

Curriculum
of
Associate Degree Program (ADP)
in
Robotics and Artificial Intelligence

(December 2019)



KHWAJA FAREED
UEIT
RAHIM YAR KHAN

Department of Information Technology
Faculty of Computer Science and Information Technology
Khwaja Fareed University of Engineering & Information Technology
Rahim Yar Khan, Pakistan

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1. Curriculum Committee

The committee consists of the following faculty members for developing the curriculum:

1. Dr. Muhammad Faheem Mushtaq, Assistant Professor, HoD (Chairperson)
2. Dr. Bushra Mughal, Assistant Professor (Member)
3. Mr. Muhammad Rizwan, Lecturer (Member)
4. Mr. Muhammad Adeel Abid, Lecturer (Member)
5. Ms. Urooj Akram, Lecturer (Member)

2. Preface

The main objective of Associate Degree Program (Robotics and Artificial Intelligence) program is to facilitate the students of South Punjab region to earn technology related degree early in the career to further target job market. We believe technology education has become necessary in the modern era to develop the indigenous strength and to face the future challenges of the 21st century. This program will provide a strong foundation for the students to have good expertise in the domain of databases and aligned fields.

In the curriculum development, courses are developed according to the need of time considering state-of-the-art technologies. Moreover, the curriculum is designed to meet the needs of modern society and to prepare the students who can serve as a network administrator, database developer, system administrator, webmaster, IT consultants, etc. In addition, the curriculum is developed to meet the minimum requirements of the Higher Education Commission (HEC) of Pakistan.

Various meetings were held by the committee, Department of Information Technology, Faculty of Computer Science and Information Technology. The committee thoroughly studied the guidelines provided by HEC. The curricula of top-ranked world universities were also considered to develop the scheme of study and course outline.

Dr. Muhammad Faheem Mushtaq
Head
Department of Information Technology

3. Acknowledgement

We are highly grateful to Allah the Almighty who enabled us to accomplish this task. The help and support provided by Prof. Dr. Suleman Tahir, Vice Chancellor, KFUEIT to initiate the program is greatly acknowledged.

4. Khwaja Fareed University of Engineering & IT

4.1 Introduction

Rahim Yar Khan is located in Southern Punjab and is a major city and industrial hub of the region. This region of Punjab is bordered by areas of Balochistan and Sindh that are similarly deprived in terms of facilities for higher education in science and technology. For decades, students from the region had to travel hundreds of miles to get engineering and technology education, even when they would be lucky enough to get admission in the face of high competition on limited seats in the public sector engineering universities of the province. Hence, establishment of an Engineering University in the city had been a long standing demand of the people of Rahim Yar Khan. Successive governments, over the years, had been making unfulfilled promises on this account. However, Mian Muhammad Shahbaz Sharif, Chief Minister of Punjab, being a man of action and not mere words, fulfilled this demand on 22 April 2014 by laying the foundation of Khwaja Fareed University of Engineering & Information Technology on Abu Dhabi Road, Rahim Yar Khan. The Government of Punjab started out by providing 220 Acres of land and thereafter through the involvement of the University of Engineering & Technology, Lahore under the dynamic leadership of its then Vice Chancellor, Lt. Gen. (Retd.) Akram Khan, a PC-1 of Rs. 3,847 Million was prepared and subsequently approved by the Planning & Development Board, Punjab for the Establishment of Khwaja Fareed University of Engineering & Information Technology, Rahim Yar Khan. M/S NESPAK, the world renowned National Engineering Services of Pakistan, were engaged as Consultants for Engineering Design and Resident Engineering Supervision for Campus Construction.

The Khwaja Fareed University of Engineering & Information Technology, Rahim Yar Khan Act (Act XVI of 2014) was passed by the Punjab Assembly on 29 May 2014 to provide the legal foundations and framework for the University. Classes were started in four rented classrooms of the Government College of Technology, Shehbazpur Road, some 18 kms away from the actual campus site, on 1st September 2014 for a batch of 200 students equally divided in the four disciplines of Mechanical Engineering, Electrical Engineering, Computer Science and Information Technology.

The first duly appointed Vice Chancellor of the University, Engr. Prof. Dr. Athar Mahboob, Tamgha-e-Imtiaz joined on 2nd September 2015. The second newly appointed Vice Chancellor of the University, Prof. Dr. Muhammad Suleman Tahir joined in November 2019. Under the capable leadership of Vice Chancellor, Prof. Dr. Muhammad Suleman Tahir, the university is being progressed to its new heights and he assured his fullest cooperation & support for launching new programs in university. After due process of following, PPRA regulations several contracts for construction of buildings and infrastructure development have already been awarded. Remaining contracts are in the process of award before the end of the year. First meeting of the duly constituted Syndicate of the University was held on 19 May 2016. The Syndicate while approving the Annual Report and the Budget Estimates expressed its satisfaction over the rapid progress being made for establishment of the University.

4.2 Vision

To become a world-class university that contributes significantly to the development of regional economy and uplift of local community by becoming a power house of intellectual and human capital generation.

4.3 Mission

1. To offer an educational experience wherein:
 - a) The curriculum and its delivery conform to international standards.
 - b) The students are provided an environment for wholesome development of their personality and creative potential.
 - c) The graduates produced are most sought after by prospective employers.
2. To conduct research to solve local and national problems requiring knowledge based solutions.

4.4 Core Values

K = **K**nowledge-able

F = **F**aithful

U = **U**seful

E = **E**co-friendly

I = **I**nnovative

T = **T**olerant

5. Department of Information Technology

5.1 Introduction

The Department of Information Technology at KFUEIT offers students and faculty a close-knit community to learn, discover, and innovate, in a shared quest for computational solutions to a spectrum of challenging problems. Our focus is on quality teaching and research using state-of-the-art facilities. The department copes with the modern needs of Information Technology where the main objective is to produce graduates to meet the emerging demands of IT at national and international markets. We have a well-designed curriculum as per HEC requirements with a combination of foundation, core, computing, supporting and elective courses equally supported by the thesis and case studies. The examination of the department is based on the semester system under unified exam policy of the university. The department educates and conducts research covering wide areas from fundamental technologies such as software engineering, image processing, object-oriented programming, computer architecture, algorithms, database system, networks, and Internet technologies, which support infrastructures of the highly information-oriented society to applied and advanced technologies. To achieve this mission, we provide attractive educational programs for students to learn from the basics to advanced technologies related to computer science and information technology. Through our educational programs, students are expected to become leading developers and researchers who are highly motivated and have practical, creative, and management skills to drive an advanced next-generation information society in all industrial fields.

5.2 Vision

To be a professional leader in delivering IT based services in support of teaching, learning, research and produce self-motivated, creative, and professionals.

