Kolhapur Institute of Technology's College of Engineering (Autonomous),

Kolhapur

Department of Computer Science & Engineering

Curriculum and Syllabus for

B. Tech. Computer Science & Engineering Scheme: 2024-25

(As Per NEP, 2020)

Multidisciplinary Minor Courses

Multidisciplinary minor in Business Analytics Teaching and Evaluation Scheme									
Course Code	**Course**	**Semester**	**Teaching Scheme**				**Evaluation Scheme**		
			L	**T**	**P**	**Credits**	**Components**	**Max**	**Min for Pass (%)**
UCSMM0341	Business Statistics	III	2	0	0	2	ESE	100	40
UCSMM0441	Optimization Methods for Analytics	IV	3	0	0	3	ESE	100	40
UCSMM0541	Multivariate Data Analysis	V	3	0	0	3	ESE	100	40
UCSMM0641	Social Media Analytics	VI	3	0	0	3	ESE	100	40
UCSMM0741	Financial Analytics	VII	3	0	0	3	ESE	100	40
			-	-	-	-	-	-	-
	Total		**14**	**0**	**0**	**14**	**Total**	**500**	
Total Contact Hours =14, Total Credits =14									

Multidisciplinary minor in Internet of Things Teaching and Evaluation Scheme									
Course Code	**Course**	**Semester**	**Teaching Scheme**				**Evaluation Scheme**		
			L	**T**	**P**	**Credits**	**Components**	**Max**	**Min for Pass (%)**
UCSMM0342	Introduction to Internet of Things	III	2	0	0	2	ESE	100	40
UCSMM0442	Introduction to Security of Cyber Physical Systems	IV	3	0	0	3	ESE	100	40
UCSMM0542	Ubiquitous Sensing, Computing and Communication	V	3	0	0	3	ESE	100	40
UCSMM0642	Embedded Systems for IoT	VI	3	0	0	3	ESE	100	40
UCSMM0742	IoT with Arduino, ESP, and Raspberry Pi	VII	3	0	0	3	ESE	100	40
			-	-	-	-	-	-	-
	Total		**14**	**0**	**0**	**14**	**Total**	**500**	
Total Contact Hours =14, Total Credits =14									

Multidisciplinary minor in Smart Healthcare Teaching and Evaluation Scheme									
Course Code	**Course**	**Semester**	**Teaching Scheme**				**Evaluation Scheme**		
			L	**T**	**P**	**Credits**	**Components**	**Max**	**Min for Pass (%)**
UCSMM0343	AI in Healthcare	III	2	0	0	2	ESE	100	40
UCSMM0443	Bioimaging	IV	3	0	0	3	ESE	100	40
UCSMM0543	Bio-Statistics and Data Analysis	V	3	0	0	3	ESE	100	40
UCSMM0643	AR VR applications for healthcare	VI	3	0	0	3	ESE	100	40
UCSMM0743	Algorithms in Computational Biology	VII	3	0	0	3	ESE	100	40
			-	-	-	-	-	-	-
	Total		**14**	**0**	**0**	**14**	**Total**	**500**	
Total Contact Hours =14, Total Credits =14									

Course Code:	UCSMM0341	L	T	P	Credit
Course Name:	Business Statistics	2			2

Course Prerequsites:

Linear algebra, Applied Statistics

Course Description:

This course introduces students to statistical methods and their applications in business decision-making. Topics covered include descriptive statistics, probability distributions, inferential statistics, hypothesis testing, regression analysis, and statistical software tools. The course aims to provide a solid foundation in statistics to enable data-driven decision-making in a business context.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Illustrate the role of statistics in business.
CO2	Develop skills in data collection and descriptive statistics.
CO3	Apply probability concepts to business scenarios.
CO4	Illustrate inferential statistical analysis.
CO5	Utilize statistical software for data analysis.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	3	2			2						2	2	2	2
CO2	3	3	3	2	3				2		3	2	3	3
CO3	2	2		2	2								1	1
CO4	2	2	2	2	3						2		2	2
CO5	2	2	2	2	3				2				3	3

Assessment Scheme:

SN	Assessment	Marks	Remark
1	End Semester Examination (ESE)	100	100% course contents

Course Contents:

Unit 1 Introduction — **2 Hours**

Importance of Statistics in Business, Types of Data: Qualitative and Quantitative, Scales of Measurement

Unit 2 Data Collection and Sampling Methods — **4 Hours**

Primary and Secondary Data, Sampling Techniques: Random, Stratified, Cluster, Systematic Data Collection Methods: Surveys, Experiments, Observational Studies

