Enterprise Application Development

HoD CS

4.2 Decision
The board approved the revised courses contents as presented in **Annex G.**

4.3 Inclusion of the undergraduate elective courses
HoD CS presented the following elective courses before the board for the inclusion in the undergraduate program.
a. Human Computer Interaction
b. Object Oriented Analysis and Design
The course contents of the mentioned courses are attached in **Annex H.**

4.4 Decision — **HoD CS**
The board approved the elective courses.

4.5 Revision of PLOs of undergraduate program
HoD CS presented the revised PLOs of the undergraduate program before the board. The revised PLOs are attached in **Annex I.**

4.6 Decision — **HoD CS**
The board approved the revised PLOs.

4.7 Inclusion of the grade elective courses related to digital health
HoD CS presented the following courses for digital health specialization in MS (CS) program.
a. Applied Health Care Statistics
b. Data Mining for Healthcare Analytics
c. Health Care Data Acquisition and Management
d. Introduction to Health Care Analytics
e. Quantitative Methods and Decision Analysis

4.8 Decision — **HoD CS**
a. After detailed discussion, the board approved the contents of the following courses:
   i. Data Mining for Healthcare Analytics
   ii. Health Care Data Acquisition and Management
b. The remaining courses are referred back to the department to incorporate the suggested changes.
c. The approved contents are attached in **Annex J.**

4.9 New elective courses
HoD CS presented the two newly offered courses in MS(CS) program before the house.
a. Secure software development
b. Advanced usability engineering

4.10 Decision — **HoD CS**
After detailed discussion, the board approved the courses. The course contents of the mentioned courses are presented in **Annex K.**

4.11 AI Stream in MS(CS) program.
HoD CS presented the AI Stream to be offered in MS (CS) program in place of Web and Information Systems stream.

4.12 Decision — **HoD CS**
The board approved the offering of AI stream in MS(CS). The courses and revised streams are given in **Annex L.**

4.13 Offering of "Research Methodology" course in MS(CS) program.

HoD CS presented the Research Methodology course to be included in MS (CS) program.

4.14 Decision

The board approved the inclusion of the Research Methodology course in the graduate program. **HoD CS**

4.15 OBE Mappings for PhD CS

HoD CS presented the mappings of Ph.D CS for outcome based education (OBE). The mappings for the RLOs to PLOs, PLOs to PEOs, and PEOs to PhD Program mission, then to Department mission were presented.

4.16 Decision

The mappings were discussed and after necessary changes, it was approved. The approved mappings are attached as **Annex M.** **HoD CS**

4.17 Comprehensive Exam for Ph.D CS

The Dean briefed the board about the revised structure of comprehensive exam of Ph.D CS. The detailed is attached in **Annex N.**

4.18 Decision

The board approved the revised structure of the comprehensive exam for Ph.D CS. **HoD CS**

4.19 Renaming of SE specialization stream courses of MS (CS)

Renaming of the following existing courses in SE specialization stream of MS (CS)

a. Renaming of "Requirements Engineering" to "Advanced Software Requirements Engineering"
b. Renaming of "Software Engineering Processes" to "Software Engineering Processes and Methodologies"
c. Renaming of "Formal Methods in Software Engineering" to "Formal Methods and Specification"

4.20 Decision

The board approved the renaming of the mentioned courses **HoD CS**

The meeting ended with a vote of thanks to the Chair as well as the participants of the meeting.

Prepared by:

Dr. Muhammad Bilal
Lecturer

Approved by:

Prof. Dr. M. Abdul Qadir
Dean FoC

Distribution
- All BoF members (by email)

Copy for information to:-
- Vice Chancellor, CUST Islamabad
- Registrar, CUST Islamabad

Annex J

Capital University of Science & Technology

Department of Computer Science

MS Computer Science (MS CS)

Course Code		
Course Title	Data Mining for Healthcare Analytics	
Credit Hours	3	
Prerequisites by Course(s) and Topics		
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	- Mid-Term Exams - Surprise Tests & Quizzes - Project and Presentation - Assignments - Final Exam	20 15 10 15 40
URL (if any)		
Course Description	- The proliferation of data in the post-EHR era creates opportunities for large-scale data analysis to discover meaningful patterns and trends. In this course, participants explore the application of data mining techniques for purposes of big data analytics using administrative and clinical systems data. Topics include an overview of the data mining process, data mining standards and output protocols, and common techniques used in mining health care data. Also covered are visual representation methods that increase understanding of complex data.	
Textbook	- Healthcare Data Analytics by Chandan K. Reddy, Charu C. Aggarwal, CRC Press, 2015	
Reference Material	- Don't Let Health Care Bankrupt America: Strategies for Financial Survival, George C. Halvorson, 2013, ISBN 1493570277	
Course Goals	- Understanding of data mining and different about data mining in the healthcare setting - Exposure to data mining standards and data mining processes - Understand data mining barriers and opportunities - Understand data mining techniques and participate in data mining exercises - Participation in a collaborative data mining project and presentation	
Topics Covered in the Course, with Number of	- Course Overview and Introduction	2
	- Data mining, the origin of data mining, data mining application	2

