Shivaji University Vidyanagar, Kolhapur, Maharashtra 416004

Department of Technology

As per NEP2020 guidelines

Pool of Specialization Minors for MDM Featured B. Tech (Computer Science and Technology), Detailed Curriculum

Specialization Minor
In
Artificial Intelligence and Machine Learning
For
B.Tech (Computer Science and Technology)

Shivaji University, Kolhapur

Department of Technology

Specialization Minor in Artificial Intelligence and Machine Learning

Teaching & Evaluation Scheme

Sr. No.	Category	Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation scheme	
									Theory	Practical
				L	T	P			ISE: ESE	IE:EE
1.	Preferably on SWAYAM (NPTEL) or any other MOOCs (Minor Program Core) Or In a Face-to-Face mode	SPM 1.1	Introduction to AI & Machine Learning	03	-	-	03	03	40:60	00:00
2.		SPM 1.2	Introduction to Data Analytics	03	-	-	03	03	40:60	00:00
3.		SPM1.3	Deep Learning and Neural Network	03	-	-	03	03	40:60	00:00
4.	Minor Program Based Internship	SPM1.4	AI ML Related Internship	One Month				03	00:00	50:50
5.	Project Based Learning	SPM 1.5	Mini Project	-	-	-	-	02	-	50:50
				-	-	-	-	14	300	200
			Total Hours	09	00	00	09	-	-	-

Note: If opted the Specialization Minor Program, Internship may be planned during winter or summer vacation days after 4th semester while respective evaluations will appear on a separate mark sheet.

Specialization Minor I: Artificial Intelligence and Machine Learning

Year, Program, Semester	Specialization Minor II, 4th Semester onwards					
Course Code	SPM-1.1					
Course Category	Specialization Minor Program Core					
Course title	**Introduction to AI & Machine Learning**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**
	03	-	-	03		03
Evaluation Scheme	**ISE**		**ESE**	**IE**	EE	**Total**
	40		60	00	00	100
Pre-requisites(if any)	Mathematical concepts such as statistics, calculus, probability, and linear algebra.					
Course Objectives	The Course is aimed to- 1. To review and strengthen important mathematical concepts required for AI &ML. 2. Introduce the concept of learning patterns from data and develop a strong theoretical foundation for understanding state of the art Machine Learning algorithms.					
Course Outcomes	Upon completion of this course, student should be able to – 1. Design and implement machine learning solutions to classification, regression and clustering problems. 2. Evaluate and interpret the results of the different ML techniques. 3. Design and implement various machine learning algorithms in a range of Real-world applications.					

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	2			3										
CO 2	2		2		3										
CO 3			2		2										

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	Defining Artificial Intelligence, Defining AI techniques, Using Predicate Logic and Representing Knowledge as Rules, Representing simple facts in logic, Computable functions and predicates, Procedural vs Declarative knowledge, Logic Programming, Mathematical foundations: Matrix Theory and Statistics for Machine Learning.	9

II	Idea of Machines learning from data, Classification of problem –Regression and Classification, Supervised and Unsupervised learning.	8
III	Linear Regression: Model representation for single variable, Single variable Cost Function, Gradient Decent for Linear Regression, Gradient Decent in practice.	8
IV	Logistic Regression: Classification, Hypothesis Representation, Decision Boundary, Cost function, Advanced Optimization, Multi-classification (One vs All), Problem of Overfitting.	8
V	Discussion on clustering algorithms and use-cases cantered around clustering and classification.	6
Text / Reference Books		
i)	Saroj Kaushik, Artificial Intelligence, Cengage Learning, 1st Edition 2011	
ii)	Anindita Das Bhattacharjee, "Practical Workbook Artificial Intelligence and Soft Computing for beginners, Shroff Publisher-X team Publisher.	
iii)	Yuxi (Hayden) Liu, "Python Machine Learning by Example", Packet Publishing Limited, 2017.	
iv)	Tom Mitchell, Machine Learning, McGraw Hill, 2017.	
v)	Christopher M. Bishop, Pattern Recognition and Machine Learning, Springer, 2011.	
vi)	T. Hastie, R. Tibshirani, J. Friedman. The Elements of Statistical Learning, 2e, 2011.	
Lab Work		
i)	Implementation of logical rules in Python	
ii)	Using any data apply the concept of: a. Liner regression b. Gradient decent c. Logistic regression	
iii)	To add the missing value in any data set.	
iv)	Perform and plot under fitting and overfitting in a data set.	
v)	Implementation of clustering and classification algorithms.	
Assessment		
	a) ISE has a total weightage of 30 marks which is a (20+10) marks pattern. Theory paper examination will be conducted at central level for 20 marks. **10 marks will be given based on the assignments of lab work**. It consists of assignments, quiz, seminars, presentations, research papers and research articles, developing working models, surveys and activities related to course as designed by the course coordinator to suit the needs of the course and to complement program outcomes. The practical work and its journal is not part of course work.	