Unit 3 Descriptive Statistics — **6 Hours**

Measures of Central Tendency: Mean, Median, Mode Measures of Dispersion: Range, Variance, Standard Deviation, Data Visualization: Histograms, Bar Charts, Pie Charts, Box Plots

Unit 4 Probability Concepts — **4 Hours**

Basic Probability Rules, Conditional Probability, Bayes' Theorem, Probability Distributions: Discrete and Continuous

Unit 5 Probability Distributions — **6 Hours**

Discrete: Binomial Distribution, Poisson Distribution, Hypergeometric Distribution. Continuous: Normal Distribution, Standard Normal Distribution (Z-scores), Applications of the Normal Distribution

Unit 6	Sampling Distributions	4 Hours
Central Limit Theorem, Sampling Distribution of the Sample Mean, Sampling Distribution of the Sample Proportion		

Text Books:

1. Vijay K. Rohatgi, A. K. Md. Ehsanes Saleh., "An Introduction to Probability and Statistics" , Second Edition, Wiley, 2008.
2. J. Susan Milton, Jesse Arnold, "Introduction to Probability and Statistics: Principles and Applications for Engineering and the Computing Sciences", 4th edition, McGraw Hill Education, 2017.

Reference Books:

1. Paul Newbold, Mr William Carlson, Ms Betty Thorne, "Statistics for Business and Economics", Eigth Edition, Pearson Education, 2012.
2. David M. Levine, Kathryn A. Szabat, David F. Stephan, "Business Statistics: A First Course ", 8th edition, Pearson College Div, 2019.

Course Code:	UCSMM0342		L	T	P	Credit
Course Name:	Introduction to Internet of Things		2			2

Course Prerequsites:

Computr networks, Computer architecture

Course Description:

This course is to make students know the IoT ecosystem and to provide an understanding of the technologies and the standards relating to the Internet of Things.In this course the students will develop skills on IoT technical planning.

Illustrate	After the completion of the course the student will be able to -
CO1	Interpret the technology and standards relating to IoTs.
CO2	Explain the critical ecosystem required to mainstream IoTs.
CO3	Develop skills on developing their own national and enterprise level technical strategies.
CO4	Illustrate and describe IoT real-time applications

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1	2		1	2		1			2	1	3	1	1
CO2	1	1		1	2					2	1	3	1	1
CO3	2	2		1	1	1				2	2	3	1	1
CO4	2	2		1	2	2				3	2	3	1	1

Assessment Scheme:

SN	Assessment	Marks	Remark
1	End Semester Examination (ESE)	100	100% course contents

Course Contents:

Unit 1 IoT & Web Technology — **6 Hours**

The Internet of Things Today, Time for Convergence, Towards the IoT Universe, Internet of Things Vision, IoT Strategic Research and Innovation Directions, IoT Applications, Future Internet Technologies, Infrastructure, Networks and Communication, Processes, Data Management, security, Privacy & Trust, Device Level Energy Issues, IoT Related Standardization, Recommendations on Research Topics.

Unit 2 M2M to IoT -A Basic Perspective — **6 Hours**

Introduction, Some Definitions, M2M Value Chains,IoT Value Chains, an emerging industrial structure for IoT, the international driven global value chain and global information monopolies. M2M to IoT-An Architectural Overview– Building an architecture, Main design principles and needed capabilities, An IoT architecture outline, standards considerations.

Unit 3 IoT Architecture -State of the Art — **6 Hours**

Introduction, State of the art, Architecture Reference Model- Introduction, Reference Model and architecture, IoT reference Model, IoT Reference Architecture- Introduction, Functional View, Information View, Deployment and Operational View, Other Relevant architectural views.

Unit 4 IoT Applications for Value Creations — **6 Hours**

IoT applications for industry: Future Factory Concepts, Brownfield IoT, Smart Objects, Smart Applications, Four Aspects in your Business to Master IoT, Value Creation from Big Data and Serialization, IoT for Retailing Industry, IoT for Oil and Gas Industry, Opinions on IoT Application and Value for Industry, Home Management, eHealth.

Unit 5	Internet of Things Privacy, Security and Governance	5 Hours

Introduction, Overview of Governance, Privacy and Security Issues, Contribution from FP7 Projects, Security, Privacy and Trust in IoT-Data-Platforms for Smart Cities, First Steps Towards a Secure Platform, Smart Approach. Data Aggregation for the IoT in Smart Cities, Security

Text Books:

1. Nitesh Dhanjani, Abusing the Internet of Things, Shroff Publisher/O'Reilly Publisher.
2. Internet of Things, RMD Sundaram Shriram K Vasudevan, Abhishek S Nagarajan,John Wiley and Sons.
3. Internet of Things, Shriram K Vasudevan, Abhishek S Nagarajan, RMD Sundaram,John Wiley & Sons.
4. Cuno Pfister, "Getting Started with the Internet of Things", Shroff Publisher/Maker Media.