Annex J

Lectures on Each Topic (assume 16-week instruction and ninety minutes lectures)	- HealthCare Data:-Different types of health care data, Importance of data quality	
	- Methods for data processing. Measures of similarity and dissimilarity	2
	- Case Study: Present the iris dataset, Perform summary statistics	2
	- Perform basic visualization. Explain multidimensional data analysis	2
	- Introduction to probability.	2
	- Classification techniques-1: Decision trees-Part1 - Classification techniques-1: Decision trees-Part2 - Classification techniques-2: Bayesian Network-Part1 - Classification techniques-2: Bayesian Network-Part2 - Classification techniques-3: K-Nearest Network	2
	- Classification Accuracy Methods:-Accuracy, Confusion Matrix, Area Under Curve	2
	- Explain the class imbalance problems. Multiclass Problem. - Case Study-1 - Revision	2
	- Association Analysis-Part1:-Basic concepts ad algorithm	2
	- Association Analysis-Part2:-Basic concepts ad algorithm	2
	- Association Analysis-Part3:-Generation of frequency item set, Rule Generation process	2
	- Association Analysis-Part3:-Generation of frequency item set, Rule Generation process	2
	- Case Study:- Association Analysis 1	2
	- Case Study:- Association Analysis 2	2
	- Cluster Analysis-part1:- Definition and uses - Cluster Analysis-part2:- K-mean - Cluster Analysis-part3:- Prototype Based Clustering, density-based clustering	2
	- Cluster Analysis-part4:- Prototype Based Clustering, density-based clustering	2
	- Data Visualization tecniques-1 - Data Visualization tecniques-2 - Preprocessing techniques Part-1 - Preprocessing techniques Part-2 - Advanced topics	2
	Total	32
Projects/Experiments Done in the Course	• Class presentations • Project presentations	

Annex J

Programming Assignments Done in the Course	-Students will use techniques for data mining related to healthcare analytics, including clustering, classifications, and processing techniques, and data visualization techniques			
Class Time Spent on (in credit hours)	**Theory**	**Problem Analysis**	**Solution Design and Practical Development**	**Social and Ethical Issues**
	40%	15%	40%	5%
Oral and Written Communications	Every student is required to submit at least 2 written reports of typically 4 pages and to make 2 oral presentations of typically 10 minute's duration detailing the steps involved in the completion of their project. The written and oral material is graded for its completeness, and accuracy and its ability to address a real-life problem. In addition, it is also checked for grammar, spelling, style, etc.			
Course Learning Outcomes (CLOs)	CLO:1. **Acquire** the basic concepts and uses of data mining and technologies with different applications/Systems. **[C1 - Knowledge]** CLO:2. **Explain** and **interpret** different methods and technologies of healthcare analytics and data mining **[C2 – Understanding]** CLO:3. **Apply** case studies, and techniques of data mining in healthcare analytics. **[C3 – Applying]** CLO:4. **Using** data mining tools and application. **[C4- Illustrate]**			

CLO – PLO Mapping

CLOs / PLOs	CLO:1	CLO:2	CLO:3	CLO:4
PLO:1 (Knowledge)	√	√		
PLO:3 (System Design)			√	
PLO:4 (Current Tool Usage)				√

Annex J

Capital University of Science & Technology

Department of Computer Science

MS Computer Science (MS CS)

Course Code	
Course Title	Health Care Data Acquisition and Management
Credit Hours	3
Prerequisites by Course(s) and Topics	-
Assessment Instruments with Weights (homework, quizzes, midterms, final, programming assignments, lab work, etc.)	- Mid-Term Exams 20 - Surprise Tests & Quizzes 15 - Project and Presentation 10 - Assignments 15 - Final Exam 40
Course Coordinator	
URL (if any)	
Course Description	The course covers to navigate complex data structures and efficiently retrieve the data needed to answer a question or solve a problem. This course explores the types and sources of healthcare data, along with methods for selecting, preparing, querying, and transforming health care data. Participants examine the range of data sources, including administrative, clinical, patient-reported, and external data (e.g., CCDs, HL-7 messages); common representations of data in health information systems (ICD, CPT); strategies for optimizing data quality; querying tools and methods; data preparation/transformation; ethics, data ownership, and privacy. Also covered are new models of healthcare data organization and analytics, such as clinical registries.
Textbook (or **Laboratory Manual** for Laboratory Courses)	- Healthcare Data Analytics and Management by Dey, N. and Ashour, A.S. and Fong, S.J. and Bhatt, C. , Elsevier Science, 2018
Reference Material	-
Course Goals	- Analyze the various types and sources of health care data, including clinical, operational, and patient-generated data. - Knowledge of common problems with health-related data, and the consequent challenges for their use in the clinical and business intelligence enterprise. - Compare and contrast common data models used in healthcare data systems. - Describe the basics of normalization.