	b) ESE will be conducted at central level at the end of the semester. It will be theory paper for 100 Marks and then it will be scaled down for 70 marks.

Year, Program, Semester	Specialization Minor II, 4th Semester onwards					
Course Code	SPM-1.2					
Course Category	Specialization Minor Program Core					
Course title	**Introduction to Data Analytics**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**
	03	-	-	03		03
Evaluation Scheme	**ISE**		**ESE**	**IE**	**EE**	**Total**
	40		60	00	00	100
Pre-requisites(if any)	Solid foundation in basic mathematics, including algebra, calculus, and probability.					
Course Objectives	The Course is aimed to- 1. Provide the knowledge and expertise to become a proficient data scientist 2. Demonstrate an understanding of statistics and machine learning concepts that are vital for data science 3. Produce Python code to statistically analyses a dataset 4. Critically evaluate data visualizations based on their design and use for Communicating stories from data.					
Course Outcomes	Upon completion of this course, student should be able to – 1. Explain how data is collected, managed and stored for data science. 2. Understand the key concepts in data science, including their real- world Applications and the toolkit used by data scientists. 3. Implement data collection and management scripts using MongoDB.					

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1				3											
CO 2					3										
CO 3			2	2											

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	Introduction to Data Science, Different Sectors using Data science, Purpose andComponents of Python in Data Science.	7
II	Data Analytics Process, Knowledge Check, Exploratory Data Analysis (EDA), EDA- Quantitative technique, EDA- Graphical Technique, Data Analytics Conclusion and Predictions.	7
III	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.	9
IV	Data Visualization- Basic principles, ideas and tools for data visualization, Examples of inspiring (industry) projects- Exercise: create your own visualization of a complex dataset.	9
V	Applications of Data Science, Data Science and Ethical Issues- Discussions on privacy,security, ethics- A look back at Data Science- Next-generation data scientists.	7
Text / Reference Books		
i)	Joel Grus, Data Science from Scratch, Shroff Publisher Publisher /O'Reilly PublisherMedia	
ii)	Annalyn Ng, Kenneth Soo, Numsense! Data Science for the Layman, Shroff PublisherPublisher	
iii)	Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from TheFrontline. O'Reilly Publisher Media.	
iv)	Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets.v2.1, Cambridge University Press.	
v)	Jake VanderPlas, Python Data Science Handbook, Shroff Publisher Publisher /O'Reilly Publisher Media	
vi)	Philipp Janert, Data Analysis with Open Source Tools, Shroff Publisher Publisher /O'Reilly Publisher Media.	
Lab Work		
i)	Python Environment setup and Essentials.	
ii)	Mathematical computing with Python (NumPy).	
iii)	Scientific Computing with Python (SciPy).	
iv)	Data Manipulation with Pandas.	
v)	Prediction using Scikit-Learn	
vi)	Data Visualization in python using matplotlib	
Assessment		
	a) ISE has a total weightage of 30 marks which is a (20+10) marks pattern. Theory paper examination will be conducted at central level for 20 marks. **10 marks will be given based on the assignments of lab work**. It consists of assignments, quiz, seminars, presentations, research papers and research articles, developing working models, surveys and activities related to course as designed by the	

	course coordinator to suit the needs of the course and to complement program outcomes. The practical work and its journal is not part of course work. b) ESE will be conducted at central level at the end of the semester. It will be theory paper for 100 Marks and then it will be scaled down for 70 marks.