Reference Books:

1. Francis daCosta, "Rethinking the Internet of Things: A Scalable Approach to Connecting Everything", 1 st Edition, Apress Publications.
2. Massimo Banzi, Michael Shiloh Make: Getting Started with the Arduino, Shroff Publisher/Maker Media Publishers.

Corresponding Online Resources: 1. https://www.coursera.org/specializations/internet-of-things

Course Code:	UCSMM0343		L	T	P	Credit
Course Name:	AI in Healthcare		2			2

Course Prerequisites:

Data Structures and algorithms, Fundamentals of Programming

Course Description:

The goal of this course is to introduce the underlying concepts, methods, and the potential of intelligent systems in medicine. This course will help in specialization in particular AI methods, clinical/healthcare applications, and relevant tools.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Interpret what is Artificial Intelligence (AI) and Machine learning (ML)
CO2	Infer the concept of Neural Networks and its applications in healthcare
CO3	Analyze the healthcare data and process it using data analysis and statistical tools
CO4	Explore the applications of AI and ML with respect to healthcare domain

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO 1	PSO2
CO1	2	1	1	1								2	3	3
CO2	2	1	2	3								2	3	3
CO3	2	2	2	4								2	3	3
CO4	2	2	2	3								2	3	3

Assessment Scheme:

SN	Assessment	Marks	Remark
1	End Semester Examination (ESE)	100	100% course contents

Course Contents

Unit 1 Introduction to Artificial Intelligence (AI) and Machine learning (ML) — 5 Hours

Importance and Applications of AI and ML in Healthcare, Types of Machine Learning and its classification -Decision Tree, Bayesian Classifier, Regression

Unit 2 Neural Networks, their types, and processing — 7 Hours

Neural Networks – learning Models, Deep Neural Network, Convolution Neural Networks & Recurrent Neural Networks, Natural Language Processing, Commonly Used and Advanced Neural Network architectures, Computer Vision
Internet of Things (IoT) - Introduction, Process flow and Tools, Use Cases, Remote Patient Monitoring

Unit 3 Data Representation — 7 Hours

Introduction to data, data frames, Data standardization, Dealing with noise and missing values, Transforming and normalizing data
Data Analytics - Overview of tools like R, Python, Statistical and Visualization tools

Unit 4 Healthcare data Analysis — 5 Hours

Sources of the healthcare data, Pre-processing of the healthcare data, Handling of the healthcare data, Creation of analysis-ready datasets

Unit 5 Healthcare — 5 Hours

Examples and Case studies, Future trends in AI Healthcare

Text Books:	
1. Russell, S. and Norvig, N. Artificial Intelligence: A Modern Approach. Prentice Hall Series in Artificial Intelligence 3 2. Bishop, C. M. Neural Networks for Pattern Recognition. Oxford University Press. 3. Hastie, T., Tibshirani, R. and Friedman, J. The Elements of Statistical Learning, Springer 4. Adam Gibson, Josh Patterson, Deep Learning, O'Reilly Media, Inc.	
Reference	
1. Deep Medicine: How Artificial Intelligence Can Make Healthcare Human Again, Eric Topol, Basic Books, 1st edition 2019. 2. Machine Learning and AI for Healthcare: Big Data for Improved Health Outcomes, Arjun Panesar, Apress, 1st Edition, 2019. 3. Artificial Intelligence in Healthcare, 2020, ISBN 978-0-12-818438-7 Elsevier Inc.	

Course Code:	UCSMM0441		L	T	P	Credit
Course Name:	Optimization methods for Analytics		3			3

Course Prerequsites:

Linear algebra, Calculus, Probability and Statistics

Course Description:

This course focuses on advanced optimization methods used in Master Data Management (MDM) for analytics. It covers both theoretical foundations and practical applications of optimization techniques in the context of data management and analytics.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Explain the Optimization Principles.
CO2	Apply Optimization Techniques and Formulate Optimization Models.
CO3	Evaluate Optimization Performance and analyze result.
CO4	Interpret Optimization Solutions and Communicate Optimization Findings.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	1								1			3		1
CO2	1	2	1		1				1	1	1	3	1	1
CO3	1	2		2					1			3		
CO4	1	2	1	2			1		1		1	3	1	1

