MAULANA ABUL KALAM AZAD UNIVERSITY OF TECHNOLOGY, WB
Syllabus of B. Sc. Cyber Security
(Effective for 2020-2021 Admission Session)
Choice Based Credit System
140 Credit (3-Year UG) MAKAUT Framework
w.e.f 2020-21

6th Semester

Subject Type	Course Name	Course Code	Credit Points	Credit Distribution			Mode of Delivery			Proposed MOOCs
				Theory	Practical	Tutorial	Offline #	Online	Blended	
CC 13	Artificial Intelligence	CYS 601	6	5	0	1	✓			As per MAKAUT notification
CC 14	Digital Commerce	CYS 602	6	5	0	1	✓			
DSE 3 (Any One)	Introduction to Data Science	CYS 603(A)	6	5	0	1	✓			
	Digital Image Processing	CYS 603(B)	6	4	0	0	✓			
		CYS 693(B)		0	2	0	✓			
DSE 4 (Any One)	Major Project	CYS 681(A)	6	1	5	0	✓			
	Internship	CYS 681(B)	6	1	5	0	✓			
Semester Credit			**24**							

Note:

Major Project/Internship- (Students have to engage in a full length/capstone project with a pre-specified Internal Guide (faculty member) throughout the semester). Industry collaboration is highly encouraged in case of Internship.

(At least two-three times progress needs to be checked and evaluation needs to be done through PCA.) It will be followed by a report submission and viva as part of University examination.

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- **CC 13: Artificial Intelligence**
- **Code: CYS 601**
- **Course Objective:**

The students will be able to make use of the knowledge on intelligent systems and agents, formalization of knowledge, reasoning with and without uncertainty, machine learning and applications at a basic level.

- **Table:-**

Sl. No.	Course Outcome	Mapped Modules
1.	Make use of Cyber Security	M1
2.	Assess Fathoming Artificial Intelligence	M2
3.	Apply Machine Learning and Deep Learning to Cybersecurity	M3
4.	Outline trends in Cybersecurity & industry use cases.	M4
5.	Model Knowledge Representation1.	M5
6.	Model Knowledge Representation2.	M6

- **Table:-**

Module Number	Content	Total Hours	%age of questions	Blooms Level	Remarks
1	Introduction	5	10	1,2	
2	Fathoming Artificial Intelligence	5	15	1,2,3	
3	Applying Machine Learning and Deep Learning to Cybersecurity	15	20	2,3	
4	Trends in Cybersecurity & industry use cases	15	20	2,3	
5	Knowledge Representation1	10	20	2,3,4	
6	Knowledge Representation2	10	15	2,3,4	
		60	100		
	Tutorial	16			

Module-1: Introduction:

Looking at the Various Aspects of Cyber security, Social engineering and phishing, Introducing ransomware, Malware intrusion, Non-malware intrusion, Detect, Respond, and Mitigate, Responding to and Recovering from Cyber-attacks and Security Events, Challenges of Cybersecurity

Module-2: Fathoming Artificial Intelligence:

Teaching Machines to be Smarter, Learning Algorithms, Supervised learning, Unsupervised learning, Being Smarter, Interacting with Humans, Natural Language Processing

Module-3: Applying Machine Learning and Deep Learning to Cybersecurity:

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Deep Learning and Deeply Layered Neural Networks, Deep Blue plays chess, introducing cognitive computing, Structured and Unstructured Data, Predictive Analytics, Introducing cognitive computing, Investigate Security Incidents taking Intelligent Action, Understand, Reason, and Learn, Winning with Threat Intelligence

Module-4: Trends in Cybersecurity & industry use cases:

Combining Application development and Cybersecurity, Using Deep Learning to Detect DGA-Generated Domains Detecting Non-Malware Threats. Adaptive Honeypots and Honey tokens, Gaining a Better Understanding of How Neural Networks Work, Employing, Capsule Networks, Deep Reinforcement Learning. Protecting the IoT, Predicting the Future, Cognitive security with Watson, Tenable's ICS security capabilities, Cybersecurity Solutions - Real-time Insights