5.3 Mission

Our mission is to provide a quality education and;

1. To produce graduates who are successful professionally, ethically, technically and scientifically to make positive contributions in the field of Information Technology.
2. To prepare students to function effectively in a dynamic technological era.

3. To contribute positively to the economic development of the country providing services to the community.
4. To prepare the human resources to overcome the shortage of skilled manpower who can face the challenges of the 21st Century.

6. Program Description

Program description is given below.

6.1 Program Introduction

The program is designed to meet the growing needs for experts in the rapidly evolving century by delivering education based on the state-of-the-art technologies. The mission is to produce graduates with a robust and solid knowledge for the development of computer and information age. The study program will enable the students to capitalize on the increasing career opportunities in the relevant industry, to increase the knowledge, and to pursue the graduate studies. Focus of the program will be on robotics, artificial intelligence and its aligned fields

6.2 Exact Title of the Program

Associate Degree Program in Robotics and Artificial Intelligence

6.3 Short Title of the Program

ADP(Robotics & Artificial Intelligence)

6.4 Program Objectives

The program offers high quality education with technical expertise at a low cost and less time to produce skillful and employable force. As per HEC initiates old BSc/BA programs are to be replaced with more suitable degree programs i.e. ADP(Associate Degree Programs)

6.5 Scope of the Program

The breadth and strong practical emphasis of this program will prepare students for early careers working with in a wide range of IT positions in business, government and industry both local and international. After completing ADP(Associate Degree Program), the students may pursue their early career in a wide variety of computing areas dealing

with robotics, artificial intelligence and its aligned areas. The students further may get admission in the 5th semester of relevant BS program.

6.6 Duration of the Program

The program information, duration and semester details are given in the following:

Program Type	Full Time
Duration of the program	2 Years
Study system	Semester
Total regular semesters	4
Number of credit hours required for degree completion	68

6.7 Entry/Admission Requirements

At the time of admission, the students must have

1. At least 50% marks in Intermediate (HSSC) examination or equivalent qualification.
2. No entry test required OR as per the University policy.
3. Any other requirement recommended by HEC or approved by the department.

6.8 Semester Plan

The semester plan is given below in the following Table:

1 st ADP Semester			
Code	Title of the Course	Cr. Hrs.	Remarks
ADIT-1101	Introduction to ICT	3	
MATH-1121	Calculus and Analytical Geometry	3	
XXXX-XXXX	Financial Accounting	3	
XXXX-XXXX	English Comprehension	2	
XXXX-XXXX	Pakistan Studies and Global Perspectives	2	
XXXX-XXXX	Islamic Studies & Professional Ethics OR General and Professional Ethics (for Non-Muslims)	2	
Total		15	

2nd ADP Semester			
Code	Title of the Course	Cr. Hrs.	Remarks
ADIT-1130	Programming for Machine Learning	3	
ENGL-1111	Technical and Business Writing	2	
XXXX-XXXX	Linear Algebra and Discrete Mathematics	3	
XXXX-XXXX	Calculus II	3	
XXXX-XXXX	Economics	3	
ADIT-1104	Computer Vision in Control Systems	3	
	Total	17	
3rd ADP Semester			
Code	Title of the Course	Cr. Hrs.	Remarks
ADIT-2101	Data Structures	3	
ADIT-XXXX	Object Oriented Programming OR Python	3	
ADIT-2109	Data Communication	3	
ADIT-2103	Engineering Graphics	3	
ADIT-2104	Additive Design and Manufacturing (3D Printing)	3	
STAT-2104	Probability and Statistics	3	
	Total	18	
4th ADP Semester			
Code	Title of the Course	Cr. Hrs.	Remarks
ADIT-2105	Computer Architecture and Assembly Language Programming	3	
ADIT-2106	Database Management Systems	3	
ADIT-2107	Robotics and Artificial Intelligence (AI)	3	
ADIT-2108	System Analysis and Design	3	
XXXX-XXXX	Numerical Analysis		
ADIT-2110	Data Systems and Analysis	3	
ADIT-2111	Internship (Mandatory – 03 months)	Pass / Fail	Duration 3 Months
	Total	18	
	Grand Total	68	

6.9 Degree Completion Requirements

The degree completion requirements are summarized below:

- Completion of 68 credit hours
- Mandatory Internship of 03 months

6.10 Date of Commencement

Spring Semester, 2020

7. Course Contents

The course contents are given below for all the courses:

Introduction to ICT					
Credit Hours:	3	Course Code:	ADIT-1101	Prerequisites:	None
Course Contents:					
Introduction to IT, Computing & Communication, Understanding Computer, Peripheral Devices, Hardware Technology, System Unit, Storage Devices, Input / Output devices, Output Devices, Telecommunications, Operating Systems, Application Software, Microsoft Office, World Wide Web, Browsers & Search Engines, Web Page Basic Design, Introduction to Data Communication and Computer Networks Connectivity, Interactivity & Multimedia, Internet Access Devices and connecting medias, Basics of Digital & Analogue Signal, Digital Communication, Networks & Protocols, System Development, Introduction to Programming, Programming Languages, Problems solving Techniques, Introduction to Software Engineering.					
Teaching Methodology:					
Lectures, Written Assignments, Practical labs, Semester Project, Presentations.					
Course Assessment:					
Mid Term Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam.					
Reference Material:					
<ol style="list-style-type: none">1. Introduction to Computers by Peter Norton, McGraw Hill Education; 6th International Edition. (2004). ISBN-10: 06723153272. Using Information Technology: A Practical Introduction to Computer & Communications by Williams Sawyer, McGraw Hill Learning Solution; 10th Edition. (2013). ISBN-10:00713179023. Computing Essentials 2017 by Timothy O'Leary and Linda O'Leary and Daniel O'Leary, McGraw Hill Education; 1st Edition. (2016). ISBN10: 1259737659					

Calculus and Analytical Geometry

Credit Hours:	3	Course Code:		Prerequisites:	None
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Course Contents:

Limits And Continuity; Introduction To Functions, Introduction To Limits, Techniques Of Finding Limits, Indeterminate Forms Of Limits, Continuous And Discontinuous Functions And Their Applications, Differential Calculus; Concept And Idea Of Differentiation, Geometrical And Physical Meaning Of Derivatives, Rules Of Differentiation, Techniques Of Differentiation, Rates Of Change, Tangents And Normal Lines, Chain Rule, Implicit Differentiation, Linear Approximation, Applications Of Differentiation; Extreme Value Functions, Mean Value Theorems, Maxima And Minima Of A Function For Single-Variable, Concavity, Integral Calculus; Concept And Idea Of Integration, Indefinite Integrals, Techniques Of Integration, Riemann Sums And Definite Integrals, Applications Of Definite Integrals, Improper Integral, Applications Of Integration; Area Under The Curve, Analytical Geometry; Straight Lines In R^3 , Equations For Planes.