Annex J

	- Expand ETL from acronym form and explain what each step means. - Assess the common data warehouse data models and the major pros/cons of each. - Assess the quality of healthcare data, and make appropriate interpretations of meaning according to existing quality frameworks and standards. - Design data models that integrate patient data from multiple sources to create comprehensive, patient-centered views of individual and population data. - Evaluate the use cases for registries. - Examine the importance of the registries focus on how the core data set/target populations are selected. - Examine the technical impacts of a strict data model on registry effectiveness. - Design complex queries to extract data from multiple sources. - Harmonize data from multiple sources and prepare integrated data files for analysis.	
Topics Covered in the Course, with Number of Lectures on Each Topic (assume 16-week instruction and ninety minutes lectures)	- Introduction to Health system	1
	- Scope and Need of Health system	1
	- Traditional and Contemporary issues and challenges faced in management	1
	- Management and the manager's job	1
	- Introduction to system-1, clinical orientation - Introduction to system-2, Process analysis, and Problem identification	2
	- Sources of Healthcare Data	2
	- Type of Healthcare Data	2
	- Electronic Health Records-1 - Electronic Health Records-2	2
	- Data Selection - Data Querying	2
	- Information Security:-Elements of the data security program	2
	- Information Security:-Components of security, role, and responsibilities of health information technician - Case Study-1 - Case Study-2	3
	- Data Harmonization 1 - Data Harmonization 2	2
	- Data Integration	2
	- Health Care data Models-1 - Health Care data Models-2 - Health Care data Models-3	3
	- Data Quality, Need and Use	2
	- Standards to measure data quality	2

Annex J

	- Acquiring Complete Data	
	- Clinical data registry, types of the registry. - Principles of registry:- Ethics	1
	- Principles of registry:- Data Ownership and Privacy - Technical impacts of a strict data model on the registry	1
	- Advanced Topics	1
	- Advanced topics	1
	- Advanced topics	1
	Total	32

Projects/Experiments Done in the Course	- In order to give the students hands-on experience with the subject, specific course projects will be assigned and techniques will be used to analyze electronic health records and visualize data models			
Assignments Done in the Course	- Students practice different techniques for data acquisition and handling. - All students work on a semester project in a group of 2 to 3 students each. The project involves techniques and methods for healthcare data acquisition and handling			
Class Time Spent on (in credit hours)	**Theory**	**Problem Analysis**	**Solution Design and Practical Development**	**Social and Ethical Issues**
	40%	15%	40%	5%
Oral and Written Communications	Every student is required to submit at least 2 written reports of typically 4 pages and to make 2 oral presentations of typically 10 minute's duration detailing the steps involved in the completion of their project. The written and oral material is graded for its completeness, and accuracy and its ability to address a real-life problem. In addition, it is also checked for grammar, spelling, style, etc.			
Course Learning Outcomes (CLOs)	CLO:1. **Acquire** the basic concepts and uses of healthcare data acquisition and handling. **[C1 - Knowledge]** CLO:2. **Explain** and **interpret** different methods and techniques for healthcare data acquisition and handling **[C2 – Understanding]** CLO:3. **Apply** different tools and methods for data acquisition. **[C3 – Applying]** CLO:4. **Using** particular tools for data handling and acquisition. **[C4- Illustrate]**			

Annex J

CLO – PLO Mapping

PLOs \ CLOs	CLO:1	CLO:2	CLO:3	CLO:4
PLO:1 (Knowledge)	√	√		
PLO:3 (System Design)			√	
PLO:4 (Current Tool Usage)				√

Capital University of Science and Technology
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Phone: +92 51 111 555 666, Fax: 92 51 4486705
Email: info@cust.edu.pk, Website: http://www.cust.edu.pk

5th Board of Faculty (BoF) Meeting

Faculty of Computing, CUST

Minutes of the Meeting held on September 15, 2022

The 5th BoF meeting was held at 3:00 AM on Thursday, September 15, 2022, in the Conference Room, M-Block.

Prof. Dr. M. Abdul Qadir, Dean FoC, presided over the meeting, and the following were present:

• Dr. Abdul Basit	HoD CS	Member
• Dr. Nadeem Anjum	HoD SE	Member
• Dr. M. Sagheer	HoD Math	Member
• Dr. Nayyer Masood	Professor	Member
• Dr. Aamir Nadeem	Professor	Member
• Dr. Amir Qayyum	Professor	Member
• Dr. Rashid Ali	Associate Prof.	Member
• Dr. Masroor Ahmed	Associate Prof.	Member
• Mr. Fida Hussain	Director QEC	Member

- Dr. Farooque Azam, and Dr. Ehsan Ullah Munir could not attend the meeting due to prior commitments.

The meeting started with the recitation of the Holy Quran. The Dean thanked all the members for their presence in the meeting.

In the preamble, the Dean outlined the agenda of the meeting.