Module-5: Knowledge Representation1:

Propositional Logic: Representation, Inference, Reasoning Patterns, Resolution, Forward and Backward Chaining. First order Logic: Representation, Inference, Reasoning Patterns, Resolution, Forward and Backward Chaining. Basics of PROLOG: Representation, Structure, Types, Clauses & Predicates, Operators, Input & Output, Loops, Backtracking

Module-6: Knowledge Representation2:

Basics of LISP: Representation, Structure, Types, Variables, Constants, Operators, Loops, Functions, Input & Output

Suggested Reading:

1. Leslie F. Sikos, "AI in Cybersecurity", Springer, 2018
2. Ted Coombs, "Artificial Intelligence & Cybersecurity", IBM Limited Edition
3. Alessandro Parisi, "Hands-On Artificial Intelligence for Cybersecurity"
4. Hands-On Artificial Intelligence for Cybersecurity, Implement smart AI systems for preventing cyber attacks and detecting threats and network anomalies by Alessandro Parisi.
5. AI in Cybersecurity by Leslie F. Sikos, Springer, Cham

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- **Course: Digital Commerce**
- **Code: CC 14**
- **Course Objective:**

- This course provides an insight to information systems for business and management. It is designed to prepare students with organizational and managerial foundations of systems, the technical foundation for understanding information systems.

Sl. No.	Course Summary	Mapped Module
1.	Appraise E-Commerce (system).	M1
2.	Make use of E-Commerce Business Models	M2
3.	Build an E-Commerce Website.	M3
4.	Assess Consumer Online.	M4
5.	Experiment with Social Networks.	M5
6.	Discuss Case Study(e.g. IPL Team's Digital Marketing Strategy By KKR, The Great Indian Freedom Sale By Amazon India etc.)	M6

Module Number	Content	Total Hours	%age of questions	Blooms Level	Remarks
1	Introduction to E-Commerce	10	15	1	
2	E-Commerce Business Models	10	20	1,2	
3	Building an E-Commerce Website	10	20	2,3	
4	Consumer Online	10	20	2,3	
5	Social Networks	10	15	2,3	
6	Case Study	10	10	3,4	
		60	100		
	Tutorial	16			

Module 1: INTRODUCTION TO ECOMMERCE

E-commerce: The revolution is just beginning, Ecommerce : A Brief History, Understanding E-commerce: organizing Themes, evaluation of E-Commerce in terms of information system and network.

Module 2: E-COMMERCE BUSINESS MODELS

E-commerce Business Models, Major Business to Consumer (B2C) business models, Major Business to Business (B2B) business models, Business models in emerging E-commerce areas, How the Internet and the web change business: strategy, structure and process, The Internet: Technology Background, The Internet Today, Internet II- The Future Infrastructure, The World Wide Web, The Internet and the Web : Features.

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Module 3: BUILDING AN E-COMMERCE WEB SITE

A systematic Approach, The e-commerce security environment, Security threats in the e-commerce environment, Technology solution, Management policies, Business procedures, and public laws, Payment system, E-commerce payment system, Electronic billing presentment and payment.

Module 4: CONSUMER ONLINE

The Internet Audience and Consumer Behaviour, Basic Marketing Concepts, Internet Marketing Technologies, B2C and B2B E-commerce marketing and business strategies, The Retail sector, Analyzing the viability of online firms, E-commerce in action: E-tailing Business Models, Common Themes in online retailing, The service sector: offline and online, Online financial services, Online Travel Services, Online career services

Module 5: SOCIAL NETWORKS

Social networks and online communities, Online auctions, E-commerce portals.

Module 6: Case Study:

Case Study(e.g. IPL Team's Digital Marketing Strategy By KKR, The Great Indian Freedom Sale By Amazon India etc.)