Teaching Methodology:

Lecturing, Written Assignments

Course Assessment:

Sessional Exam, Home Assignments, Quizzes, Final Exam

Reference Material:

1. Calculus and Analytic Geometry by Kenneth W. Thomas, Addison-Wesley Longman, Incorporated; 8 1992. ISBN-9780201607000
2. Calculus by James Stewart, Cengage Learning; 7th Edition, 2012. ISBN-10: 0538497815
3. Calculus by Earl Swokowski, Michael Olinick and Dennis D. Pence, Brooks Cole; 6th Edition, 1996. ISBN-10: 0534936245

Financial Accounting				
Credit Hours:	3	Course Code:		Prerequisites: None
Course Contents:				
Accounting and its role, Basic Accounting Concepts, The recording process, Preparation of Financial Statements, The adjusting and closing entries, Accounting for trading organization, Accounting Systems, Cash and temporary investment, Accounting for debtors and stock, Accounting for property, plant and equipment.				
Teaching Methodology:				
Lectures, Written Assignments, Practical Labs, Semester Project, Presentations.				
Course Assessment:				
Mid Term Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam.				
Reference Material:				
<ol style="list-style-type: none"> 1. Financial & Managerial Accounting, Williams, Haka, Bettner, Prentice Hall, 18th Edition, 2017, ISBN-10-125969240. 2. Business Accounting, Frank Wood's, Pearson Education Limited 14th Edition, ISBN: 10: 1292208627. 				

Probability and Statistics

Credit Hours:	3	Course Code:	STAT-2104	Prerequisites:	None
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Course Contents:

Set Theory, Types of sets, Methods of Representing sets ,Venn Diagram, System of Linear Equations and its Applications, Solution of Linear system of equations as well as solution by graphically method, Quadratic Inequalities, Sets and properties of sets, Slopes, distance between two points, graphical understanding, Rate, Ratio, proportion, percentage, Interest, depreciation and fraction, Solution of linear equations involving one and two variables and presenting them in real line, Mathematical concepts in Business, Introduction to Statistics, Constructing a Frequency Distribution, Graphing Frequency Distribution, Measures of Central Tendency, Percentiles, Declines and Quartiles, Measures of Dispersion and skewness, Range and Semi-Inter quartile Range, Definitions of Probability, Addition and Multiplication Rules of Probability, Probability Distribution

Teaching Methodology:

Lectures, Written Assignments, Practical Labs, Semester Project, Presentations.

Course Assessment:

Mid Term Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam.

Reference Material:

1. Business statistics by Malim, Muhammad Razi | Faridah Abdul Halim, Call Number: 519.5 MAL, ISBN: 9789834509644, Publication Date: 2011
2. Business Accounting, Frank Wood's, Pearson Education Limited 14th Edition, ISBN: 10: 1292208627.

English Comprehension				
Credit Hours:	2	Course Code:		Prerequisites: None
Course Contents:				
<p>Essay Writing (Introduction, Body, Conclusion), Paragraph Structure (Topic Sentence, Supporting Examples, Transition Sentences), Basic Rhetorical Modes (Narration, Description, Comparison/Contrast, Cause & Effect), Descriptive Essays; Sentence Errors, Writing Process (Brainstorming, Outlining, Drafting, Revising, Editing), Thesis Statements, Fundamentals Of Persuasive Writing: Supporting Claims, Acknowledging Counter-Arguments, Making Concessions, Persuasive Writing; How To Give Presentations, Sentence Errors; Oral Presentations, Effective Use Of Quotation, Paraphrase And Summary, Stylistics (Syntax, Vocabulary, Conciseness, Creating Interest, Tone), Correct Paper Formatting, Grammar & Mechanics As Needed, Responding To And Discussing Assigned Readings, Comparison And Contrast Essays, Dialogue Writing, Short Story Writing, Review Writing, Narrative Essays, Letter Writing.</p>				
Teaching Methodology:				
Lecturing, Written Assignments, Presentation, Report Writing				
Course Assessment:				
Sessional Exam, Home Assignments, Quizzes, Presentation, Final Exam				
Reference Material:				
1. College Writing Skills with Readings by John Langan, McGraw-Hill; 5th Edition, 2005. ISBN- 10: 0072381213				

Pakistan Studies and Global Perspectives				
Credit Hours:	2	Course Code:		Prerequisites: None
Course Contents:				
<p>Historical Background of Pakistan, Muslim Society in Indo-Pakistan, The Movement Led by the Societies, The Downfall of Islamic Society, The Establishment of British Raj- Causes and Consequences, Political and Social Conditions of South Asia on the Eve of the Mughal Invasion, Zaheeruddin , Muhammad Baburhis Early Life, First Battle of Panipat and the Foundation of Mughal Empire, Wars with the Rajputs, Character and Achievements. Naseeruddin Muhammad Humayun Difficulties after his Accession, Defeat at the Hands of Sher Shah Suri, Humayun In Exile and Reoccupation of Throne, Sher Shah Suri and the Later Rulers of Sur Dynastyearly, Life, Capture of Throne, Conquests, Successors of Sher Shah and the end of Sur Dynast, Jalaluddin Muhammad Akbar Early Life, Accession To Throne, Second Battle Of Panipat, Bairam Khan and his Downfall, Conquests, Deccan Policy, Rajput Policy, Engagements and Wars In the North West with Afghan, Religious Policy, Din-i-Ellahi and Reforms, Administration, Character and Achievements of Akbar, Nuruddin Muhammad Jahangir Early Life and Accession, Khusru’s Revolt, Noor Jehan, Qandhar Question, Revolts of Khurram and Mahabat Khan, Activities of European, Character and Achievements, Shahabuddin, Muhammad Shah Jahan Accession to Throne, Golden Period of the Mughal Rule, Central Asian Policy and Qandhar, Deccan Policy, Relations with English East India Company, War of Succession, Character and Achievements. Muhiyuddin Muhammad Aurangzeb Alamgir Accession and Theory Of Kingship, Military Expeditions, Religious Policy and Policy Towards Marathas, Sikhs and Afghans, Political Evolution of Muslims in the Twentieth Century: Sir Syed Ahmed Khan, Muslim League, Nehru, Allama Iqbal: Independence Movement, Lahore Resolution, Pakistan and Its Geo-Political Dimension, Pakistan and International Affairs, Pakistan and the Challenges Ahead.</p>				
Teaching Methodology:				
Lectures, Written Assignments, Practical labs, Semester Project, Presentations.				
Course Assessment:				
Mid Term Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam.				
Reference Material:				
<ol style="list-style-type: none"> 1. The emergence of Pakistan by Chaudhri Muhammad Ali, Columbia University Press; 1st Edition, 1967. ISBN-10: 0231029330 2. The Making of Pakistan by K.K. Aziz, Sang-E-Meel Publication; 1st Edition, 1967. ISBN-10: 969350870X Subject: Political Science 				