Action By

Item # 1 Department of Mathematics

1.1 BS Mathematics Program Mission, PEOs, and PLOs

HoD Math presented the BS Math Program Mission, PEOs, and PLOs before the board for approval. The detailed is attached in the **Annex-A.**

1.2 Decision — **HoD Math**

The board approved the BS Math Program Mission, PEOs, and PLOs.

2.11 Replacement courses for discontinued core courses SE Program

HoD SE presented the following core courses that have been removed from SE curriculum since spring 2018.

i. Computer Organization and Architecture
ii. Computer Organization and Assembly Language
iii. Digital Logic Design
iv. Design and Analysis of Algorithm

However, a few SE students from Batch 173, required to register for these courses for their degree completion requirements. The CRC suggested that, since the department is not offering the above-mentioned courses, following courses may be considered as one time replacement courses to accommodate the students.

i. Automated Software Testing
ii. Computer Game Programming
iii. Web Engineering

HoD SE

2.12 Decision

The board approved the replacement courses for the above mentioned students.

Item # 3 Department of Computer Science

3.1 CLOs to PLOs mapping of BS CS program's core courses

With reference to the item 4.5 of BoF 4th Meeting minutes, in which the BS CS PLO's were revised and approved by the board. HoD CS presented the BS CS program's core courses CLOs to PLOs mapping before the board for approval. The detailed CLOs to PLOs mapping is attached in **Annex J**.

HoD CS

3.2 Decision

After a detailed discussion, the board approved the CLOs to PLOs mapping of BS CS program.

3.3 New elective course for BS CS program

HoD CS presented the following elective courses before the board for approval.

i. Cloud Computing
ii. Digital Image Processing

The course contents of the above mention courses are available at the **Annex K.**

HoD CS

3.4 Decision

After detailed discussion, the board approved the above mentioned courses to be added in BS CS program.

3.5 Induction of practicing professor from industry to BS CS program

HoD CS presented the recommendation of industrial outreach committee (IOC) - CS that a practicing professor from industry should be appointed as industrial consultant

before board for approval. The practicing professor will be helpful in shaping high quality FYP, use of latest technologies and converting prototypes into products.

3.6 Decision — **HoD CS**

The board approved the induction of practicing professor in CS department.

3.7 Updated content of the BS CS program's courses

HoD CS presented the following courses updated contents to the board for approval.

i. Data Structures
ii. Introduction to Information Security and Forensics
iii. Web Application Development
iv. Probability and Statistics
v. Introduction to Database Systems

The updated content of the above mentioned courses are attached in **Annex L.**

3.8 Decision — **HoD CS**

The board approved the updated content of the above mentioned courses.

3.9 New elective courses for MS CS program

HoD CS presented the following new elective courses for MS CS program for approval.

i. Embedded Systems for Healthcare
ii. Internet of Things for Healthcare

The content of above mentions courses are presented in **Annex M.**

3.10 Decision — **HoD CS**

After detailed discussion, the board approved the above mentioned courses to be added in MS CS program.

The meeting ended with a vote of thanks to the Chair as well as the participants of the meeting.

Prepared by:

Dr. Muhammad Bilal
Lecturer

Approved by:

Prof. Dr. M. Abdul Qadir
Dean, FoC

Distribution
- All BoF members (by email)

Copy for information to:-
- Vice Chancellor, CUST Islamabad
- Registrar, CUST Islamabad

5

Annexure M

3	Microprocessors in Embedded Systems.
4	Embedded System Hardware Components.
5	Embedded System Software Components.
6	Communication Protocols in Embedded Systems.
7	Communication Protocols in Embedded Systems.
8	Sensors and Actuators.
Mid-Term Exam	
9	Convertors in Embedded Systems
10	Data Acquisition for Embedded Healthcare.
11	Data Acquisition for Embedded Healthcare.
12	Software Development for Embedded Systems.
13	Software Development for Embedded Systems.
14	Case Study: Embedded System based Healthcare monitors.
15	Design of an Embedded Solution for Data Acquisition of Cardiovascular Patients.
16	Design of an Embedded Solution for Data Acquisition of Cardiovascular Patients.

Course Title:	Internet of Things for Healthcare
Pre-requisite(s):	None
Credit Hours:	3
Instructor(s):	Instructor name

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Annexure M

Text Book(s):	• Hemanth, D. J. (2021). Internet of Medical Things: Remote Healthcare Systems and Applications. Springer Nature.
Reference Book(s):	• Pankajavalli, P. B., & Karthick, G. S. (Eds.). (2019). Incorporating the Internet of Things in Healthcare Applications and Wearable Devices. IGI Global. • Buyya, R., & Dastjerdi, A. V. (Eds.). (2016). Internet of Things: Principles and paradigms. Elsevier. ISBN: 978-0-12-805395-9.
Web Reference:	• https://www.jmir.org/2020/11/e20135/

Course Introduction:

Internet of Things (IoT) plays a vital role in healthcare. Modelling and integrating medical data with the IoT help in building effective prediction systems for automatic recommendations of diagnosis and treatment. There is a great demand for the design and development of methods dealing with capturing and automatically analyzing medical data from imaging systems and IoT sensors. This course discusses interactions, advantages, limitations, challenges and future perspectives of IoT based remote healthcare monitoring systems. Moreover, data privacy and security aspects of the Internet of Medical Things (IoMT) are also covered.