Suggested Reading:

1. Kenneth C. Laudon, "E-Commerce : Business, Technology, Society", 15th Edition, Pearson, 2019.
2. S. J Joseph," E-Commerce: an Indian perspective", PHI. 5th Edition, 2010.
3. Daniel Minoli & Emma Minoli, "Web Commerce Technology Handbook". Tata McGraw Hill – 2017.
4. https://digitalscholar.in/ecommerce-digital-marketing-case-studies-india/

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- **DSE 3: Introduction to Data Science**
- **Code: CYS 603(A)**
- **Course Objective:**

1.	To organise knowledge of data, information and data science.
2.	To be able to identify and discuss problems related to data science.
3.	To be able to make use of logical thinking .
4.	To be able to outline basic machine learning principles and apply the knowledge in appropriate domains.

Sl. No.	Course Summary	Mapped Module
1.	This module describes about Introduction to Data Science	M1
2.	This module describes about Introduction to Statistics.	M2
3.	This module describes about Data Analysis	M3
4.	This module describes about Machine Learning.	M4
5.	This module describes about Application of Machine Learning.	M5
6.	This module describes about Introduction to Feature.	M6
7.	This module describes about Recommendation Systems.	M7
8.	This module describes about Social-Network Graphs	M8
9.	This module describes about Data Visualization	M9
10.	This module describes about Data Science and Ethical Issues	M10

Module Number	Content	Total Hours	%age of questions	Blooms Level	Remarks
1	Introduction	6	5	1,2	
2	Introduction to Statistics	6	5	1,2	
3	Data Analysis	6	15	1,2,3	
4	Machine Learning	6	15	1,2,3	
5	Application of Machine Learning	6	15	2,3	
6	Introduction to Feature	6	15	1,2	
7	Recommendation Systems	6	5	1,2,3	
8	Social-Network Graphs	6	10	1,2,3	
9	Data Visualization	6	10	2,3	
10	Data Science and Ethical Issues	6	5	1,2	
		60	100		
	Tutorial	16			

Module 1: Introduction

What is Data Science? - Big Data and Data Science hype – and getting past the hype - Why now? – Datafication - Current landscape of perspectives - Skill sets needed.

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Module 2: Introduction to Statistics

Statistical Inference - Populations and samples - Statistical modeling, probability distributions, fitting a model - Intro to R.

Module 3: Data Analysis

Exploratory Data Analysis and Data Science Process - Basic tools (plots, graphs and summary statistics) of EDA - Philosophy of EDA
- The Data Science Process - Case Study: RealDirect (online real estate firm).

Module 4: Machine Learning

Three Basic Machine Learning Algorithms - Linear Regression - k- Nearest Neighbors (k-NN) - k-means.

Module 5: Application of Machine Learning

One More Machine Learning Algorithm and Usage in Applications - Motivating application: Filtering Spam - Why Linear Regression and k-NN are poor choices for Filtering Spam - Naive Bayes and why it works for Filtering Spam - Data Wrangling: APIs and other tools for scrapping the Web.

Module 6: Introduction to Feature

Feature Generation and Feature Selection (Extracting Meaning From Data) - Motivating application: user (customer) retention - Feature Generation (brainstorming, role of domain expertise, and place for imagination) - Feature Selection algorithms – Filters; Wrappers; Decision Trees; Random Forests.

Module 7: Recommendation Systems

Building a User-Facing Data Product - Algorithmic ingredients of a Recommendation Engine - Dimensionality Reduction - Singular Value Decomposition - Principal Component Analysis - Exercise: build your own recommendation system.

Module 8: Social-Network Graphs

Mining Social-Network Graphs - Social networks as graphs - Clustering of graphs - Direct discovery of communities in graphs - Partitioning of graphs - Neighborhood properties in graphs.