Islamic Studies & Professional Ethics OR General and Professional Ethics (for Non-Muslims)

Credit Hours:	2	Course Code:		Prerequisites:	None
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Course Contents:

Introduction to Quranic Studies, Basic Concepts of Quran, History of Quran, Uloom-ul-Quran, Basic Themes of Quran, Introduction to Sciences of Hadith, Introduction to Islamic Jurisprudence, Primary & Secondary Sources of Islamic Law, Makken & Madnian life of the Prophet, Islamic Economic System, Political Theories, Social System of Islam, Verses of Surah Al-Baqara Related to Faith (Verse No-284-286), Verses of Surah Al-Hujrat Related to Adab Al-Nabi (Verse No-1-18), Verses of Surah Al-Mumanoon Related to Characteristics of Faithful (Verse No-1-11), Verses of Surah al-Furqan Related to Social Ethics (Verse No.63- 77), Verses of Surah Al-Inam Related to Ihkam (Verse No-152-154), Verses of Surah Al-Ihzab Related to Adab al-Nabi (Verse No.6, 21, 40, 56, 57, 58.), Verses of Surah Al-Hashar (18,19,20) Related to Thinking, Day of Judgment, Verses of Surah Al-Saf Related to Tafakar, Tadabar (Verse No-1,14), Seerat of Holy Prophet (S.A.W), Life of Muhammad Bin Abdullah (Before Prophet Hood), Life of Holy Prophet (S.A.W) in Makkah, Important Lessons Derived from the Life of Holy Prophet in Makkah, Life of Holy Prophet (S.A.W) in Madina, Important Events of Life Holy Prophet in Madina.

Teaching Methodology:

Lectures, Written Assignments, Practical labs, Semester Project, Presentations.

Course Assessment:

Mid Term Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam.

Reference Material:

1. Islamic Ethics: Critical Concepts in Islamic Studies by Tariq Ramadan, Routledge; 1st Edition, 2016. ISBN-10: 1138848166
2. Muslim Jurisprudence and the Quranic Law of Crimes by Waliullah Mir, Adam Publishers and Distributors; 3rd Edition, 2007. ISBN- 10: 8174355227

Programming for Machine Learning					
Credit Hours:	3	Course Code:	ADIT-1103	Prerequisites:	None
Course Contents:					
Introduction to Data Science, Data Science Life cycle & Process (Asking Right Questions, Obtaining Data, Understanding Data, Building Predictive Models, Generating Visualizations), For Building Data Products, Introduction to Data (Types of Data and Data Sets), Data Quality (Measurement and Data Collection Issues), Data pre-processing Stages (Aggregation, Sampling, Dimensionality Reduction, Feature subset selection, Feature creation etc.), Algebraic & Probabilistic View of Data, Introduction to Python Data Science Stack (Python, Numpy, Pandas, Matplotlib), Relational Algebra & SQL, Scraping & Data Wrangling (assessing, structuring, cleaning & munging of data), Basic Descriptive & Exploratory Data Analysis using Plotly and Matplotlib, Introduction to Text Analysis (Stemming, Lemmatization, Bag of Words, TF-IDF), Introduction to Prediction and Inference (Supervised & Unsupervised) Algorithms, Introduction to Scikit Learn, Bias-Variance Tradeoff, Model Evaluation & Performance Metrics (Accuracy, Contingency Matrix, Precision-Recall, F1-Score, etc.), Introduction to Map-Reduce paradigm, Introduction to R, Reading data into R, Data frames, Basic and advanced plots for Data Visualization.					
Teaching Methodology:ss					
Lectures, Written Assignments, Practical labs, Semester Project, Presentations.					
Course Assessment:					
Mid Term Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam.					
Reference Material:					
<ol style="list-style-type: none"> 1. Introduction to Data Science: A Python Approach to Concepts, Techniques and Applications by Laura Igual and Santo Segui, Springer, 1st Edition, 2017; ISBN 978-3-319-50016-4 2. Python Data Science Cookbook by Gobi Subramanian, Packt Publishing, 1st Edition, 2015; ISBN 978-1-78439-640-4 3. Data Science from Scratch by Joel Grus, O'Reilly Media, 1st Edition, 2015; ISBN 978-1-491-90142-7 					

Linear Algebra

Credit Hours:	3	Course Code:	MATH-XXXX	Prerequisites:	None
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Course Contents:

Algebra of Linear Transformations and Matrices, Matrices and Linear Equations Matrices ,Multiplication of Matrices, Homogeneous Linear Equations and Elimination, Row Operations and Gauss Elimination , Row Operations and Elementary Matrices , Linear Combinations , Determinants, Rank, Systems Of Equations, Vector Spaces, Convex Sets, Linear Independence , Dimension, The Rank of a Matrix Orthogonal Transformations, Linear Dependence, Linear Independence And Bases, The Kernel and Image of a Linear Map, The Rank and Linear Equations Again, Composition and Inverse Mappings, Eigenvalues And Eigenvectors ,Characteristic Equations, Inner Product Space And Quadratic Forms, Eigenvectors and Eigenvalues, Eigenvalues and Eigenvectors of Symmetric Matrices, Diagonalization of a Symmetric Linear Map

Teaching Methodology:

Lectures, Written Assignments, Practical labs, Semester Project, Presentations.

Course Assessment:

Mid Term Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam.

Reference Material:

1. Introduction to Linear Algebra by Gilbert Strang, Wellesley-Cambridge Press; 5th Edition , 2016. ISBN-10: 0980232775
2. Advanced Linear Algebra by Nicholas Loehr, Chapman and Hall/CRC; 1st Edition, 2014. ISBN-10: 1466559012
3. Linear Algebra Applications, and Techniques by Richard Bronson, Gabriel B. Costa and John T. Saccoman, Academic Press; 3rd Edition , 2013. ISBN-10: 97801239142

