https://datascience.uiu.ac.bd/ug-program/course-plan/

Sequence of Course Offerings in Twelve Trimesters Trimester 1 DS 1501 Programming for Data Science * Course Code: DS 1501 * Credit Hour: 3.0 * Prerequisite:

Branching and iteration; String Manipulation, Guess and Check, Approximations, Bisection; Decomposition, Abstractions, Functions; Tuples, Lists, Aliasing, Mutability, Cloning; Recursion, Dictionaries; Testing, Debugging, Exceptions, Assertions, Files and I/O. DS 1502 Programming for Data Science Laboratory * Course Code: DS 1502 * Credit Hour: 1.0 * Prerequisite:

Laboratory work based on DS 1501. ENG 1011 English â€" I * Course Code: ENG 1011 * Credit Hour: 3.0 * Prerequisite:

Reading and Writing: Cohesion, Skimming, Coherence, Scanning; Reading and Annotation; Main ideas, Brainstorming and Taking notes; Comprehensions; Linking and Transitional words; Grammatical Knowledge: Parts of Speech, Punctuation, Subject Verb Agreement, Tense; WH Questions; Paraphrasing; Summarizing; News Report Writing; Creative Writing; Presentation. Speaking and Listening: Speaking and Listening strategies; Pronunciation and Intonation; Vocabulary, Educated guess from content; Linking words and Fillers; Introduction to Drama; Performing Play; Art of Questioning; Famous Speeches; Listening Activities; How to make and present a brochure; News Reporting; Impromptu Speaking; Group Presentation. BDS 1201 History of the Emergence of Bangladesh * Course Code: BDS 1201 * Credit Hour: 2.0 * Prerequisite:

Partition of Bengal (1947); Language Movement (1952); Movement for Autonomy; 6-point and 11-Point Programs; The 1970 Election; Speech on 7th of March 1971; Military Action, Genocide in the East Pakistan; The Liberation War; The Emergence of Bangladesh as a Sovereign Independent State in 1971; Constitution of Bangladesh and citizen rights; Culture: Cultural diffusion and change, Bengali culture and problems of society; social problems of Bangladesh; Social change: theories of social change; social change in Bangladesh; urbanization process and its impact on Bangladesh society. Trimester 2 DS 1115 Object Oriented Programming for Data Science * Course Code: DS 1115 * Credit Hour: 3.0 * Prerequisite:

Philosophy of Object Oriented Programming (OOP); Advantages of OOP over structured programming; Abstraction and Encapsulation, classes and objects, access specifiers, static and non-static members; Constructors, destructors and copy constructors; Array of objects, object pointers, and object references; Inheritance: single and multiple inheritance; Polymorphism:overloading, abstract classes, virtual functions and overriding; Exceptions; Object Oriented I/O; Template functions and classes; Multithreaded Programming. DS 1116 Object Oriented Programming Laboratory for Data Science * Course Code: DS 1116 * Credit Hour: 1.0 * Prerequisite:

Laboratory work based on DS 1115. ENG 1013 English - II * Course Code: ENG 1013 * Credit Hour: 3.0 * Prerequisite: ENG 1011

Reading and Writing: Outlining, Drafting, Editing, Revising, Final Draft, Publishing; Prewriting Techniques: Free writing, Scratching out, Clustering, Questioning; Differences between a paragraph and an essay; Format of a paragraph; Adding details/ Body paragraphs: Ordering paragraphs, Time order, Emphatic order, Use of transitional words; Structure of a traditional essay; Types of Essays: Descriptive, narrative, Cause-Effect, Argumentative, Compare and Contrast, Persuasive essay; Writing a good conclusion; Academic reading: Using index, choosing a book; narratorâ€™s point of view; Preventing regression; Critical thinking; Expanding fixations; Return sweep. Speaking and Listening: Greetings and Expressions; Practice speaking; Role play (using modals and phrases); Handling situations; Listening tracks and speeches; Developing public speaking: Increasing confidence; Critical thinking and Vocabulary list; newspaper project; Human rights discussion; Special occasion speech; Impromptu; Developing presentation skills; Developing argumentative skill: Argumentative

presentation. Grammar Contents: Overview of verb tenses; Present and Past, Simple and Progressive; Perfect progressive tenses and Future time. MATH 1151 Fundamental Calculus * Course Code: MATH 1151 * Credit Hour: 3.0 * Prerequisite:

Function: domain and range of a function, Translation, reflection, compression and stretches of a function; Even and odd functions; Inverse functions; One-to-One and many-to-one functions; Family of exponential, logarithmic, sine and cosine functions; Limit, continuity and differentiability; Tangent line; Derivative and chain rule; An overview of area problem; Newton's antiderivative method in finding area; Indefinite integral, fundamental theorem of calculus; Definite integral; Area between two curves, arc length. Trimester 3 DS 1101 Fundamentals of Data Science * Course Code: DS 1101 * Credit Hour: 3.0 * Prerequisite:

Elements of Data Science: data collection and management; summarizing and visualizing data; basic ideas of statistical inference; machine learning; Computational thinking and programming; Data Scientist's toolbox; Getting and Cleaning data; Exploratory data analysis; Reproducible Research; Statistical Inference; Developing Data Products. BIO 3105 Biology * Course Code: BIO 3105 * Credit Hour: 3.0 * Prerequisite:

Introduction; The Basics of Life: Chemistry; Organic Molecules: The Molecules of Life; Cell Structure and Function; Enzymes, Coenzymes, and Energy; Biochemical Pathways: Cellular Respiration, Photosynthesis; DNA and RNA: The Molecular Basis of Heredity; Cell Division; Patterns of Inheritance; Applications of Biotechnology; Diversity within Species and Population Genetics; Evolution and natural Selection; The Formation of Species and Evolutionary Change; Ecosystem Dynamics: The Flow of Energy and Matter; Community Interactions; Population Ecology; Evolutionary and Ecological Aspects of Behavior; The Origin of Life and Evolution of Cells; The Classification and Evolution of Organisms; The ature of Microorganisms; The Plant Kingdom; The Animal Kingdom Materials Exchange in the Body; nutrition: Food and Diet; The Body's Control Mechanisms and Immunity; Human Reproduction, Sex, and Sexuality. MATH 2107 Linear Algebra * Course Code: MATH 2107 * Credit Hour: 3.0 * Prerequisite:

System of linear equations. Definitions, equality, addition, subtraction, multiplication, transposition, inversion, rank of matrices. Solution of system of equations by matrix method. Eigen values and Eigen vectors. PHY 2105 Physics * Course Code: PHY 2105 * Credit Hour: 3.0 * Prerequisite:

Waves and Oscillations Periodic motion: periodic waves, elastic restoring force, simple harmonic motion (SHM), differential equation of SHM and its solutions, examples of SHM, energy calculation of SHM, time period, velocity, acceleration, frequency calculation with graph, Lissajou's figure design, spring mass system and torsional pendulum, DHM, characteristic graph, differential equations for spring mass system with damping mechanism and RLC circuit-series and parallel analysis, resonant frequency, reactance, impedance, FHM; Mechanical Waves; Vibrating bodies and acoustic phenomena: progressive wave and its differential equation, EM wave, group velocity, phase velocity, standing waves, node and antinode; The Doppler effects, application of acoustic Phenomena. Electricity magnetism Electrostatic Force and Electric Field; Concept of charge, Coulomb's law, concept of electric field and its calculation, electric dipole; Gauss's law in electrostatic and its application, electric field due to dipole, torque on a dipole in uniform e-field, electric flux, flux density, Gauss's law and Coulomb's law; Electric Potential: electric potential and its calculation, electric potential energy, relationship between field and potential, potential due to a point charge, dipole, continuous charge distribution, electric field calculation from electric potential, equipotential surface, potential gradient; Capacitance and Dielectric : capacitors, capacitors in series and parallel, energy of charged capacitors, electrical energy density in terms of electric field, electron volt, dielectric media, polarization vector and displacement vector, Laplace's and Poission's equations, capacitor with a dielectric material, Gauss's law with dielectric; Current, Resistance and Electromotive Force: current and current density, resistance and resistivity, Ohm's law, EMF, power, resistance in series and parallel, Kirchhoff's Rules, RC circuit; Magnetic Field: magnetic field, magnetic flux and flux density, Lorentz force, Gauss's law for magnetism, motion of a charged particles in magnetic field : Hall effect; Mag- netic field intensity, magnetic dipole moment, Biot-Savart Law, Ampere's law and its applications; Magnetic properties of material, magnetization, hysteresis; Inductions and Inductance: induced emf and Faraday's law of induction; Lenz's law; Mutual inductance ; Self inductance; Energy in an inductor; Inductance in series, in parallel, and their combination, MMF, leakage and fringing flux, Transformers. Çªuantum Physics Çªuantum theory: quantum theory of radiation, energy of photons, photo-electric Effect, work function, threshold frequency, threshold voltage, Compton effect, X-rays production, properties and application, Bragg Diffraction, De Broglie wavelength, Heisenberg' s Uncertainty Principle, correspondence principle, pair production, pair annihilation; Schrodinger equation: wave function, Schrodinger equation-time dependent and time independent form, expectation value, quantum operator, tunneling effect, quantum numbers, energy of trapped electron, quantum dots and corrals, quantization of Bohr orbital energy. PHY 2106 Physics Laboratory * Course Code: PHY 2106 * Credit Hour: 1.0 * Prerequisite:

Experiments based on PHY 2105. Trimester 4 CSE 2215 Data Structures and Algorithms - I * Course Code: CSE 2215 * Credit Hour: 3.0 * Prerequisite:

Internal data representation; Abstract data types; Introduction to algorithms; Asymptotic analysis: growth of functions, O, and notations; Correctness proof and techniques for analysis of algorithms; Master Theorem; Elementary data structures: arrays, linked lists, stacks, queues, trees and tree traversals, graphs and graph representations, heaps, binary search

trees; Graph Traversals: DFS, BFS, Applications of DFS and BFS; Sorting: heap sort, merge sort, quick sort, linear-time sorting; Data structures for set operations. CSE 2216 Data Structures and Algorithms - I Laboratory * Course Code: CSE 2216 * Credit Hour: 1.0 * Prerequisite:

Laboratory works based on CSE 2215. MATH 2101 Advanced Calculus * Course Code: MATH 2101 * Credit Hour: 3.0 * Prerequisite:

Uncertain world, perfect knowledge of the uncertainty; Counting; Random variables, distributions, quantiles, mean variance; Conditional probability, Bayes' theorem, base rate fallacy; Joint distributions, covariance, correlation, independence; Central limit theorem. Characteristics of discrete and continuous distributions; Elementary sampling theory; Estimation of parameters. Humanities Optional - I * Course Code: * Credit Hour: 3.0 * Prerequisite:

CSE 2213 Discrete Mathematics * Course Code: CSE 2213 * Credit Hour: 3.0 * Prerequisite:

Set theory: sets, relations, functions; Mathematical Logic: propositional calculus and predicate calculus; Mathematical reasoning and proof techniques; Counting: permutations, combinations, Discrete Probability principles of inclusion and exclusion; Recurrence relations; Graph Theory: graphs, paths, and trees. Trimester 5 CSE 2217 Data Structures and Algorithms - II * Course Code: CSE 2217 * Credit Hour: 3.0 * Prerequisite: CSE 2215

Methods for the design of efficient algorithms: divide and conquer, greedy methods, dynamic programming; Graph algorithms: MST algorithms, shortest path algorithms, maximum flow and maximum bipartite matching; Advanced data Structures: balanced binary search trees (AVL trees, red-black trees, splay trees), skip lists, advanced heaps (Fi- bonacci heaps, binomial heaps); Hashing; String matching algorithms; P-completeness; P-hard and NP-Complete problems; Coping with hardness: backtracking, branch and bound, approximation algorithms. CSE 2218 Data Structures and Algorithms - II Laboratory * Course Code: CSE 2217 * Credit Hour: 3.0 * Prerequisite: CSE 2215

Methods for the design of efficient algorithms: divide and conquer, greedy methods, dynamic programming; Graph algorithms: MST algorithms, shortest path algorithms, maximum flow and maximum bipartite matching; Advanced data Structures: balanced binary search trees (AVL trees, red-black trees, splay trees), skip lists, advanced heaps (Fi- bonacci heaps, binomial heaps); Hashing; String matching algorithms; P-completeness; P-hard and NP-Complete problems; Coping with hardness: backtracking, branch and bound, approximation algorithms. CSE 2218 Data Structures and Algorithms - II Laboratory * Course Code: CSE 2218 * Credit Hour: 1.0 * Prerequisite: CSE 2215, CSE 2216

Laboratory works based on CSE 2217. MATH 2205 Probability and Statistics * Course Code: MATH 2205 * Credit Hour: 3.0 * Prerequisite:

Frequency distribution; Mean, median, mode and other measures of central tendency; Standard deviation and other measures of dispersion; Moments, skewness and kurtosis, correlation and regression analysis; Statistical Inference; Hypothesis testing. DS 3885 Data Wrangling * Course Code: DS 3885 * Credit Hour: 3.0 * Prerequisite:

Understand various data formats, including CSV, TSV, XML, JSO , and HTML; acquire data through various sources, such as plain text, databases, the Web and API; clean and prepare both structured and unstructured data. Trimester 6 CSE 3521 Database Management Systems * Course Code: CSE 3521 * Credit Hour: 3.0 * Prerequisite:

Concepts of database systems; Data Models: Entity-Relationship model, Relational model; Query Languages: SQL, Relational algebra, Constraints, View; Security and Integrity Management; Unstructured databases: NoSQL, Graph database; Functional dependencies and normalization; Indexing: primary and secondary indexes, B+ trees; Hashing: Static and Dynamic hashing, Collision Problem in Hashing; Transaction management; Recovery: RAID Different levels; File storage management CSE 3522 Database Management Systems Laboratory * Course Code: CSE 3522 * Credit Hour: 1.0 * Prerequisite:

Laboratory works based on CSE 3521. DS 3101 Advanced Probability and Statistics * Course Code: DS 3101 * Credit Hour: 3.0 * Prerequisite: MATH 2101, STAT 2107

Random variables; Stochastic process; Markov chains: discrete parameter, continuous parameter, birth-death process; Çᵃueuing models: birth-death model, Markovian model, open and closed queuing network; Application of queuing models (Computation, simulation, and visualization using R will be used throughout the course). DS 3521 Data Visualization * Course Code: DS 3521 * Credit Hour: 3.0 * Prerequisite:

Visualization of high dimensional data including interactive methods directed at exploration and assessment of structure and dependencies in data. Methods for finding groups in data including traditional and modern methods of cluster analysis. Dimension reduction methods including multidimensional scaling, nonlinear and other methods. DS 3522 Data Visualization Laboratory * Course Code: DS 3522 * Credit Hour: 1.0 * Prerequisite:

Laboratory works based on DS 3521. Trimester 7 DS 4889 Machine Learning * Course Code: DS 4889 * Credit Hour: 3.0 * Prerequisite:

Introduction to Machine Learning; Regression analysis: linear regression; Classification techniques: classification trees, support vector machines; Statistical performance evaluation: bias variance tradeoff; VC dimension; Reinforcement Learning; eural networks; EM Algorithm; Unsupervised Learning: k-means clustering; Principal component analysis; Deep Learning; Practical applications of machine learning. DS 4523 Simulation and Modeling * Course Code: DS 4523 * Credit Hour: 3.0 * Prerequisite: MATH 2101, STAT 2107

Simulation methods, model building, random number generator, statistical analysis of results, validation and verification techniques; Digital simulation of continuous system; Simulation and analytical methods for analysis of computer systems and practical problems in business and practice; Introduction to simulation packages. DS 4891 Data Analytics * Course Code: DS 4891 * Credit Hour: 3.0 * Prerequisite:

Data analysis process; exploratory data analysis; selection of descriptive analytics techniques; identification of important attributes; development of derived attributes; predictive and prescriptive analytics; discovering patterns in datasets; data mining concepts and methodologies including classification, clustering, associations, and anomaly detection; selecting appropriate data mining algorithms. DS 4892 Data Analytics Laboratory * Course Code: DS 4892 * Credit Hour: 1.0 * Prerequisite:

Laboratory works based on DS 4891. DS 3120 Technical Report Writing and Presentation * Course Code: DS 3120 * Credit Hour: 2.0 * Prerequisite:

Issues of technical writing and effective oral presentation in Data Science; Writing styles of definitions, propositions, theorems and proofs; Preparation of reports, research papers, theses and books: abstract, preface, contents, bibliography and index; Writing of book reviews and referee reports; Writing tools: Latex; Diagram drawing software; presentation tools. Trimester 8 DS 4429 Machine Learning Systems Design * Course Code: DS 4429 * Credit Hour: 3.0 * Prerequisite:

Introduction to Machine Learning; Regression analysis: linear regression; Classification techniques: classification trees, support vector machines; Statistical performance evaluation: bias variance tradeoff; VC dimension; Reinforcement Learning; Neural networks; EM Algorithm; Unsupervised Learning: k-means clustering; Principal component analysis; Deep Learning; Practical applications of machine learning. DS 2251 Bayesian Statistics * Course Code: DS 2251 * Credit Hour: 3.0 * Prerequisite: MATH 2101, STAT 2107

Data in an uncertain world, perfect knowledge of the uncertainty; Bayesian inference with known priors, probability intervals; Conjugate priors; Data in an uncertain world, imperfect knowledge of the uncertainty; Bayesian inference with unknown priors; Frequentist significance tests and confidence intervals; Resampling methods: bootstrapping; Bayesian regression, Graphical Models. (Computation, simulation, and visualization using R will be used throughout the course.) CSE *Systems and Development Optional - I * Course Code: CSE* * Credit Hour: 3.0 * Prerequisite:

DS 3881 Regression and Multivariate Analysis * Course Code: DS 3881 * Credit Hour: 3.0 * Prerequisite:

Simple Linear Regression, Multiple Linear Regression, Polynomial Regression; Model Selection for Multiple Linear Models; Multiple Linear Regression â€" Diagnostics; Analysis of Variance: Fixed Effects; Experimental Design; Penalized Regression; Robust Regression; Linear Regression; Generalized Linear Models; Mixed Effects Models; Time Series Regression: Correlated Errors; Functional Linear Models; Additive Models Introduction to principal components, cluster analysis, discriminant analysis, factor analysis, self organizing maps, matrix estimation and other commonly used multivariate techniques. Trimester 9 DS 4211 Deep Learning * Course Code: DS 4211 * Credit Hour: 3.0 * Prerequisite:

Gradient descent and logistic regression; Probability, continuous and discrete distributions; maximum Likelihood; Neural Networks: cost functions, hypotheses and tasks; training data; maximum likelihood based cost, cross entropy, MSE cost; feed-forward networks; MLP, sigmoid units; neuroscience inspiration; Learning in neural networks: output vs hidden layers; linear vs nonlinear networks; Backpropagation: learning via gradient descent; recursive chain rule (backpropagation); if time: biasvariance tradeoff, regularization; output units: linear, softmax; hidden units: tanh; Deep learning strategies; SCC/TensorFlow overview; Convolutional neural networks; Deep Belief Nets: probabilistic methods; Recurrent neural networks; Other DNN variants; Neural Turing Machines; Unsupervised deep learning; Deep reinforcement learning. CSE *Systems Optional - II * Course Code: CSE* * Credit Hour: 3.0 * Prerequisite:

DS *Option - I * Course Code: DS* * Credit Hour: 3.0 * Prerequisite:

DS *Option - II * Course Code: DS* * Credit Hour: 3.0 * Prerequisite:

DS *Option - II * Course Code: DS* * Credit Hour: 3.0 * Prerequisite:

Trimester 10 DS 4000A Capstone Project - I * Course Code: DS 4000A * Credit Hour: 2.0 * Prerequisite:

A capstone project designed in the field of data science. DS 4217 Data Privacy and Ethics * Course Code: DS 4217 * Credit Hour: 3.0 * Prerequisite:

Introduction to privacy, economics and incentives, cryptobased solution for privacy, hiding data from the database user, hiding access patterns from the database owner, anonymous routing and TOR, privacy in online social networks, privacy in cellular and Wi-Fi networks, location privacy, privacy in e-cash systems, privacy in e-voting, genomic privacy; Ethical issues faced by data science professionals including those related to computing in the workplace, 42 security, crime, privacy, property rights, risk, liability, and the internet. DS *** Option - I * Course Code: DS*** *** Credit Hour: 3.0 * Prerequisite:

DS *** Option - II * Course Code: DS*** *** Credit Hour: 3.0 * Prerequisite:

DS 4817 Big Data * Course Code: DS 4817 * Credit Hour: 3.0 * Prerequisite:

Introduction to Big Data: characteristics of Big Data and dimensions of scalability; Data Science: getting value out of Big Data, foundations for Big Data systems and programming, getting started with Hadoop; Big Data Modelling and Management Systems: Big Data modelling, Big Data management, designing a Big Data management system; Big Data Integration and Processing: retrieving Big Data, Big Data integration, processing Big Data, Big Data analytics using Spark; Machine Learning with Big Data: introduction to machine learning with Big Data, data exploration, classification, evaluation of machine learning models, regression, cluster analysis, and association analysis; Graph Analytics for Big Data: introduction to graphs, graph Analytics, graph analytics techniques, computing platforms for graph analytics. Trimester 11 DS 4000B Capstone Project - II * Course Code: DS 4000B * Credit Hour: 2.0 * Prerequisite: DS 4000A

In this course the students will partially implement the project proposal that is accepted in the course DS 4000A. Humanities Optional - II * Course Code: * Credit Hour: 3.0 * Prerequisite:

DS *** Option - I * Course Code: DS*** *** Credit Hour: 3.0 * Prerequisite:

DS *** Option - II * Course Code: DS*** *** Credit Hour: 3.0 * Prerequisite:

Trimester 12 DS 4000C Capstone Project - III * Course Code: DS 4000C * Credit Hour: 2.0 * Prerequisite: DS 4000B

In this course the students will implement the project that is partially implemented in DS 4000B. Humanities Optional - III * Course Code: * Credit Hour: 3.0 * Prerequisite:

DS *** Option - I * Course Code: DS*** *** Credit Hour: 3.0 * Prerequisite:

DS *** Option - II * Course Code: DS*** *** Credit Hour: 3.0 * Prerequisite:

Huminities Optional SOC 2102 Society, Environment and Computing Ethics * Course Code: SOC 2102 * Credit Hour: 3.0 * Prerequisite:

Society: emergence of Sociology as moral lessons for society; Basic institutions in society, organization and institutions in society, Types of Society; Culture: basics of culture, elements of culture, cultural change, socialization, and social issues around us; Technology and society: interaction between technology and society; Data ethics: understanding ethics, computing and data ethics; Moral reasoning and computing as social experimentation; The computing professional's concern for safety, professional responsibility; Employer authority; Rights of a data scientist; Global issues; Career choice and professional outlook; Ethical problems are like design problems; Genetically modified objects (GMO); Environment: environment and environmental issues— environmental degradation, waste management and renewable energy; Basic understanding of sustainable development, SDGs, climate change adaptation; Disability and Accessibility. TEC 2499 Technology Entrepreneurship * Course Code: TEC 2499 * Credit Hour: 3.0 * Prerequisite:

Defining the startup vision: Start: How and when to start a new venture, what one needs to start, forming a suitable team; Define: Defining the core idea of a new venture, technological feasibility, market feasibility; Learn: Get the basic business model canvas, value propositions, partners, and customers; Experiment: How to get a working prototype, what is a working prototype, how to evaluate a prototype. Steering a new startup: Leap: Plunging in with your startup; Test: Test the prototype with potential customers, how to define customers, what to test, what questions to ask; Measure: How to interpret and evaluate the feedback, finding the early evangelists; Pivot (or Persevere): Do we change or keep the prototype based on the feedback? when to pivot, why pivoting is paramount, some of the successful companies that radically changed their business model. Accelerating towards success: Batch Production: Getting to mass production, mass producing software vs mass producing hardware, scaling in the cloud, scaling for connected devices; Grow: Evaluating and utilizing feedback from the bigger market audience, navigating legal and promotional problems; Adapt: Change with changing technology and market conditions, change due to size and scope; Innovate: How to keep being a leader, responding to competitors, intellectual property rights. ECO 4101 Economics * Course Code: ECO 4101 * Credit Hour: 3.0 * Prerequisite:

Definition of Economics; Economics and engineering; Principles of economics. Micro-Economics: Introduction to various economic systems — capitalist, command and mixed economy; Fundamental economic problems and the mechanism through which these problems are solved; Theory of demand and supply and their elasticities; Theory of consumer behavior; Cardinal and ordinal approaches of utility analysis; Price determination; ature of an economic theory;

Applicability of economic theories to the problems of developing countries; Indifference curve techniques; Theory of production, production function, types of productivity; Rational region of production of an engineering firm; Concepts of market and market structure; Cost analysis and cost function; Small scale production and large scale production; Optimization; Theory of distribution; Use of derivative in economics: maximization and minimization of economic functions, relationship among total, marginal and average concepts. Macro-Economics: Savings; investment, employment; national income analysis; Inflation; Monetary policy; Fiscal policy and trade policy with reference to Bangladesh; Economics of development and planning. PMG 4101 Project Management * Course Code: PMG 4101 * Credit Hour: 3.0 * Prerequisite:

Triple Constraint in Project Management: Time, Scope and Cost; Process methodology, Requirement Collection, Plan, schedule a project including risk assessment with proper documentation and presentation. Cost Estimation, Optimization, and performance calculation, Change management, Çªuality improvement, Use of Modern tools in project planning, resource allocation and estimation. ACT 2111 Financial and Managerial Accounting * Course Code: ACT 2111 * Credit Hour: 3.0 * Prerequisite:

Financial Accounting: Objectives and importance of accounting; Accounting as an information system; Computerized system and applications in accounting. Recording system: double entry mechanism; accounts and their classification; Accounting equation; Accounting cycle: journal, ledger, trial balance; Preparation of financial statements considering adjusting and closing entries; Accounting concepts (principles) and conventions. Financial statement analysis and interpretation: ratio analysis. Cost and Management Accounting: Cost concepts and classification; Overhead cost: meaning and classification; Distribution of overhead cost; Overhead recovery method/rate; Job order costing: preparation of job cost sheet and quotation price; Inventory valuation: absorption costing and marginal/variable costing techniques; Cost-Volume-Profit analysis: meaning breakeven analysis, contribution margin approach, sensitivity analysis. Short-term investment decisions: relevant and differential cost analysis. Long-term investment decisions: capital budgeting, various techniques of evaluation of capital investments. SOC 4101 Introduction to Sociology * Course Code: SOC 4101 * Credit Hour: 3.0 * Prerequisite:

Concept and theory: major schools of sociology â€" functionalism, critical theory, gender, interactionism and post-modernism; Sociology of communications: the impacts of contemporary media institutions and communications technologies on the social construction of knowledge and the construction of socially significant identities and ideologies; Society: discussion on key concepts of society, social institutions, social structure and stratification, religion and so on; Sociology of development: technology, gender, business, globalization, and how do we formulate reasonable expectations? Global and social issues; Social research: importance of research, research methods and techniques. IPE 3401 Industrial and Operational Management * Course Code: IPE 3401 * Credit Hour: 3.0 * Prerequisite:

Introduction, evolution, management function, organization and environment. Organization: Theory and structure; Coordination; Span of control; Authority delegation; Groups; Committee and task force; Manpower planning. Personnel Management: Scope; Importance; eed hierarchy; Motivation; Job redesign; Leadership; Participative management; Training; Performance appraisal; Wages and incentives; Informal groups; Organizational change and conflict. Cost and Financial Management; Elements of costs of products depreciation; Break-even analysis; Investment analysis; Benefit cost analysis. Management Accounting: Cost planning and control; Budget and budgetary control; Development planning process. Marketing Management: Concepts; Strategy; Sales promotion; Patent laws. Technology Management: Management of innovation and changes; Technology life cycle; Case studies. BAN 2501 Bangla * Course Code: BAN 2501 * Credit Hour: 3.0 * Prerequisite:

URC 1101 Life Skills of Success * Course Code: URC 1101 * Credit Hour: 3.0 * Prerequisite:

The course is intended for fresh entrants at the first trimester who need to be oriented and adapted to university survival skills, as well as achieving soft skills for success as a responsible citizen in the society. Complementary to this core object, students need to be motivated and inspired to study attentively with a sense of integrity and ethical orientation. In addition, this course will create studentsâ€™ awareness to build a successful career as well as becoming a successful individual in the society. The course will cover lectures on rules and regulations of the university, the importance of student life, contribution of family, building professional ethics and personal integrity, time management, study skills, etiquette and manners, social responsibility including environmental concerns, effective communication, dealing with health and psychological issues, etc. The course is expected to take care of this broad gamut of soft skills that would immensely inspire towards developing a quality person. SOC 4301 Introduction to Anthropology * Course Code: SOC 4301 * Credit Hour: 3.0 * Prerequisite:

Scope and History of anthropology; Anthropology and Colonialism; Different branches of anthropology; Anthropology and other Disciplines; Theory and methods in anthropology; Core Concepts: Culture, Marriage and Family, Kinship, Descent and Social Structure; Economic Systems, Political Systems; Applying Anthropology: Applied Anthropology; Recent Trends in Anthropology: Changes and Direction; Research methods to study human behavior; Computational Methods in Anthropology. FLN 1101 Introduction to a Foreign Language (Name of the Language) * Course Code: FLN 1101 * Credit Hour: 3.0 * Prerequisite:

Elementary proficiency in oral expression, listening comprehension, reading and writing in a foreign language; cultural understanding on topics related to daily activities and personal environment; basic grammatical knowledge and vocabulary for common use; ability to communicate in the most predictable and common situations using high frequency words, expressions, and phrases. SWL 4101 Software and Law * Course Code: SWL 4101 * Credit Hour: 3.0 * Prerequisite:

Introduction: Why law is necessary, the laws relevant to software and its use, taking a global perspective. Intellectual property (IP) rights: intellectual-property law, copyright, patents, marks and brands; common and public goods. The issue of who owns software and digital content how that ownership can be protected using instruments like copyright and patents. Contracts: how contracts are used to formalize the relationship between purchasers and suppliers of software. Responsibilities to employees and the public: the laws that apply to information technology and software to ensure that organizations meet their responsibility of care towards employees, customers, and the general public. BHV 2101 Introduction to Behavioral Science * Course Code: BHV 2101 * Credit Hour: 3.0 * Prerequisite:

Basic scientific theoretical perspectives, epistemological views and theories of the behavioral sciences; central concepts, theories, models and research results in the behavioral sciences; integration of educational, psychological, and sociological theories in the behavioral science field; diversity perspectives based on class, gender and ethnicity in relation to behavioral science theories; relevant search tools and critically review search results. MKT 4313 Digital Marketing * Course Code: MKT 4313 * Credit Hour: 3.0 * Prerequisite:

Digital Marketing Essentials: The Digital Marketing Environment; The Digital Consumer; Content Marketing; Digital Marketing Tools and Channels: Social Media Marketing; Augmented, Virtual and Mixed Reality, Search Engine Optimization (SEO); Search Engine Marketing (SEM); Digital Marketing Strategy and Planning: Digital Marketing Strategy and Objectives; Digital Marketing Management: Integrating, Improving and Transforming Digital Marketing; Further issues in legal and social Sensitivity. PSY 2101 Psychology * Course Code: MKT 4313 * Credit Hour: 3.0 * Prerequisite:

Digital Marketing Essentials: The Digital Marketing Environment; The Digital Consumer; Content Marketing; Digital Marketing Tools and Channels: Social Media Marketing; Augmented, Virtual and Mixed Reality, Search Engine Optimization (SEO); Search Engine Marketing (SEM); Digital Marketing Strategy and Planning: Digital Marketing Strategy and Objectives; Digital Marketing Management: Integrating, Improving and Transforming Digital Marketing; Further issues in legal and social Sensitivity. PSY 2101 Psychology * Course Code: PSY 2101 * Credit Hour: 3.0 * Prerequisite:

The objective of this course is to provide knowledge about the basic concepts and principles of psychology pertaining to real-life problems. The course will familiarize students with the fundamental processes that occur within organism-biological basis of behavior, perception, motivation, emotion, learning, memory and forgetting and also to the social perspective-social perception and social forces that act upon the individual. Systems and Development CSE 4511 Operating Systems and Scripting * Course Code: CSE 4511 * Credit Hour: 3.0 * Prerequisite:

Operating system: its role in computer systems; multitasking, multiuser, multiprocessing OS; Operating system structures; Process: process concept and scheduling, inter-process communication, communication in client-server systems; CPU scheduling: scheduling criteria and algorithms, thread scheduling, multiple-processor scheduling; Process synchronization: critical-section problem, semaphores, monitors; Deadlock: resource allocation and deadlock, deadlock detection, prevention and recovery; Memory management: swapping, paging, segmentation, virtual memory; File Systems: files, directories, security, protection; Case study of some operating systems; Linux OS: Architecture, Distributions, Terminal, Software; Linux Commands: Files, Directories, Viewing, Wrangling, Archiving, Compression; Linusx Scripting: Filters, Pipes, and Variables; Bash Shell; Cron. CSE 3411 System Analysis and Design * Course Code: CSE 3411 * Credit Hour: 3.0 * Prerequisite:

Fundamentals on System and System Study: system concept, system organogram, system development life cycle (SDLC). Steps and functionalities of SDLC, prototyping SDLC etc. Information Gathering: Types of information, sources of information, detail study on information gathering tools, pros and cons of each method etc. Different types of feasibility study for IT products, SWOT analysis, profitâ€"loss calculation for software products (cash flow/NPV methods); System Design: Structured and Object Oriented Design, Design with UML tools Class diagram, Use case, Context, DFD, Sequence diagram, State diagram, deployment diagram etc. Effective design of Input, Output and UI design; Writing Software Requirement Specifications (SRS) etc. Project management, scheduling by Gantt Chart, PERT/CPM method etc. Industry experience sharing/industry visit etc. CSE 3421 Software Engineering * Course Code: CSE 3421 * Credit Hour: 3.0 * Prerequisite:

Basic Concepts: software, software engineering, recent trends and challenges; Process Models: waterfall, incremental, iterative; Requirements Engineering: software requirements specification, system requirements specification, stakeholder requirements specification; Architecture: monolithic architecture, service-oriented architecture, micro-service architecture, model-view controller pattern and variants, system design; Services Computing: application programming interface, web services, cloud services, representational state transfer, JavaScript object notation, simple object access protocol; User Interface Design: web and mobile platform, wireframe model, methods and tools; Software Testing: manual and automated test, black box and white box test, unit test, integration test, regression test, acceptance test, non-functional

test, test planning, test documentation; Version Control and Repository: version numbering, version control software, code repository systems; Documentation: requirements, architecture, technical, end user, marketing; Legal and Ethical Aspects: terms and conditions, end-user license agreement, software engineering code of ethics, privacy engineering; Business Case Study: case study on local and international popular software products. CSE 4197 Introduction to Internet of Things (IoT) * Course Code: CSE 4197 * Credit Hour: 3.0 * Prerequisite:

The Internet of Things: Definitions, implications, perspectives, and some stats, a simplified model, architecture, Industry Markets and Applications, Issues and Challenges, Planning a Deployment, Industry and academic trends, Business models and projected growth, Case Study and Examples; Internet: layers, protocols, packets, services, performance parameters of a packet network as well as applications such as web, Peer-to-peer, sensor networks, and multimedia; Local Area etworks; Mobile etworking; Real-time networking; Data Storage in Cloud. CSE 4587 Cloud Computing * Course Code: CSE 4587 * Credit Hour: 3.0 * Prerequisite:

Basic Concepts: cloud computing and applications, assessing the value proposition, issues and challenges, cloud architecture, service models, deployment models; Cloud Platforms: abstraction and virtualization, capacity planning, platform as a service, Amazon web services , Microsoft Azure, Google cloud platform; Cloud Infrastructure: managing the cloud, cloud security; Services and Applications: service-oriented architecture, moving applications to the cloud, cloud-based storage, media and streaming, cloud based mobile apps and web services. CSE 4531 Computer Security * Course Code: CSE 4531 * Credit Hour: 3.0 * Prerequisite:

Fundamental concepts: confidentiality, integrity and availability, assurance, authenticity and anonymity; threats and attacks, security principles; Encryption, symmetric and asymmetric key encryption; Security: OS access control, Web and mobile application security, software security, hardware security, memory protection, data base security; Security Attacks: malware, DDos, Trojan and backdoors, buffer overflow, social engineering. Option â€" I Courses (Advanced Data Science and Computing) DS 4213 Natural Language Processing * Course Code: DS 4213 * Credit Hour: 3.0 * Prerequisite:

Word representations: Representing documents for neural networks, Introduction to embeddings. Continuous bag-of-words representations; Pre-training word embedding models: introduction, SGNS algorithm, Evaluation and interpretation of word embeddings, Subword representations; Language modelling: N-gram language models, Recurrent neural networks, The LSTM architecture, Recurrent neural network language models, Contextualized word embeddings; Introduction to generation tasks, Evaluation of generation systems; Introduction to machine translation, Neural machine translation; Attention, The Transformer architecture; Pre-trained transformer models: GPT, BERT; Summarization; Dialogue Systems; Domain Adaptation; Structured prediction. DS 4215 Social Media Analytics * Course Code: DS 4215 * Credit Hour: 3.0 * Prerequisite:

Introduction; Phenomenology of social media; Analysis Basics; Sentiment Analysis; network Analysis; Influence and Centrality in Social networks; Information diffusion; Social ties and information diffusion; Social ties and link prediction; Social Spam and Malicious Behavior; Geospatial social data mining; Privacy in a networked World; Predicting the future with social media; Emotional contagion; Friendship paradox and detection of contagions; Social tagging and folksonomies. DS 4219 Game Theory * Course Code: DS 4219 * Credit Hour: 3.0 * Prerequisite:

Solution Concepts for Static Games: Complete information: rationalizability, ash equilibrium, epistemic foundations; Incomplete information: Bayesian ash equilibrium, interim correlated rationalizability; Solution Concepts for Extensive-form Games; Backwards induction, subgame perfection, iterated conditional dominance; Bargaining with complete information; Equilibrium Concepts for Games with Imperfect Information; Signaling and Forward Induction; Stable equilibrium, the intuitive criterion, iterated weak dominance, epistemic foundations; Repeated Games; Reputation Formation: Reputation with short-lived opponents, Screening and reputation in bargaining; Supermodular Games; Global Games; Cooperative Games; ash bargaining solution, core, Shapley value; on-cooperative implementations. DS 4221 Complex Systems * Course Code: DS 4221 * Credit Hour: 3.0 * Prerequisite:

Complex systems: definitions, methodologies; Dynamical systems, onlinear dynamics; Chaos, Bifurcations and Feigenbaum constant, Predictability, Randomness and Chaos; Models of complex systems, Cellular automata, Wolframâ€™s classification, Game of life; Autonomous agents, Flocking, Schooling, Synchronization, Formation creation; Cooperation and Competition, Game theory basics, ash equilibrium; Game theory: Prisonerâ€™s Dilemma, Coordination games, Mixed strategy games; Adaptation, Evolution, Genetic algorithms, Evolutionary games; network Science: Definitions and examples; Graph theory, Basic concepts and definitions; Diameter, Path length, Clustering, Centrality metrics; Structure of real networks, Degree distribution, Power-laws, Popularity; Models of network formation; The Erdos-Renyi random model; Clustered models; Models of network growth, Preferential attachment; Small-world networks, network navigation; Peer-to-peer systems and overlay networks; Structured overlays, DHTs, Key-based routing, Chord; Distributed network formation: ewscast, Cyclon, T-Man; Processes on networks: Aggregation; Rational dynamics: Cooperation in selfish environments, Homophily, Segregation; Diffusion, Percolation, Tipping points, Peer-effects, Cascades. DS 4223 Recommender Systems * Course Code: DS 4223 * Credit Hour: 3.0 * Prerequisite:

Introduction to recommender systems; Non-personalized and Content Based: Taxonomy, past, present and future,

preferences and ranking; Non-Personalized and Stereotype- Based Recommenders, demographics and related approaches; Content based filtering; User collaborative filtering; Trust based recommendation; Item-item algorithm; The Cold Start Problem; Recommending for Groups; Threat Models; Hidden Data Evaluation; Prediction Accuracy Metrics; Decision Support Metrics; Rank-Aware Top-N Metrics; Advanced Metrics and Offline Evaluation; Online evaluation: Usage Logs and Analysis, A/B Studies (Field Experiments); Matrix factorization; Hybrid Recommenders. DS 4225 Probabilistic Graphical Models * Course Code: DS 4225 * Credit Hour: 3.0 * Prerequisite:

Introduction, Probability Theory, Bayesian etworks; Undirected models; Learning Bayes ets; Exact Inference; Message Passing; Sampling; MAP Inference; Structured prediction; Parameter Learning; Bayesian Learning; Structure Learning; Exponential families; variational inference; Advanced topics. DS 4227 Mathematical Optimization * Course Code: DS 4227 * Credit Hour: 3.0 * Prerequisite:

Introduction; Classical methods with single and multi variables; Basics of Mathematical Programming; Linear programming; Graphical method with mathematical definitions and theorems; onlinear programming: one dimensional problems by elimination and interpolation methods; Unconstrained and constrained techniques; Geometrical programming, stochastic programming; Calculus of variations; Optimality and relaxation, Lagrangian Relaxation; Convexity and Subgradient Optimization; Subgradient Optimization for the Lagrangian Dual. DS 4229 Data Warehousing * Course Code: DS 4229 * Credit Hour: 3.0 * Prerequisite:

Data Warehouses, Data Marts, and Data Lakes; Popular Data Warehouse Systems; Selecting a Data Warehouse System; Overview of Data Warehouse Architectures; CUBEs, ROLLUPs, Materialized Views and Tables; Facts and Dimensional Modeling; Data Modeling using Star and Snowflake Schemas; Staging Areas for Data Warehouses; Verify Data Çªuality; Populating a Data Warehouse; Çªuerying the Data; Introduction BI Tools; Dashboards. CSE 4337 Robotics * Course Code: CSE 4337 * Credit Hour: 3.0 * Prerequisite:

Introduce the basic concepts of robotics, types of robots, robotics and AI; Automation & autonomy architectures; Robot hardware: sensors, actuators; Robotic mapping: localization, Monte Carlo localization, multi-object localization; Robotic navigation and locomotion: motion planning, dynamics and control; Human-robot interaction: natural language learning; Multi-agents: tasks and teams. CSE 3811 Artificial Intelligence * Course Code: CSE 3811 * Credit Hour: 3.0 * Prerequisite:

Survey and concepts in Artificial Intelligence; Problem solving agents; Uninformed and Informed search techniques; Local Search Techniques; Game playing; Constraint Satisfaction Problems; Bayesian learning; Supervised Learning: Classification, Perceptrons; Stationary processes and Markov assumptions; Hidden Markov Models; Human Aware AI Systems. DS 4821 Generative Machine Learning * Course Code: DS 4821 * Credit Hour: 3.0 * Prerequisite:

Introduction; Auto-regressive Models; Variational auto-encoders; ormalizing flows; Generative Adversarial etworks; Energy based models; Score based models; Evaluation of generative models; Combining generative model variants; Applications of generative models. DS 4823 Reinforcement Learning * Course Code: DS 4823 * Credit Hour: 3.0 * Prerequisite:

Multi-arm bandits; Markov Decision Process; Tabular methods: dynamic Programming; Sample based methods: Monte Calro and temporal difference learning; Planning and Learning: Dyna and its variants; Function Approximation and coding, tiling; Policy Gradient methods, actor-critic algorithm; Deep Reinforcement Learning; frontiers. DS 4825 Deep Learning for Computer Vision * Course Code: DS 4825 * Credit Hour: 3.0 * Prerequisite:

Computer vision overview; Image Classification with Linear Classifiers; Regularization and Optimization; neural networks and Backpropagation; Image Classification with Convolutional neural networks(C); C Architectures; Training neural networks; Recurrent neural networks; Attention and Transformers; Understanding Video; Object Detection and Image Segmentation; Visualizing and Understanding; Self-supervised Learning; Robot Learning; Generative Models; 3D vision; Human-Centered Artificial Intelligence. DS 4921 Special Topic - I * Course Code: DS 4921 * Credit Hour: 3.0 * Prerequisite:

Course designed on recent topics from Advanced Data Science and Computing. Syllabus should be approved prior to the commencement of the term. In each term only one such course title under this course number can be offered. Furthermore, one student can take such course only once. Option â€" II Courses (Application Area) DS 4111 Genomic Data Analysis * Course Code: DS 4111 * Credit Hour: 3.0 * Prerequisite:

Central Dogma of Molecular Biology; Modern genomics and the experimental tools; ext-generation sequencing: D A, R A, and epigenetic patterns; Galaxy project: Using Python; ChIP-Sequence Analysis with MACS; Algorithms for D A sequencing, assembly; Command line tools; Tools from Bio- conductor project: Using R; Statistics for Genomic data: clustering, dimensionality reduction, regression, inference; Working with Genomic data. DS 4113 Spatial Analytics * Course Code: DS 4113 * Credit Hour: 3.0 * Prerequisite:

Introduction to Spatial Data Science; Importance issues: DBMS problems, topology, spatial indexing, and spatial big data; Spatial autocorrelation, map projection, uncertainty, and modifiable areal unit problem; Open source software: ÇªGIS, PostgreSÇªL and PostGIS and Hadoop; Spatial Data Science Problems; Geographic Information System (GIS); Layers of GIS: spatial reference framework, spatial data model, spatial data acquisition systems, spatial data analysis, and

geovisualization; Steps of formulation of physical earth, geoid, ellipsoid, datum, and map projections; Coordinate transformation between different map projections; Spatial data acquisition systems; Spatial data analysis; Geovisualization and information delivery; Spatial DBMS; Spatial big data processing using Hadoop MapReduce; Spatial data analysis: Proximity and Accessibility, Spatial Autocorrelation, Spatial Interpolation, Spatial Categorization, Hotspot Analysis; Practical Applications of Spatial Data Science. DS 4115 Marketing Analytics * Course Code: DS 4115 * Credit Hour: 3.0 * Prerequisite:

Introduction to Business Analytics; Predictive Analytics: lending analytics, financial analytics; Prescriptive Analytics: retail analytics, sales-force analytics, portfolio analytics; Supply Chain analytics and Decision Support System; Linear Regression; Time Series Analysis; Data Mining: Cluster Analysis, Market Basket Analysis; Spreadsheet Models; Linear Optimization: Integer Linear Optimization, onlinear Optimization; Monte Carlo Simulation; Decision Analysis; Supervised Learning. DS 4117 Computational Finance * Course Code: DS 4117 * Credit Hour: 3.0 * Prerequisite:

Financial algorithms used in decision analysis, risk management, data mining and market analysis, and other modern business processes; Background on probabilistic methods used for financial decision-making and their application in number of fields such as financial modeling, venture capital decision-making, operational risk measurement and investment science; umber of financial applications and algorithms are being presented for portfolio risk analysis, modeling real options, venture capital decision-making, etc. Algorithms for financial risk assessment and presents the security concepts and challenges of financial information systems. DS 4119 Health Informatics * Course Code: DS 4119 * Credit Hour: 3.0 * Prerequisite:

Historical, technological and theoretical framework for health informatics; Exploration of critical issues and challenges; Potential applications, benefits, and opportunities using information technology; Development of virtual and interactive healthcare; Interoperability, standardization, safety, and risks associated with the implementation of the electronic health record; Professional roles and responsibilities related to managing health information technology; Technical advances, medical connectivity, enabling technologies, education, health policy and regulation and biomedical and health services research dealing with clinical effectiveness, efficacy and safety of telemedicine. DS 4121 Introduction to Actuarial Science * Course Code: DS 4121 * Credit Hour: 3.0 * Prerequisite:

The theory of rates of interest and discount; annuities and sinking funds with practical applications to mortgage and bond questions. Yield rates; The future lifetime random variable: probability and survival functions; force of mortality; complete and curtate expectation of life; Makeham and Gompertz mortality laws. Life tables: characteristics of population and insurance life tables; selection; fractional age assumptions. Life insurance payments and annuity payments: present value random variables; expected present values; higher moments; actuarial notation. Annual, 1/mthly and continuous cases. Relationships between insurance and annuity functions. Premiums: expense loadings. Present value of future loss random variables and distribution, net and gross cases. Equivalence principle. Portfolio percentile principle. Extra risks; Policy Values: Annual, 1/mthly, and continuous cases. Thiele's equation. Modified premium policy values. Multiple state models: applications in life contingencies; assumptions; Kolmogorov equations; premiums, policy values, multiple decrement models; Joint life models: valuation of insurance benefits on joint lives, dependent and independent cases. DS 4123 Human Computer Interaction * Course Code: DS 4123 * Credit Hour: 3.0 * Prerequisite:

Foundations of human computer interaction: understanding and conceptualizing interaction; Understanding users: human perception, ergonomics, cognition, psychology; Task Analysis; User Interface Design, interface programming, graphical user interfaces, user survey, user journey and experience, mobile devices, multimodal interfaces and ubiquitous computing, user centered system development and evaluation, user centered software development and evaluation; Prototyping; Interaction design for new environments; Affective and social computing; Assistive and augmentative communication, assistive technology and rehabilitation; Human machine interface, brain computer interface; Experimental research ethics. DS 4125 Medical Image and Signal Processing * Course Code: DS 4125 * Credit Hour: 3.0 * Prerequisite:

Biomedical Signals and Images: ECG, Cardiac electrophysiology, relation of electrocardiogram (ECG) components to cardiac events, clinical applications; Speech Signals: The source-filter model of speech production, spectrographic analysis of speech; Speech Coding: Analysis-synthesis systems, channel vocoders, linear prediction of speech, linear prediction vocoders; Imaging Modalities: Survey of major modalities for medical imaging: ultrasound, X-ray, CT, MRI, PET, and SPECT; MRI: Physics and signal processing for magnetic resonance imaging; Surgical Applications: A survey of surgical applications of medical image processing; Fundamentals of Deterministic Signal and Image Processing; Data Acquisition: Sampling in time, aliasing, interpolation, and quantization; Digital Filtering: Difference equations, FIR and IIR filters, basic properties of discrete-time systems, convolution; DIFT; DFT; Sampling and spectral analysis; Image Segmentation and Registration. DS 4127 Computational Epidemiology * Course Code: DS 4127 * Credit Hour: 3.0 * Prerequisite:

Introduction, models, and disease dynamics. What is epidemiology? What is computational epidemiology? Historical overview of epidemiology and computational epidemiology. The importance of understanding and controlling disease-spread. Mass action disease models. etworked computational epidemiology. Dynamics of disease-spread in mass action models and on contact network models; Inference, prediction, and forecasting problems. Given noisy and sparse disease incidence data, how to infer disease model parameters such as transmission probability, period of infectivity, and

reproduction number? How to infer infection source and most likely cascades? How to infer latent spreaders? How to predict future cases, forecast future epidemics? Infection surveillance and control problems. Given contact network model and disease model, how to design low-cost disease surveillance and infection control policies? Surveillance includes placing data collection sites in clinics, performing extra testing on selected patients, swabbing selected surfaces in a hospital, etc. Infection control policies include vaccination, prescribing antibiotics and antivirals, quarantining, sequestering, etc. Additional Topics. Sources of disease data: UIHC databases, CDC MMWR, Healthcare Cost and Utilization Project (HCUP) datasets, Truven Health Analytics datasets, MIMIC dataset, other publicly available datasets for research. Deployment and use of technology for gathering contact and behavior data. High-performance computing for large-scale simulations. Game-theory of vaccination. DS 4129 Remote Sensing of Environment * Course Code: DS 4129 * Credit Hour: 3.0 * Prerequisite:

Introduction to the principles, characteristics and applications of environmental remote sensing; concepts and foundations of remote sensing, photographic systems and interpretation, thermal and multispectral scanning, radar systems, satellite remote sensing, and digital image processing. DS 4131 Precision Agriculture * Course Code: DS 4131 * Credit Hour: 3.0 * Prerequisite:

Introduction; Technology in precision agriculture: CAN bus, GNSS, displays; Autoguidance Swaths, components; Yield Monitoring; Water Management; Smart Irrigation; Digital pasture management; Soil health, field productivity zoning; Blockchain and farm trade; Telematics and Software; Drones. DS 4923 Special Topic - II * Course Code: DS 4923 * Credit Hour: 3.0 * Prerequisite:

Course designed on recent topics from Application Area of Data Science. Syllabus should be approved prior to the commencement of the term. In each term only one such course title under this course number can be offered. Furthermore, one student can take such course only once.

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