Course Objectives:

- To understand the basic concepts of IoT for healthcare system.
- To understand the communication standards, and architecture for IoT in healthcare system.
- To understand the capabilities of smart thing/object/device identification, and physical principles of sensing.
- To understand various issues of the resource constrained environment.
- To familiarize students with various lightweight communication protocols of IoT in healthcare system, to efficiently utilized the bandwidth and resources.
- To understand various privacy and security issues related to IoMT.

Course Contents:

Week	Contents
1	Introduction to IoT and IoT based Healthcare Networks.
2	Components of IoT
3	IoT Architecture & System functionality
4	Functional Blocks of IoT, HW Components

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Annexure M

New elective course for MS CS program

Course Title:	Embedded Systems for Healthcare
Pre-requisite(s):	None
Credit Hours:	3
Instructor(s):	Instructor name
Text Book(s):	• Embedded System Design: A Unified Hardware Software Introduction By Frank Vahid, Tony D. Givargis, John Wiley And Sons
Reference Book(s):	• Embedded Systems Architecture, Programming And Design By Raj Kamal • Biomedical Applications with Using Embedded Systems, Gulcicek Dere
Web Reference:	• https://orthogone.ca/embedded-systems-in-medical-applications/

Course Introduction:

This course introduces students with the design of embedded systems and its applications in healthcare. Students will learn about essential embedded technologies, embedded design components, and how to apply these technologies in healthcare devices and smart healthcare solutions. Students will also learn about embedded devices, sensors, actuators, Internet of Things (IoT) and IoT based solutions being used to transform the future of healthcare. Course is structured to provide students with a broad and in-depth knowledge of latest trends in embedded systems and smart healthcare.

Course Objectives:

- Overview of Embedded Systems and its applications in healthcare.
- Apply Embedded Systems tools and techniques for data acquisition, processing and healthcare monitoring.
- Design and development of embedded solutions for healthcare problems.

Course Contents:

Week	Contents
1	Overview of Embedded System Building Blocks.
2	Embedded Systems in Healthcare.

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Annexure M

5	SW Programming, Integrated & Flexible Systems.
6	IoT Communication APIs and Communication Models.
7	Wireless Sensor Networks (WSNs) , Wireless Personal Area Networks (WPANs)
8	Wireless Body Area Networks (WBANs).
Mid-Term Exam	
9	IoT Protocol Stack
10	Edge and Fog Computing Concepts
11	Emerging Trends in e-health and Electronic Health Information Systems.
12	Interoperability between IoT smart health devices.
13	Security in IoT devices, Software and Hardware vulnerabilities.
14	IoT Challenges in healthcare, Advancements and Future Directions.
15	Case Study: Development of IoT Framework for monitoring and evaluation of cardiovascular disease.
16	Case Study: Development of IoT Framework for monitoring and evaluation of cardiovascular disease.

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Annexure C

Post Graduate Level Course (COMSAT)

COMSATS University Islamabad
Registrar Secretariat, Academic Unit (PS)
No. CUI-Reg/SOPS/15/Rev#01

Subject: **Minutes of 31st meeting of the Board of Faculty of Information Sciences and Technology**

The 31st meeting of the Board of Faculty of Information Sciences and Technology was held on Monday, October 3, 2022 at 11:30 online via MS Team. The meeting was chaired by **Prof. Dr. Zulfiqar Habib**, Dean, Faculty of Information Sciences and Technology and the following were present in the meeting:

1. Prof. Dr. Saleem Farooq Shaukat, Director, Vehari Campus
2. Prof. Dr. Muhammad Mahroof Shah, Director, Abbottabad Campus
3. Prof. Dr. Muhammad Junaid Mughal, Director, Attock Campus
4. Prof. Dr. Syed Asad Hussain, Director, Lahore Campus
5. Prof. Dr. Muhammad Abid, Director, Wah Campus
6. Prof. Dr. Nazir Ahmed Zafar, Director, Sahiwal Campus
7. Prof. Dr. Ehsan Ullah Munir, Chairman, Department of Computer Science,
8. Prof. Dr. Sohail Asghar, Department of Computer Science, Islamabad Campus
9. Prof. Dr. Majid Iqbal, Department of Computer Science, Islamabad Campus
10. Prof. Dr. Muhammad Wasif Nisar, Department of Computer Science, Wah Campus
11. Dr. Abdullah Shah, Associate Professor, Department of Mathematics, Islamabad Campus
12. Dr. Abdul Rauf Siddiqi, Assistant Professor, Department of Bio Sciences, Islamabad Campus
13. Mr. Muhammad Hanif, Deputy Registrar, Registrar's Secretariat Principal Seat
14. Mr. Muhammad Irfan, Deputy Registrar, Registrar's Secretariat Principal Seat

2. The meeting commenced with the recitation of a few verses from the Holy Quran by Dr. Ehsan Ullah Munir, Chairman Department of Computer Science. The Convener welcomed all members. The chair in his opening remarks appreciated the consistent efforts to have productive agenda points on the forum and prayed to continue the spirit for quality education and high class research in the department.