Discrete Mathematics			
Credit Hours:	3	Course Code:	
Prerequisites:			None
Course Contents:			
<p>Propositional & Predicate Logic, Mathematical Reasoning, Logic Connectives & Their Applications, Laws of Logic, Rules of Inference, Contraposition, Proof by Contradiction, Proof by Implication, Circuit's Theory, Logic Connectives & Logic Gates, Set Theory, Venn Diagram, Set Identities & Venn Diagram Applications, Relations, Relation Forms & Types, Relation Representation Mechanism, Partition Orderings, Recurrence Relations, Relation Properties & Their Applications. Functions: Function Mappings, Function Composition, Inverse Functions & Recursive Functions. Sequences, Series, Counting, Permutations & Combinations, Elements of Graph Theory, Directed Graph, Weighted Graph and Its Applications, Path & Circuits, Matrix Representation of Graphs, Function & algorithms, Dividing algorithms, Comparing Different Algorithms, Time and Space Complexity of Algorithms, Data Structures: Stack, Queues, Link List, Trees, and Searching Techniques in Tree.</p>			
Teaching Methodology:			
Lectures, Exercise, Practice-Problem Solving Session, Presentations.			
Course Assessment:			
Mid Term Exam, Home Assignments, Quizzes, Final Exam.			
Reference Material:			
<ol style="list-style-type: none"> 1. Discrete Mathematics and its Applications by Kenneth H. Rosen, McGraw-Hill Education, 7th Edition, 2011; ISBN:978-0073383095 2. Discrete Mathematics with Applications by Susanna S. Epp, Cengage Learning, 4th Edition, 2010; ISBN:978-0495391326 3. Discrete Mathematics by Richard Johnson Baugh, Pearson, 7th Edition, ISBN: 978-0131593183 			

Calculus II					
Credit Hours:	3	Course Code:	MATH-XXXX	Prerequisites:	None
Course Contents:					
Limits And Continuity; Introduction To Functions, Introduction To Limits, Techniques Of Finding Limits, Indeterminate Forms Of Limits, Continuous And Discontinuous Functions And Their Applications, Differential Calculus; Concept And Idea Of Differentiation, Geometrical And Physical Meaning Of Derivatives, Rules Of Differentiation, Techniques Of Differentiation, Rates Of Change, Tangents And Normal Lines, Chain Rule, Implicit Differentiation, Linear Approximation, Applications Of Differentiation; Extreme Value Functions, Mean Value Theorems, Maxima And Minima Of A Function For Single-Variable, Concavity, Integral Calculus; Concept And Idea Of Integration, Indefinite Integrals, Techniques Of Integration, Riemann Sums And Definite Integrals, Applications Of Definite Integrals, Improper Integral, Applications Of Integration; Area Under The Curve, Analytical Geometry; Straight Lines In R ³ , Equations For Planes.					
Teaching Methodology:					
Lecturing, Written Assignments					
Course Assessment:					
Sessional Exam, Home Assignments, Quizzes, Final Exam					
Reference Material:					
<ol style="list-style-type: none"> 1. Calculus and Analytic Geometry by Kenneth W. Thomas, Addison-Wesley Longman, Incorporated; 8 Edition, 1992. ISBN-9780201607000 2. Calculus by James Stewart, Cengage Learning; 7th Edition, 2012. ISBN-10: 0538497815 3. Calculus by Earl Swokowski, Michael Olinick and Dennis D. Pence, Brooks Cole; 6th Edition, 1996. ISBN-10: 0534936245 					

Technical and Business Writing

Credit Hours:	2	Course Code:	ENGL-1111	Prerequisites:	None
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Course Contents:

Overview of Technical Reporting, Use of Library and Information Gathering, Administering ,Questionnaires, Reviewing the Gathered Information, Exemplification, Definition, Classification and Division, Casual Analysis, Effective Exposition, Technical Narration, Description and Argumentation, Persuasive Strategy, Organizing Information and Generation. Organizing Material, Construction of the Formal Outline, Outlining Conventions, Electronic Communication, Paragraphs, Listening Sentence Structure, Clarity, Length and Order, Pomposity, Empty Words, Pompous Vocabulary, Document Structure, Preamble, Summaries, Abstracts, Table of Contents, Footnotes, Glossaries, Cross-Referencing, Plagiarism, Citation and Bibliography, Glossaries, Index, Appendices, Typesetting Systems, Creating the Professional Report; Elements, Mechanical Elements And Graphical Elements. Reports: Proposals, Progress Reports, Leaflets, Brochures, Handbooks, Magazines Articles, Research Papers, Feasibility Reports, Project Reports, Technical Research Reports, Manuals and Documentation.

Teaching Methodology:

Lectures, Written Assignments, Practical labs, Semester Project, Presentations.

Course Assessment:

Mid Term Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam.

Reference Material:

1. Technical Report Writing, by Pauley and Riordan, Houghton Mifflin Company; 8thEdition, 2002. ISBN -10: 0618140166, ISBN - 13: 9780618140169
2. Effective Technical Communication by Ashraf Rizvi, Tata McGraw-Hill; 3rd Edition, 2005. ISBN-10:1259082512, ISBN-13: 9781259082511

Linear Algebra and Discrete Mathematics

Credit Hours:	2	Course Code:		Prerequisites:	None
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Course Contents:

Introduction, Propositional Logic, Predicate Logic, Methods of Proof, Set Theory, Sequences and Recurrence, Mathematical Induction, Basic of Counting and Permutation, Combination, Probability Theory, Independent events, Bayes' Theorem and its applications, Functions, Relations, Algebra of Linear Transformations and Matrices, Matrices and Linear Equations Matrices, Multiplication of Matrices, Homogeneous Linear Equations and Elimination, Row Operations and Gauss Elimination, Row Operations and Elementary Matrices, Linear Combinations, Determinants, Rank, Systems Of Equations, Vector Spaces, Convex Sets, Linear Independence, Dimension, The Rank of a Matrix Orthogonal Transformations, Linear Dependence, Linear Independence And Bases, The Kernel and Image of a Linear Map, The Rank and Linear Equations Again, Composition and Inverse Mappings, Eigenvalues And Eigenvectors, Characteristic Equations, Inner Product Space And Quadratic Forms, Eigenvectors and Eigenvalues, Eigenvalues and Eigenvectors of Symmetric Matrices, Diagonalization of a Symmetric Linear Map.

Teaching Methodology:

Lectures, Written Assignments, Practical labs, Semester Project, Presentations.

Course Assessment:

Mid Term Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam.

Reference Material:

1. Introduction to Linear Algebra by Gilbert Strang, Wellesley-Cambridge Press; 5th Edition, 2016. ISBN-10: 0980232775
2. Applied Discrete Structures by Ken Levasseur, 2019, ISBN-13: 978-1105559297
3. Discrete Mathematics and its Applications by Kenneth H. Rosen, McGraw-Hill Education, 7th Edition, 2011; ISBN: 978- 0073383095