Year, Program, Semester	Specialization Minor II, 4th Semester onwards					
Course Code	SPM-1.3					
Course Category	Specialization Minor Program Core					
Course title	**Deep Learning and Neural Network**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**
	03	-	-	03		03
Evaluation Scheme	**ISE**		**ESE**	**IE**	**EE**	**Total**
	40		60	00	00	100
Pre-requisites(if any)	Basic Mathematics, matrix arithmetic, probability.					
Course Objectives	The Course is aimed to- 1. Strengthen important Mathematical concepts required for Deep learning and neural network. 2. Get a detailed insight of advanced algorithms of neural networks. 3. Introduce different deep learning network.					
Course Outcomes	Upon completion of this course, student should be able to – 1. Design and implement Artificial Neural networks. 2. Decide when to use which type of NN. 3. Implement and analyze various deep learning architectures					

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1			2		2										
CO 2		2			2										
CO3		2	3		3										

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	Information flow in a neural network, understanding basic structure and ANN.	8
II	Training a Neural network, how to determine hidden layers, recurrent neural network.	8
III	Convolutional neural networks, image classification and CNN.	8
IV	RNN and LSTMs. Applications of RNN in real world.	8
V	Creating and deploying networks using tensor flow and keras	7
Text / Reference Books		
i)	John Paul Mueller, Luca Massaron, Deep Learning for Dummies, John Wiley & Sons.	
ii)	Adam Gibson, Josh Patterson, Deep Learning, A Practitioner's Approach, ShroffPublisher /O'Reilly Publisher Media.	
iii)	Christopher M. Bishop, Neural Networks for Pattern Recognition, Oxford.	
iv)	Russell Reed, Robert J MarksII, Neural Smithing: Supervised Learning in Feedforward Artificial Neural Networks, Bradford Book Publishers	
Lab Work		
i)	Introduction to Kaggle and how it can be used to enhance visibility.	
ii)	Build general features to build a model for text analytics.	
iii)	Build and deploy your own deep neural network on a website using tensor flow.	
Assessment		
	a) ISE has a total weightage of 30 marks which is a (20+10) marks pattern. Theory paper examination will be conducted at central level for 20 marks. **10 marks will be given based on the assignments of lab work**. It consists of assignments, quiz, seminars, presentations, research papers and research articles, developing working models, surveys and activities related to course as designed by the course coordinator to suit the needs of the course and to complement program outcomes. The practical work and its journal is not part of course work. b) ESE will be conducted at central level at the end of the semester. It will be theory paper for 100 Marks and then it will be scaled down for 70 marks.	

Year, Program, Semester	Specialization Minor I, 4th Semester onwards						
Course Code	SPM 1.4						
Course Category	Specialization Minor Based Internship						
Course Title	**AI ML Related Internship**						
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**		
	One Month				03		
Evaluation Scheme	**ISE**	**ESE**	**IOE**	**IPE**	**EOE**	**EPE**	**Total**
	00	00	50	-	50	-	100
Pre-requisites(if any)	Basics of unit processes and unit operations.						
Course Rationale	The course caters specifically to B.Tech Computer Science and Technology students as the part of multidisciplinary Minor with respect to AI & ML. This course offers practical exposure to industry settings aligned with their chosen discipline, aiming to bridge the gap between theoretical knowledge and practical application. By engaging in a one-month internship, students gain firsthand experience, essential skills, and insights crucial for their future careers in additional sector of industry.						
Course Objectives	The course teacher will 1. Help expose students to the 'real' working environment; 2. Promote hands-on experience to the students' in their related field; 3. Develop synergetic collaboration between industry and the university in promoting a knowledgeable society; 4. Assist in providing the opportunity for students to test their interest in a particular career before permanent commitments are made. 5. Elaborate the dynamic and challenging nature of industrial environments.						
Course Outcomes	Upon completion of this course, student should be able to 1. Understand industrial processes and operations related to their minor sub-specializations. 2. Apply theoretical concepts to solve practical problems in the industry. 3. Communicate effectively with industry professionals, colleagues, and supervisors. 4. Collaborate efficiently in team environments to complete tasks and projects. 5. Adapt to the dynamic and challenging nature of industrial environments. 6. Reflect on internship experiences for personal and professional growth.						