Agenda Item No. 1: **Confirmation of minutes of the 30th meeting of the Board of Faculty of Information Sciences and Technology**

3. The Chair invited comments from the house on the above said minutes as no comments were received; therefore, the house considered and approved the minutes of 30th meeting of the Board of Faculty of Information Sciences and Technology.

Agenda Item No. 2: **Implementation Status of Recommendations of Board of Faculty of Information Sciences and Technology in its 30th meeting**

4. The Secretary briefed the house about the implementation status of the recommendations of 30th meeting of the Board of Faculty of Information Sciences and Technology for which the members expressed their satisfaction.

Agenda Item 3: **Consideration of recommendations made by the Board of Studies for Computer Sciences in its 34th meeting**

i. Permission to allow Bachelor's degree holder as visiting faculty

5. The Chairman briefed the house about the proposal that allowing a Bachelor's degree holder as a visiting faculty for the undergraduate program in the department will provide a chance for CS students to get knowledge of the latest trends, techniques, and tools in their filed.
6. The house discussed the matter in detail and recommended allowing a Bachelor's Degree holder with a minimum of 3 years of industrial experience as a visiting faculty for undergraduate programs only in the department of Computer Science subject if there is no issue/objection by the HEC accreditation bodies.

ii. Revisions in the Scheme of Studies of Doctor of Philosophy in Computer Science

7. The Chairman Department of Computer Science briefed the house that the existing Scheme of Studies was notified back in 2012 and need to revise as per the latest trends in the field of Computer Science. The Board of Faculty of Information Sciences and Technology discussed the revisions in detail and recommended the revised Scheme of Studies of Doctor of Philosophy in Computer Science, effective from Spring 2023.

iii. Inclusion of Elective courses in the Scheme of Studies of Master of Science and PhD in Computer Science programs.

8. The house was briefed about the requirement of more elective courses in the Scheme of Studies of Master and PhD Computer Science programs. The addition of elective courses in the current Scheme of Studies will strengthen the list with the latest courses.

COMSATS University Islamabad

Registrar Secretariat, Academic Unit (PS)

Subject: **Minutes of the 34th Meeting of the Board of Studies for Computer Science**

The 34th meeting of the Board of Studies for Computer Science was held on Tuesday, August 16, 2022, at 10:30 am, online via MS teams. Prof. Dr. Ehsan Ullah Munir, Chairman, Department of Computer Science, chaired the meeting. The following were present in the meeting:

1. Prof. Dr. Sohail Asghar, Islamabad Campus, CUI
2. Dr. Kashif Munir, Head School of Computing, FAST, Islamabad
3. Dr. Muhammad Usman, Associate Professor/ HoD, SZABIST, Islamabad
4. Mr. Barkan Saeed, Ex-Chairman P@SHA, CEO Vizteck, Islamabad
5. Mr. Muhammad Farrukh Mahmood, CEO, 11 Values, Islamabad
6. Prof. Dr. Manzoor Ilahi Tamimy, Islamabad Campus, CUI
7. Prof. Dr. Majid Iqbal Khan, HoD, Islamabad Campus, CUI
8. Prof. Dr. Muhammad Wasif Nisar, Wah Campus, CUI
9. Dr. Ghulam Rasool, Associate Professor, Lahore Campus, CUI
10. Dr. Muhammad Sharif, Associate Professor, Wah Campus, CUI
11. Dr. Sheraz Anjum, Associate Professor / HoD, Wah Campus, CUI
12. Dr. Farooq Ahmed, Associate Professor, Lahore Campus, CUI
13. Dr. Javed Ferzund, Associate Professor, Sahiwal Campus, CUI
14. Dr. Muhammad Waqas Anwar, Associate Professor / HoD, Lahore Campus, CUI
15. Dr. Mazhar Ali, Associate Professor/HoD, Abbottabad Campus, CUI
16. Dr. Khalid Mahmood Awan Associate Professor / HoD, Attock Campus, CUI
17. Dr. Abdul Nasir, Associate Professor, Abbottabad Campus, CUI
18. Dr. Adnan Ahmad, Associate Professor, Lahore Campus, CUI
19. Dr. Aqeel ur Rehman, Assistant Professor, Vehari Campus, CUI
20. Dr. Fiaz Gul Khan, Associate Professor, Abbottabad Campus, CUI
21. Dr. Iftikhar Ahmad, Associate Professor, Abbottabad Campus, CUI
22. Dr. Hamid Turab Mirza, Associate Professor, Lahore Campus, CUI
23. Dr. M. Hasnain Chaudhry, Associate Professor, Lahore Campus, CUI
24. Dr. Munam Ali Shah, Associate Professor, Islamabad Campus, CUI
25. Dr. Shahbaz Akhtar Abid, Associate Professor, Lahore Campus, CUI
26. Dr. Usama Ijaz Ahmad Bajwa, Associate Professor, Lahore Campus, CUI