Data Structures					
Credit Hours:	3	Course Code:	ADIT-2101	Prerequisites:	
Course Content:					
<p>Abstract data types, Complexity Analysis, Big-O notation, Stacks (Linked Lists and Array Implementations), Recursion and Analyzing Recursive Algorithms, Divide and Conquer algorithms, Sorting Algorithms (Selection, Insertion, Merge, Quick, Bubble, Heap, Shell, Radix, Bucket), Queue, Dequeue, Priority Queues (Linked and Array Implementations of Queues), Linked List & its Various Types, Sorted Linked List, Searching an Unsorted Array, Binary Search for Sorted Arrays, Hashing and Indexing, Open Addressing and Chaining, Trees and Tree Traversals, Binary Search Trees, Heaps, M-way Tress, Balanced Trees, Graphs, Breadth-First and Depth-First Traversal, Topological Order, Shortest Path, Adjacency Matrix and Adjacency List Implementations, Memory Management and Garbage Collection.</p>					
Teaching Methodology:					
Lectures, Written Assignments, Practical labs, Semester Project, Presentations					
Course Assessment:					
Sessional Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam					
Reference Material:					
<ol style="list-style-type: none"> 1. Data Structures and Abstractions with Java by Frank M. Carrano & Timothy M. Henry, Pearson, 5thEdition 2018; ISBN-13: 978-0134831695. 2. Data Structures and Algorithm Analysis in C++ by Mark A. Weiss, Pearson, 4th Edition, 2013; ISBN-13: 978-0132847377. 3. Java Software Structures: Designing and Using Data Structures by John Lewis and Joseph Chase, Pearson, 4thEdition, 2013; ISBN-13: 978-0133250121. 					

Economics					
Credit Hours:	3	Course Code:		Prerequisites:	None
Course Content:					
The Economic Problem, Microeconomics, Macroeconomics, Distinction Between Microeconomics and Macroeconomics, Scope of macroeconomics, Demand and Supply, Elasticity, Elasticity of Demand & Supply, Costs of Production, Perfect Competition, Monopoly and Imperfect Competition, Economic Welfare and Income Distribution, Measures of Economic Activity, Inflation and Unemployment, Economic Fluctuations, Fiscal Policy, Money, Monetary Policy					
Teaching Methodology:					
Lectures, Written Assignments, Practical labs, Semester Project, Presentations					
Course Assessment:					
Sessional Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam					
Reference Books:					
<ol style="list-style-type: none"> 1. Lovewell, M. (2012) Understanding Economics: A Contemporary Perspective (7th edition), Toronto: McGraw-Hill Ryerson 2. Mankiw N. Gregory, Principles of Microeconomics 7 th edition (or latest available). 3. N. Gregory Mankiw. Principles of Macroeconomics, (latest edition) 					

Computer vision in Control System					
Credit Hours:	3	Course Code:	ADIT-1104	Prerequisites:	None
Course Contents:					
Introduction, Image Processing for Computer Vision, Linear image processing, Model fitting, Frequency domain analysis, Camera Models and Views, Camera models, Stereo geometry, Camera calibration, Multiple views, Image Features, Feature detection, Feature descriptors, Model fitting, Lighting, Photometry, Lightness, Shape from shading, Image Motion, Overview, Optical flow, Tracking, Introduction to tracking, Parametric models, Non-parametric models, Tracking considerations, Classification and Recognition, Introduction to recognition, Classification: Generative models, Classification, Discriminative models, Action recognition, Useful Methods, Color spaces and segmentation, Binary morphology, 3D perception, Human Visual System, The retina, Vision in the brain.					
Teaching Methodology:					
Lectures, Written Assignments, Practical labs, Semester Project, Presentations.					
Course Assessment:					
Mid Term Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam.					
Reference Material:					
<ol style="list-style-type: none"> 1. Ballard and Brown. "Computer Vision." Prentice Hall. Szeliski, Richard, Computer Vision: Algorithms and Applications Springer, 2011 2. Computer Vision in Control Systems-4 Editors: Favorskaya, Margarita N., Jain, Lakhmi (Eds.) 					

Object Oriented Programming

Credit Hours:	3+1	Course Code:	ADIT-2102	Prerequisites:
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Course Content:

Introduction to Object Oriented Design, History and Advantages of Object Oriented Design, Introduction to Object Oriented Programming Concepts, Classes, Objects, Data Encapsulation, Constructors, Destructors, Access Modifiers, Const. vs Non-Const. Functions, Static Data Members & Functions, Function Overloading, Operator Overloading, Identification of Classes and their Relationships, Composition, Aggregation, Inheritance, Multiple Inheritance, Polymorphism, Abstract Classes and Interfaces, Generic Programming Concepts, Function & Class Templates, Standard Template Library, Object Streams, Data and Object Serialization Using Object Streams, Exception Handling.

Teaching Methodology:

Lectures, Written Assignments, Practical labs, Semester Project, Presentations

Course Assessment:

Sessional Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam

Reference Material:

1. Starting Out with C++ from Control Structures to Objects by Tony Gaddis, Pearson, 9th Edition, 2017; ISBN-13: 978-0134498379.
2. C++ How to Program by Paul J. Deitel and Harvey Deitel, Pearson, 10th Edition, 2016; ISBN-13: 978-0134448237.
3. Java: How to Program by Paul Deitel and Harvey Deitel, Prentice Hall, 9th Edition, 2011; ISBN-13: 978-0132575669.
4. Beginning Java 2 by Ivor Horton, Wrox, Java 7th Edition, 2011; ISBN-13: 978-0470404140.
5. An Introduction to Object Oriented Programming with Java by C. Thomas Wu, McGraw-Hill Education, 5th Edition, 2009; ISBN-13: 978-0073523309.
6. Object Oriented Programming in C++ by Robert Lafore and Waite Group, Sams Publisher, 3rd Edition, 1998; ISBN-13: 978-1571691606.

Python					
Credit Hours:	3	Course Code:	ADIT-2142	Prerequisites:	None
Course Contents:					
<p>Introduction to Problem Solving, Control Flow, Methods and Data Structures, Object Oriented Programming, I/O, File Handling, Threading, Multi-Threading, Multiprocessing, Functional Programming using Python, Numpy, Numerical Computation, High Performance Computing, Book-keeping and Log Files, Security, Hashing Techniques, Event-driven Programming using Python, Graphical User Interface in Python(Tkinter), Scientific Computation using Python, Data Representation Using Python, Matplotlib, Plotting, Data Mining and Machine Learning using Python, Image Manipulation using Python, Natural Language Processing using Python, Audio/Video manipulation, Graph Theory, Computer Vision using Python, Network Emulation, Raw Packet Manipulation using Python, Networking: Socket programming using Python, Pandas, Scipy, Big Data and Warehouse-Scale Computing, MapReduce-Theory and Implementation.</p>					
Teaching Methodology:					
Lectures, Written Assignments, Practical labs, Semester Project, Presentations.					
Course Assessment:					
Mid Term Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam.					
Reference Material:					
<ol style="list-style-type: none"> 1. Introduction to Computation and Programming Using Python by John V. Guttag, The MIT Press, Spring 2013; ISBN-13: 978-0262519632. 2. The Art of Computer Programming by Donald E. Knuth, Addison-Wesley Professional 1st edition 2011, ISBN-13: 978-0321751041. 3. How to Think Like a Computer Scientist: Learning with Python by Allen B. Downey and Jeffrey Elkner and Chris Meyers, Green Tea Press 2002, ISBN-13: 978-0971677500. 					