Course Outcome and Program Outcome Mapping

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	-	-	-	-	-	-	-	-	-	-	-
CO 2	-	3	2	-	-	-	-	-	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	-	3	-	-
CO 4	-	-	-	-	-	-	-	-	3	-	-	-
CO 5	-	-	-	-	-	2	-	-	-	-	-	3
CO 6	-	-	-	-	-	-	-	-	-	-	-	2

Level of Mapping as: Low 1, Moderate 2, High 3

Course Content	Hours
The course consists of a one-month internship with respect to applications of AI & ML. Students will be placed in companies or organizations that align with the particular requirement. During the internship, students will engage in various activities, including but not limited to: 1. Shadowing industry professionals to observe and learn about different processes and operations. 2. Assisting with ongoing projects or research initiatives within the organization. 3. Participating in hands-on tasks related to their minor sub-specialization, under the guidance of experienced mentors. 4. Attending training sessions, workshops, and seminars conducted by the industry to enhance their knowledge and skills. 5. Engaging in discussions and meetings with supervisors and colleagues to gain insights into industry practices, challenges, and innovations. 6. Documenting their internship experience through reports, presentations, or reflective journals. The period of one month for this internship will be during the winter or summer vacations, any such slots 4th Semester onwards.	4 weeks

Course Evaluation Method

This particular evaluation will be the part of the structure of 7th Semester.
The evaluation for the Industrial Internship course will be conducted as follows:

- **Internal Evaluation (50 marks):**
    - Assessment by course teachers based on students' performance during the internship, including attendance, participation, attitude, and contribution to assigned tasks.
    - Evaluation by industrial supervisors on students' professional conduct, technical skills, problem-solving abilities, and overall performance in the workplace.
- **External Evaluation (50 marks):**
    - Evaluation by an external examiner appointed by the institute, who will assess students' internship reports, presentations, or any other documentation submitted at the end of the internship period.
    - The external examiner will review the quality of students' reflections on their internship experience, their ability to apply theoretical knowledge to practical situations, and the depth of their understanding of industry practices and challenges.

The final grades for the Industrial Internship course will be determined based on the combined assessment from both internal and external evaluations.

Year, Program, Semester	Specialization Minor I, 4th Semester onwards							
Course Code	SPM 1.5							
Course Category	Project Based Learning							
Course Title	**Mini Project**							
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**		
	-	-	-	-		02		
Evaluation Scheme	**ISE**	**ESE**		**IOE**	**IPE**	**EOE**	**EPE**	**Total**
	00	00		50	-	50	-	100
Pre-requisites(if any)	Basics of Computers and programming							
Course Rationale	This course aims to provide students with practical exposure and hands-on experience in real-world industrial settings, fostering a deeper understanding of theoretical concepts through application. By engaging in this field project, students will develop essential skills such as problem-solving, teamwork, and communication, preparing them for future challenges in the professional arena for AI ML applications.							
Course Objectives	The course teacher will 1. Facilitate application of theoretical knowledge. 2. Guide the students about enhancement of practical skills. 3. Explain about development of industry-relevant competencies.							
Course Outcomes	Upon completion of this course, student should be able to 1. Demonstrate application of theoretical concepts with instructor guidance. 2. Collaborate effectively in instructor-led team-based projects. 3. Communicate findings and insights professionally under instructor supervision.							

Course Outcome and Program Outcome Mapping

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	-	-	2	-	-	-	2	-	-	-
CO 2	-	-	3	-	-	-	-	-	3	-	2	1
CO 3	-	-	-	-	-	-	-	-	-	3	-	2

Level of Mapping as: Low 1, Moderate 2, High 3

Course Content

Specialization Minor Program Based Mini Project is a dynamic course designed to bridge the gap between classroom learning and real-world application. All the students will engage themselves in a series of tasks and challenge that will enable them to apply theoretical concepts learned in previous courses to solve practical problems. The project work need to be carried out independently covering a range of topics relevant to their field of study, allowing them to explore different facets of the particular discipline and develop versatile skill sets with respect to application of AI & ML.

This activity may be planned after 4th Semester and can be completed prior to 8th Semester of their Major studies.

Course Assessment Process

This particular evaluation will be the part of 8th Semester of the major structure.