Assessment Scheme:

SN	Assessment	Marks	Remark
1	End Semester Examination (ESE)	100	100% course contents

Course Contents:

Unit 1 Introduction to Optimization — **6 Hours**

Basics of Optimization - Definitions and scope,Importance in analytics , Types of Optimization Problems - Linear vs. Non-linear, Continuous vs. Discrete,Deterministic vs. Stochastic, Formulation of Optimization Problems - Objective functions,Constraints, Decision variables, Applications in Analytics : Case studies in various domains (e.g., finance, marketing, operations)

Unit 2 Linear Programming (LP) — **6 Hours**

Linear Programming Fundamentals - Formulation of LP problems, Graphical method, The Simplex Method - Standard form of LP, Simplex algorithm steps, Duality and Sensitivity Analysis - Dual problems, Economic interpretation of duality,Sensitivity analysis and its applications, Applications of LP : Resource allocation,Supply chain optimization,Portfolio optimization

Unit 3 Integer Programming (IP) — **8 Hours**

Introduction to Integer Programming: Formulation of integer programs,Types of integer programming problems (pure, mixed) Solution Methods : Branch and bound method,Cutting plane method,Heuristic and metaheuristic approaches, Applications of IP: Scheduling,Capital budgeting,Network design

Unit 4 Non-Linear Programming (NLP) — **8 Hours**

Basics of Non-Linear Programming - Differences from linear programming, Formulation of NLP problems, Solution Techniques - Unconstrained optimization (e.g., gradient descent), Constrained optimization (e.g., Lagrange multipliers, KKT conditions), Convex and Non-Convex Optimization - Properties of convex functions, Local vs. global optima, Applications of NLP - Machine learning (e.g., training of models), Energy optimization, Pricing strategies

Unit 5 Dynamic Programming (DP) — **6 Hours**

Introduction to Dynamic Programming - Principle of optimality,Recursive relationships, Solution Methods - Deterministic dynamic programming, Stochastic dynamic programming, Applications of DP - Inventory management, Financial planning, Markov decision processes (MDPs)

Unit 6	**Metaheuristic and Evolutionary Algorithms**	**6 Hours**

Overview of Metaheuristics - Importance in solving complex optimization problems, Characteristics and general framework, Popular Metaheuristic Algorithms - Genetic algorithms (GA), Simulated annealing (SA), Particle swarm optimization (PSO), Ant colony optimization (ACO), Applications of Metaheuristics - Large-scale optimization problems, Multi-objective optimization, Real-world case studies

Text Books:

1.G. Hadley,"Linear programming", Narosa Publishing House, New Delhi, 1990.
2. S.S. Rao,"Engineering Optimization: Theory and Practice", New Age International P)Ltd., New Delhi, 2000

Reference Books:

1. H.A. Taha,"Operations Research:An Introduction", 5th Edition, Macmillan, New York, 1992 4. Convex Optimization" by Stephen Boyd and Lieven Vandenberghe,Stephen Boyd and Lieven Vandenberghe, Cambridge University Press
2."Dynamic Programming and Optimal Control" by Dimitri P. Bertsekas,Vol. I, 3rd edition, Athena Scientific publicaton,2005 ,ISBN 1886529086
3. Meta-heuristic and Evolutionary Algorithms for Engineering Optimization,by Omid Bozorg-Haddad, Mohammad Solgi, Hugo A. Loáiciga,Released October 2017,Publisher(s): Wiley,ISBN: 9781119386995

Course Code:	UCSMM0442		L	T	P	Credit
Course Name:	Introduction to Security of Cyber-Physical Systems		3			3

Course Prerequsites:

Introduction to IoT, Computer Network basics

Course Description:

This course provides a comprehensive foundation in CPS security, equipping students with the knowledge and skills to address security challenges in this critical field.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Explain the basics of security and various types of security issues.
CO2	Summarize different cryptography techniques available and various security attacks.
CO3	Demonstrate network security model and how they are implemented in real world.
CO4	Outline various issues of Web security and biometric authentication.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2	3	3		1	2	2	1				1	2	1
CO2	3	1	3		1	2	2	1				1	2	1
CO3	2		3		1	2	2	1				1	2	1
CO4	1	1	3		1	2	1	1				1	2	1

Assessment Scheme:

SN	Assessment	Marks	Remark
1	End Semester Examination (ESE)	100	100% course contents

Course Contents:

Unit 1	Introduction	5 Hours

Overview of Security in Information Systems, Security goals, Threats and vulnerabilities, Privacy in Information System.