27. Dr. Zia Ur Rehman, Associate Professor, Abbottabad Campus, CUI
28. Dr. Tariq Umer, Associate Professor, Lahore Campus, CUI
29. Dr. Farhana Jabeen, Associate Professor, Islamabad Campus, CUI
30. Dr. Farrukh Zeshan, Associate Professor, Lahore Campus, CUI
31. Dr. Hikmat Ullah, Associate Professor, Wah Campus, CUI
32. Dr. Khalil Afzal, Associate Professor, Wah Campus, CUI
33. Dr. Malik Ahmad Kamran, Associate Professor, Islamabad Campus, CUI
34. Dr. Nadir Shah, Associate Professor, Wah Campus, CUI
35. Dr. Tassawar Iqbal, Associate Professor, Wah Campus, CUI
36. Dr. Mussarat Abdullah, Assistant Professor, Wah Campus, CUI
37. Dr. Tariq Ali, HoD / Assistant Professor, Sahiwal Campus, CUI
38. Mr. Rashid Mehmood, Lecturer, Islamabad Campus, CUI
39. Mr. Muhammad Irfan, Deputy Registrar, Registrar Secretariat Principal Seat, CUI

The meeting formally commenced with the recitation of verses from the Holy Quran by Dr. Usama Ijaz Bajwa, Associate Professor, CUI, Lahore Campus. The convener welcomed all the members, especially the new members and the external members for their valued presence. After the opening remarks, the main agenda was taken up for discussion as under:

Agenda Item 1: Confirmation of the Minutes of 33rd meeting of Board of Studies

1. The Chair informed the house that the minutes of the 33rd meeting of the Board of Studies for Computer Science were circulated among all members through email. The house confirmed the minutes of the 33rd meeting of the Board of Studies for Computer Science with satisfaction.

Agenda Item 2: Implementation status of 33rd meeting of Board of Studies

2. The secretary informed the house that all the recommendations of the 33rd meeting of Board of Studies for Computer Science were presented in 30th meeting of the Board of Faculty of Information Sciences and Technology and in the 34th meeting of Academic Council. The status is approved.

Agenda Item 3: Consideration of Undergraduate Matters

a) Addition of a new Elective Course in the Scheme of Studies of Bachelor of Science in Software Engineering.

3. The house discussed the matter in detail and referred back the agenda point with directions to present it in the next meeting along with CDF.

b) Addition of Elective Course in the Scheme of Studies of Bachelor of Science in Computer Science.

4. The house discussed the matter in detail and referred back the agenda.

c) Bachelor (BS) level Industry Evaluator and Visiting faculty for Bachelor Programs

5. The house discussed the matter in detail and recommended a Bachelor's degree holder along with minimum 5 years of industry experience for visiting faculty for undergraduate programs in the Department of Computer Science for the improvement of knowledge and skills of the students as per the latest market/industry trends.

d) Updating of Course Description Form CSC103 Programming Fundamentals

6. The house discussed the matter in detail and referred back the agenda point to the department.

e) Launching of Bachelor of Software Engineering program under ECE department.

7. The house discussed the matter in detail and unanimously disagreed with the proposal to allow the offering of a Bachelor of Software Engineering in any other faculty because FIST is the pioneer in starting this program and is successfully running the program producing high-quality graduates. This is a flagship program of department of computer science, therefore the BoS principally agreed to continue offering this program under the department of Computer Science.

Agenda Item 4: Consideration of Graduate Matters

a) Revised Scheme of Studies for Doctor of Philosophy (PhD) in Computer Science in Computer Science

8. The house discussed the agenda point in detail and recommended revision of Scheme of Studies for the Doctor of Philosophy (PhD) program.

b) Inclusion of Elective Courses in the Scheme of Studies of MS and PhD programs.

9. The house discussed the matter in detail and recommended the inclusion of Elective courses in the Scheme of Studies of Master of Science and PhD in Computer Science programs.

c) Addition of External Examiners for MS/PhD Thesis Evaluation.

10. The house discussed and recommended the addition of new external local/foreign examiners/ evaluators for MS/PhD thesis evaluation.

d) Addition of Courses in the Scheme of Studies of Master of Science in Computer Science

11. The house discussed matter in detail and referred back the agenda point to the department.

Elective Course(s)

Course Code: CSC465 **Pre-Requisite:**
Course Title: Artificial Intelligence in Healthcare
Credit Hours: 3(3, 0)

Course Description:

Artificial Intelligence (AI) in healthcare is an umbrella to describe the applications of Machine Learning (ML) algorithms and other cognitive technologies in medical settings. AI can help make healthcare more predictive and proactive by analyzing big data to develop improved preventive care recommendations for patients and doctors as well.