Data Communication					
Credit Hours:	3	Course Code:	ADIT-2109	Prerequisites:	COSC-3101
Course Contents:					
<p>Introduction to Wireless Networks, Understanding Network Models, Applications of Wireless Networks, Fundamentals of Wireless Mediums, Wireless Hardware & Software, Access Points, WLAN Routers, WLAN Bridges, WLAN Repeaters, WLAN Controllers/Switches, POE Infrastructure, Antennas and Accessories, WLAN Connectivity, WLAN Security, WLAN QoS & Power-Save, Radio Frequency (RF) Fundamentals, Units of RF measurements, Factors affecting network range and speed, Environment, Line of Sight, Interference, Range, coverage, and capacity, Mobile networks, addressing and device mobility, dynamic Routing and IP-based solutions. WLAN, Infrastructure and Hot-Spot Networks, Sensor Networks, Mobile Ad Hoc Networks, Vehicular Ad Hoc Networks, Wireless Mesh Networks, Cellular Systems and Networks, architectures and techniques, 1G, 2G, 2.5 G, GPRS, EDGE, 3G, UMTS, 4G, Satellite systems, Wireless Standards, IEEE 802.11 (Wi-Fi), IEEE 802.16 (wimax), IEEE 802.20 (Mobile Broadband Wireless Access), IEEE 802.15.1 (Bluetooth), IEEE 802.15.4 (zigbee).</p>					
Teaching Methodology:					
Lectures, Written Assignments, Practical Labs, Semester Project, Presentations.					
Course Assessment:					
Mid Term Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam.					
Reference Material:					
<ol style="list-style-type: none"> 1. Wireless Communication Networks and Systems by Cory Beard and William Stallings, Pearson, 1st Edition, 2015; ISBN-13: 978-0133594171 2. Wireless Networking by Michael Miller, Pearson, 1st Edition, 2013; ISBN- 0133381307 3. Data Communications and Networking by Behrouz A. Forouzan, McGraw-Hill Science, 5th Edition, 2012; ISBN-10: 073376221 4. Data and Computer Communications by William Stallings, Prentice Hall, 9th Edition, 2010; ISBN-10: 0131392050 					

Engineering Graphics					
Credit Hours:	3	Course Code:	ADIT-2103	Prerequisites:	None
Course Contents:					
Standards and conventions including the importance of computer graphics to engineering drawings, Sketching (equipment, materials, lines, proportions and curves including orthographic projections and pictorial representations), Dimensioning (terminology and conventions, choice, rules), Views (sections, auxiliary, rotated and selection of views), Tolerances and allowances (methods, fits), Fasteners.					
Teaching Methodology:					
Lectures, Written Assignments, Practical Labs, Semester Project, Presentations.					
Course Assessment:					
Mid Term Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam.					
Reference Material:					
<ol style="list-style-type: none"> 1. Fundamentals Of Graphics Communication Author: Gary Robert Bertoline 2. Technical Drawing with Engineering Graphics Authors: Giesecke, Hill, Spencer, Mitchell, Dygdon, Novak, Lockhart & Goodman 					

Additive Design and Manufacturing (3D Printing)					
Credit Hours:	3	Course Code:	ADIT-2104	Prerequisites:	None
Course Contents:					
<p>Process Physics For Additive Manufacturing (AM), General!Overview, Why Additive Manufacturing?, Direct Digital Manufacturing and AM parts and their uses, Computer Aided Design (CAD) and Manufacturing(CAM) and AM, Different AM processes and relevant Process Physics, Materials Science for Additive Manufacturing, Polymer and Photopolymerization, Polymer and selective Laser Sintering (SLS), Ceramics: SLS and Laser Chemical Vapor Deposition(LCVD), Metals: Direct Metal Deposition (DMD) and SLS, Role of Rapid Solidification, Evolution of Non-Equilibrium Structure, Structure Property relationship, Design of tailored structure for end application, Selection of process for desired application, Mathematical Models for Additive Manufacturing, Transport phenomena models for: i) Temperature History ii) Fluid Flow History iii) Composition, Residual stress history, Process monitoring and Control for AM, Defects,Geometry, Temperature, Composition, Phase Transformation, Application of AM for various Industries, Aerospace: Reactive and Lightweight materials, Automobile: Light Weight components, mold Thermal and Wear management, Oil and Gas: Wear and Corrosion management, Agriculture: Wear and Corrosion management, Additive Manufacturing Systems, Stereolithography, 3MD Printing, Selective Laser Sintering(SLS), Direct Metal Deposition(DMD), and Light Engineered Net Shaping(LENS).</p>					
Teaching Methodology:					
Lectures, Written Assignments, Practical Labs, Semester Project, Presentations.					
Course Assessment:					
Mid Term Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam.					
Reference Material:					
<ol style="list-style-type: none"> Additive Manufacturing Technologies Authors: Ian Gibson, David W. Rosen, Brent Stucker. Fabricated: The New World of 3D Printing by Hod Lipson, Melba Kurman 					

Database Management Systems					
Credit Hours:	3	Course Code:	ADIT-2106	Prerequisites:	None
Course Contents:					
<p>Basic database concepts, Characteristics, advantages and implications of the database approach to information systems as contrasted with traditional integrated file systems. DBMS architecture. Roles involved with database systems. The database system environment including data models, schemas, database languages and interfaces. Three-schema architecture and data independence. Information analysis to identify query keys, candidate keys, entities, attributes relationships and integrity constraints. ER modeling as a means of representing information concepts. Extended entity relationship modeling as it relates to specialization, generalization and inheritance. Relational model concepts. Referential integrity, entity integrity, and other constraints. Defining a relational schema from an ER diagram. Definition and use of relational algebra operations to query a relational database. Use of SQL to define a relational data model. Basic and complex queries in SQL. Insert, delete and update statements in SQL. Defining and using Views in SQL. Implement security with Grant/Revoke. Definition of functional dependency, full functional dependency, transitive dependency and multi-valued dependency. Definition of the normal forms from un-normalized through 4th normal form and how to apply the normalization process to recognize normal forms. How to move a data model to a higher normal form and the issues of de-normalization as it applies to retrieval performance.</p>					
Teaching Methodology:					
Lectures, Power Point Slides, Interactive Sessions, Extra Material, Projects, Presentations					
Course Assessment:					
Midterm Exam, Quizzes, Home Assignments, Case Study, Projects, Presentations, Final Exam					
Reference Material:					
<ol style="list-style-type: none"> 1. Database Systems: Design, Implementation & Management by Thomas Connolly and Steven Morris, Cengage Learning, 13th Edition, 2018; ISBN-10: 1337627909 2. Modern database management by Jeffrey A. Hoffer, Ramesh Venkataraman and Heikki Topi, Pearson, 11th Edition, 2012; ISBN-10: 0132662256. 3. Database system concepts by Abraham Silberschatz, Henry Korth and S. Sudarshan, McGraw-Hill Education, 6th Edition, 2010; ISBN-10: 0073523321 					