Unit 2	Security Fundamentals	8 Hours

Applied Cryptography & Intrusion Detection, Architecture of Applied Cryptography, One Way Hash Function and Integrity, Encryption Algorithms and Confidentiality, Digital Signature and Authentication (DH, RSA, 2 class), Intrusion Detection and Information Theory.

Unit 3	IoT Security	7 Hours

Internet of Things Security, Security and Privacy for IoT Case Study: Smart Home, Smart Grid Network, Modern Vehicle, Wearable Computing & BYOD, Mobile HealthCare.

Unit 4	Security of SDN	7 Hours

Software-Defined Networks, Introduction of Software-Defined Networks, Security for Software-Defined Networks, Privacy Leakages for Software-Defined Networks, Case Studies: How to Attack Software-Defined Networks.

Unit 5	CPS fundamentals	6 Hours

Cyber-Physical Systems (CPS), CPS - Platform components, CPS implementation issues, Intelligent CPS, Secure Deployment of CPS.

Unit 6	Security in CPS	7 Hours

Network Security in CPS- Network protocols used in CPS, Securing communication channels and network infrastructure, Physical Layer Security- Security issues at the sensor and actuator levels, Techniques for protecting physical components from tampering and attacks, Control System Security- Security in industrial control systems (ICS) and SCADA, Protecting control algorithms and ensuring secure control operations

Text Books:

1.Cyber Security, Nina Godbole, John Wiley & Sons.
2. Li Da Xu, Shancang Li, "Securing the Internet of Things", Syngress.

Reference Books:

1. Alasdair Gilchrist, "IoT Security Issues", De Gruyter
2. Sean Smith, "The Internet of Risky Things" 4. Sean Smith, Shroff Publisher/O'Reilly Publisher

Course Code:	UCSMM0443		L	T	P	Credit
Course Name:	Bioimaging		3			3

Course Prerequsites:

Signals and systems and linear algebra.

Course Description:

This course attempts to provide an introduction to the different commonly-used medical imaging systems. After the initial introduction and review modules, the different modalities can be taken as a stand-alone-module, and for each the physics, instrumentation, reconstruction and Image quality will be discussed.

Course Outcomes: After the completion of the course the student will be able to -

CO1	Explain the fundamental concepts of biomedical imaging
CO2	Apply radiation dosimetry techniques,
CO3	Interpret image formation processes, and factors affecting image quality.
CO4	Illustrate the principles of radioactive decay and its statistical properties.
CO5	Explain the Doppler Effect in ultrasound.

CO-PO Mapping:

	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2
CO1	2									1		2	2	
CO2	1	1			2				1	2				
CO3	2		2	1	3							1	2	2
CO4	2	2	2	2	1								2	2
CO5	1		1								1	1	3	

Assessment Scheme:

SN	Assessment	Marks	Remark
1	End Semester Examination (ESE)	100	100% course contents

Course Contents:

Unit 1	Introduction, 2D- Signals Systems review, Image Quality metrics	7 Hours

Introduction to Biomedical Imaging, Signals, System, Image Quality, Image Quality Metrics - contrast, resolution, noise, Signal to noise ratio, sampling, accuracy

Unit 2	Projection Radiography	7 Hours

Physics of Radiography - Ionization, Forms of Ionizing Radiations, Nature and properties of Ionizing Radiations, Radiation Dosimetry. Projection Radiography - Instrumentation, Image Formation, Noise and Scattering

Unit 3	Computed Tomography	5 Hours

CT Instrumentation, Image Formation, Image Quality in CT

Unit 4	Nuclear Medicine- PET/SPECT	8 Hours

Physics of Nuclear Medicine - Radioactive Decay, Modes of Decay, Stastics of Decay, Radiotracers
Planar scintigraphy - Instrumentation, Image Formation, Image Quality
Emission Computed Tomography (SPECT/PET) - Instrumentation, Image Formation, Image Quality in SPECT and PET

Unit 5	Ultrasound Imaging	6 Hours

Doppler Effect, Beam Pattern Formation and Focusing, UNtrasound Instrumentation, Ultrasound Imaging Modes, Steering and Focusing, 3D Ultrasound Imaging, Image Quality in Ultrasound		
Unit 6	**Magnetic Resonance Imaging**	**6 Hours**
MRI Instrumentation, MRI Data Acquisition, Image Reconstruction, Image Quality in MRI		
Text Books:		
1. Medical Imaging Signals and Systems by J. L. Prince and J. M. Links, Pearson Prentice Hall, 2006, ISBN 0130653535.		
Reference Books:		
1. Webb's Physics of Medical Imaging, 2nd Edition, CRC press		