Module 9: Data Visualization

Data Visualization - Basic principles, ideas and tools for data visualization 3 - Examples of inspiring (industry) projects - Exercise: create your own visualization of a complex dataset.

Module 10: Data Science and Ethical Issues

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Discussions on privacy, security, ethics - A look back at Data Science - Next-generation data scientists.

Suggested Reading :

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
Jure Leskovek, AnandRajaraman and Jeffrey Ullman	Mining of Massive Datasets. v2.1		Free Online
Kevin P. Murphy	Machine Learning: A Probabilistic Perspective	ISBN 0262018020	
Foster Provost and Tom Fawcett	Data Science for Business: What You Need to Know about Data Mining and Data-analytic Thinking	ISBN 1449361323. 2013	
Trevor Hastie, Robert Tibshirani and Jerome Friedman	Elements of Statistical Learning	Second Edition. ISBN 0387952845. 2009. (free online)	
Cathy O'Neil and Rachel Schutt	Doing Data Science, Straight Talk From The Frontline		O'Reilly

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- **Course: Digital Image Processing**
- **Code: CYS 603(B) & 693 (B)**
- **Course Objective:**

1	To analyse and discuss the fundamental concepts and applications of Digital Image Processing.
2	To appraise various basic operations in Digital Image Processing.
3	To make use of various transform domains.

Sl. No.	Course Summary	Mapped Module
1.	This module describes about Introduction to Image Processing.	M1
2.	This module describes about Digital Image Formation	M2
3.	This module describes about Image Enhancement	M3
4.	This module describes about Image Restoration	M4
5.	This module describes about Image Segmentation	M5

Table (CYS 603B):-

Module Number	Content	Total Hours	%age of questions	Blooms Level	Remarks
1	Introduction	8	10	1	
2	Digital Image Formation	10	20	2,3	
3	Image Enhancement	10	30	3,4	
4.	Image Restoration	10	20	3,4	
5.	Image Segmentation	10	20	3,4	
		48	100		

Table (CYS 693B) :-

Module Number	Content	Total Hours	%age of questions	Blooms Level	Remarks
3	Image Enhancement	8	25	3,4	
4.	Image Restoration	10	35	3,4	
5.	Image Segmentation	10	40	3,4	
		28	100		

Module 1: Introduction
Background, Digital Image Representation, Fundamental steps in Image Processing, Elements of Digital Image Processing - Image Acquisition, Storage, Processing, Communication, Display.

Module 2:Digital Image Formation
A Simple Image Model, Geometric Model- Basic Transformation (Translation, Scaling, Rotation),

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Perspective Projection, Sampling & Quantization - Uniform & Non uniform.

Module 3: Image Enhancement
Spatial Domain Method, Frequency Domain Method, Contrast Enhancement -Linear & Nonlinear Stretching, Histogram Processing; Smoothing - Image Averaging, Mean Filter, Low-pass Filtering; Image Sharpening. High-pass Filtering, High-boost Filtering, Derivative Filtering, Homomorphic Filtering; Enhancement in the frequency domain - Low pass filtering, High pass filtering.

Module 4: Image Restoration
Degradation Model, Discrete Formulation, Algebraic Approach to Restoration - Unconstrained & Constrained; Constrained Least Square Restoration, Restoration by Homomorphic Filtering, Geometric Transformation - Spatial Transformation, Gray Level Interpolation.

Module 5: Image Segmentation
Point Detection, Line Detection, Edge detection, Combined detection, Edge Linking & Boundary Detection- Local Processing, Global Processing via The Hough Transform; Thresholding - Foundation, Simple Global Thresholding,; Region Oriented Segmentation - Basic Formulation, Region Growing by Pixel Aggregation, Region Splitting & Merging.

Suggested Reaing:

Name of Author	Title of the Book	Edition/ISSN/ISBN	Name of the Publisher
Gonzalves	Digital Image Processing		Pearson
S. Sridhar	Digital Image Processing		Oxford