Robotics and Artificial Intelligence (AI)

Credit Hours:

3

Course Code:

ADIT-2107

Prerequisites:

Course Contents:

Introduction to AI, basic component of AI, Identifying AI systems, branches of AI, Reasoning and Knowledge Representation of AI, Introduction to Reasoning and Knowledge Representation, Propositional Logic, First order Logic, Problem Solving by Searching (Informed searching, Uninformed searching, Local searching.), Constraint Satisfaction Problems, Adversarial Search (Min-max algorithm, Alpha beta pruning, Game-playing), Learning Unsupervised learning, Supervised learning, Reinforcement learning, Uncertainty handling, Uncertainty in AI, Fuzzy logic, Recent trends in AI and applications of AI algorithms, Case study of AI systems, Analysis of AI systems

Teaching Methodology:

Lectures, Written Assignments, Practical labs, Semester Project, Presentations.

Course Assessment:

Mid Term Exam, Home Assignments, Quizzes, Project, Presentations, Final Exam.

Reference Material:

1. Artificial Intelligence. A Modern Approach, Stuart Russell and Peter Norvig, 3rd Edition, Prentice Hall, Inc., 2010; ISBN-10: 0136042597
2. Pattern classification. Hart, P.E., Stork, D.G. and Duda, John Willey & Sons, ISBN-10: 0471056693
3. AI algorithms, data structures, and idioms in Prolog, Lisp, and Java, Luger, G.F. and Stubblefield, W.A., 2009. Pearson Addison-Wesley, ISBN-10: 0136070477

System Analysis and Design					
Credit Hours:	3	Course Code:	ADIT-2108	Prerequisites:	None
Course Contents:					
<p>Introduction to systems analysis and design, Introduction to Systems Development: organizational and business context of systems development. Approaches to Systems Development and Project Management: explain and apply systems development methodologies, models, tools and techniques for developing quality software, project management in the context of systems development, Systems Analysis Activities: how to define, prioritise, and evaluate requirements of an information system as well as build general and detailed models that specify the system requirements, Essentials of Systems Design: describe, organize and structure the components of a system, including decisions about the system's hardware, software, and network environment, designing effective user and system interfaces considering human-computer interaction principles, Advanced Systems Design Concepts: learn to apply object-oriented design in order to build detailed models that assist programmers in implementing the system, learn how to store and exchange data in the system by considering database management and security issues, and creating database models and controls, Making the System Operational: learn about implementation, software testing and deployment issues, Current Trends in System Development: learn about emerging trends in systems development.</p>					
Teaching Methodology:					
Lectures, Written Assignments, Semester Project, Lab Assignments, Presentations.					
Course Assessment:					
Sessional Exam, Home Assignments, Quizzes, Final Exam					
Reference Material:					
<ol style="list-style-type: none"> 1. <i>Systems Analysis and Design in a Changing World, edition 6th</i> by J.W. Satzinger, R. B. Jackson and S. D. Burd Boston, USA: Thomson Course Technology, 2012. (ISBN-10: 1-111-53415-2 ISBN-13: 978-1-111-53415-8) 2. Systems Analysis and Design (Shelly Cashman Series) 11th Edition by Scott Tilley, Cengage learning february 5, 2016 (ISBN-10: 1305494601, ISBN-13: 978-1305494602) 					

Data Systems and Analysis

Credit Hours:	3	Course Code:	ADIT-2110	Prerequisites:	None
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Course Contents:

System analysis, analyst and its role, data as product, introduction to data analysis, life cycle of data analysis, defining data items, management of data dictionary, DFD use case, studying different data gathering techniques, data process: data normalization, data cleansing, Data storage: data modeling, data communication. Introduction to data science: data mining techniques, study different data processing and mining algorithms.

Teaching Methodology:

Lectures, Written Assignments, Semester Project, Lab Assignments, Presentations.

Course Assessment:

Sessional Exam, Home Assignments, Quizzes, Final Exam

Reference Material:

1. *Data driven modeling and Scientific computation* by J. Nathan Kutz, oxford university press; 1st edition September 15 2013, isbn10: 0199660344

Numerical Analysis				
Credit Hours:	3	Course Code:		Prerequisites: None
Course Contents:				
<p>Mathematical preliminaries and error analysis, round-off errors and computer arithmetic, Calculate Divided Differences. Use Divided-difference Table. Find Newton's Interpolation Polynomial. Calculate Interpolation with Equally Spaced Data. Find the Difference Table. Calculate, Newton's Forward & Backward Difference Formulae. Use Gauss Formulae. Use Stirling's Interpolation Formula. Use Bessel's Interpolation Formula. Use Everett's Interpolation Formula. Solve Nonlinear Equations. Solve Equations by Bisection Method. Solve Equations by Regula Falsi Method. Solve Equations by Secant Method. Solve Equations by Newton-Raphson Method. Find Fixed Point Iteration. Solve Equations by Jacobi Iterative Methods. Solve Equations by Gauss Seidel Method Calculate Numerical Differentiation. Find Numerical Differentiation Formulae Based on Equally Spaced Data. Find Numerical Differentiation Based on Newton's Forward Differences. Find Numerical Differentiation Based on Newton's Backward Differences. Find Numerical Differentiation Based on Stirling's Formula. Find Numerical Differentiation Based on Bessel's Formula. Find Numerical Differentiation Based on Lagrange's Formula. Calculate Error Analysis of Differentiation Formulae. Solve Richardson Extrapolation. Calculate Numerical Integration. Use Trapezoidal Rule with Error Term. Use Simpson's 1/3 Rule with Error Term. Use Simpson's 3/8 Rule with Error Term. Use Composite Numerical Integration. Use Composite Trapezoidal Rule. Use Composite Simpson's Rule. Find Richardson's Extrapolation. Find Newton-Cotes Closed Quadrature Formulae.</p>				
Teaching Methodology:				
Lectures, Written Assignments, Semester Project, Lab Assignments, Presentations.				
Course Assessment:				
Sessional Exam, Home Assignments, Quizzes, Final Exam				
Reference Material:				
<ol style="list-style-type: none"> 1. Numerical Analysis by Richard L. Burden, J. Douglas Faires, Brooks/Cole Boston USA, 9th Edition, 2011, ISBN-10: 0538733519. 2. Numerical Methods for Scientific Computing by J.H. Heinbockel Trafford Publishing USA, 2004, ISBN 10: 1412031532. 				