Course Objectives:

- Fundamental concepts and principles of ML as it apply to medicineand healthcare.
- To explore ML approaches, medical use cases, metrics unique to healthcare
- To practices for designing, building, and evaluating ML applicationsin healthcare.
- To offer detailed understanding of the existingalgorithms.
- To design algorithms and applications
- To work with medical Doctors on real problems of interest
- To produce a final paper and/or project is required.

Course Contents:

Introduction to AI and Healthcare system in developing countries, Overview of Healthcare system problems in rural areas, Ways AI is transforming the primary care, benefits, and limitations, Introduction to ML algorithms, Classification techniques, Supervised, unsupervised, and re-enforcement learning techniques, Medical use cases for ML algorithms, Introduction to the Medical Datasets, measurement units, Introduction to the vital signs, their measurements, upper and lower limits, Use case: AI in Maternal and infant Healthcare, Use case: AI in Infant Healthcare, Introduction to Neural Networks, Deep Learning in Healthcare use case study, Application of Deep Learning in Healthcare, Prediction, and Prevention in Healthcare using ML techniques, Data acquisition and data normalization, analysis, and evaluation

Recommended Textbooks:

- Artificial Intelligence in Health Care: The Hope, the Hype, the Promise, the Peril, Michael Matheny, Sonoo Thadaney Israni, Mahnoor Ahmed, and Danielle Whicher, Editors 2019, WASHINGTON, DC.
- Introduction to Machine Learning, Fourth Edition, By Ethem Alpaydin, Cambridge, MA: MIT Press 2020.
- An Introduction to Bioinformatics Algorithms, By Neil C. Jones and Pavel A. Pevzner, Cambridge, MA: MIT Press 2004.

Elective Course(s)

Course Code: CSC654 **Pre-Requisite:**
Course Title: Security and Privacy in IoT-based Healthcare
Credit Hours: 3(3, 0)

Course Description:

In recent years, healthcare organizations have aimed to provide more customer-oriented services. To achieve this goal, the quality of care needs to be improved, which, in turn, requires timely access to high-quality organized information. For remote healthcare monitoring, a number of IoT devices have been developed. Although emerging IoT paradigms in healthcare have a substantial contribution to enhancing current healthcare systems, there are several privacy and security considerations that end-users need to consider. End-users can be susceptible to malicious threats when they allow permission to potentially vulnerable or leaky third-party apps. Since the data is migrated to the cloud, it goes over insecure communication channels, all of which have their security concerns. Moreover, there are alternative data violation concerns when the data projects into the proprietor's cloud storage facility. To manage healthcare data electronically, Electronic Health Record (EHR) system comes into play that has patients' medical history, maintained by the provider over time, and may include all of the key administrative clinical data relevant to a person under a particular provider, including demographics, progress notes, problems, medications, vital signs, past medical history, immunizations, laboratory data and radiology reports. EHR systems help to facilitate use of e-health and are the most important and most complex type of health information system. In terms of the privacy, availability, accessibility, and accuracy and security of data, EHR systems are highly dependent on other information systems in the field of healthcare. Obviously, standardization of other systems will accelerate the process of integration and creation of EHRs. The process of creating and using EHRs is not an easy job and involves a number of barriers that make achieving predetermined goals difficult. Before adoption, privacy and security of data related technical and nontechnical issues must be identified and resolved, because majority end-users are unaware of the privacy and security concerns affiliated with emerging healthcare IoT devices. Today, Protected Health Information (PHI) is more important than credit card credentials or even personally identifiable information (PII). Hence, there is a higher motivation for cybercriminals to target medical databases, and so they can sell the PHI or adapt it for their benefits. In Europe, General Data Protection Regulation (GDPR) is to protect individuals' fundamental rights and freedoms, particularly their right to protection of their personal data. Companies which are not compliant to GDPR, cannot operate in Europe. Similarly, Blockchain technology also offers immutability and tracking which can be valuable in

terms of healthcare tracking applications for insurance. In short, security and privacy of humans and in particular healthcare information is high value domain to be studied by students for research and development.

Course Objectives:

- Understanding security, privacy, and their usage in healthcare
- Understanding and implementing data protection standards like GDPR
- Understanding Blockchain and then using it for providing healthcare solution

Course Contents:

Introduction to privacy and security of healthcare system in the developing countries. Health Insurance Portability and Accountability Act (HIPAA) and General Data Protection Regulation (GDPR). Patients' Health Information Rights, Electronic Health Records (HER). HIPAA and GDPR Security Rule. Cybersecurity, Medicare and Medicaid HER. Blockchain and healthcare. Internet of Things (IoT) in healthcare; Blockchain, healthcare and IoT with and without GDPR. Identifying healthcare security and privacy breaches.

Recommended Textbooks:

- Mahmood, Z. ed., 2019. Security, Privacy and Trust in the IoT environment. Springer.
- Namasudra, S. and Deka, G.C. eds., 2021. Applications of Blockchain in Healthcare. Singapore: Springer.
- Marques, G. and Bhoi, A.K. eds., 2021. IoT in Healthcare and Ambient Assisted Living. Springer.