The course evaluation for the internals will be at the course teacher end while there will also be the external evaluation of the Project work.

The teachers will follow the instructions as below:
Evaluation Format: The evaluation may be conducted using a combination of assessment methods, including:
• Rubric-based assessment for the project work and its report.
• Peer evaluation for project.
• Instructor-led discussions or presentations to evaluate communication skills and critical thinking.
• Overall course grading based on a weighted average of individual assessments and participation.
The evaluation format should be transparent, fair, and aligned with the course objectives and outcomes. Regular feedback and communication with students will ensure that the evaluation process remains supportive of their learning journey.

Specialization Minor
In
Cyber Security
For
B.Tech(Computer Science and Technology)

Shivaji University, Kolhapur
Department of Technology

Specialization Minor in Cyber Security

Teaching & Evaluation Scheme

Sr. No.	Category	Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	Preferably on SWAYAM (NPTEL) or any other MOOCs (Minor Program Core) Or In a Face-to-Face mode	SPM 2.1	Information Theory for Cyber Security	03	-	-	03	03	40:60	00:00
2.		SPM 2.2	Data Encryption	03	-	-	03	03	40:60	00:00
3.		SPM 2.3	Security Assessment and Risk Analysis	03	-	-	03	03	40:60	00:00
4.	Minor Program Based Internship	SPM 2.4	Cyber Security Related Internship	One Month				03	00:00	50:50
5.	Project Based Learning	SPM 2.5	Mini Project	-	-	-	-	02	-	50:50
				-	-	-	-	14	300	200
			Total Hours	09	00	00	09	-	-	-

Note: If opted the Specialization Minor Program, Internship may be planned during winter or summer vacation days after 4th semester while respective evaluations will appear on a separate mark sheet.

Specialization Minor II: Cyber Security

Year, Program, Semester	Specialization Minor I, 4th Semester onwards					
Course Code	SPM 2.1					
Course Category	Specialization Minor Program Core					
Course title	**Information Theory for Cyber Security**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**
	03	-	-	03		03
Evaluation Scheme	**ISE**		**ESE**	**IE**	EE	**Total**
	40		60	00	00	100
Pre-requisites(if any)	Basic Mathematics					
Course Objectives	The Course is aimed to- 1. Provide a foundation of information theory, basics of random variables, and probability distribution factors. 2. Describe details about secrecy, authentication and block codes 3. Theoretic of security and cryptographic techniques 4. Provide details of secrecy metrics and secure source coding 5. Overview of digital forensics, public key cryptography					
Course Outcomes	After completion of the course, students would be able to: 1. Understand the foundation of information theory, the basics of random variables, and probability distribution factors. 2. Justify details about secrecy, authentication and block codes 3. Explain theoretic of security and cryptographic techniques 4. Analyze secrecy metrics and secure source coding 5. Overview of digital forensics, public key cryptography					

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	2	1		1											
CO 2	2	2	1	2	1								2		
CO 3	3	2	1	1	1								2		
CO 4	2	3	2	1	1								2		
CO 5	2	2	2		1								1		

Level of Mapping as: Low 1, Moderate 2, High

Unit No.	Course Content	Hours
I	Shannon's foundation of Information theory, Random variables, Probability distribution factors, Uncertainty/entropy information measures, Leakage, Quantifying Leakage and Partitions, Lower bounds on key size: secrecy, authentication and secret sharing. Provable security, computationally secure, symmetric cipher.	8
II	Secrecy, Authentication, Secret sharing, Optimistic results on perfect secrecy, Secret key agreement, Unconditional Security, Quantum Cryptography, Randomized Ciphers, Types of codes: block codes, Hamming and Lee metrics, description of linear block codes, parity check Codes, cyclic code, Masking techniques.	8
III	Information-theoretic security and cryptograph, basic introduction to Diffie-Hellman, AES, and side-channel attacks.	7
IV	Secrecy metrics: strong, weak, semantic security, partial secrecy, Secure source coding: rate-distortion theory for secrecy systems, side information at receivers, Differential privacy, Distributed channel synthesis.	9
v	Digital and network forensics, Public Key Infrastructure, Light weight cryptography, Elliptic Curve Cryptography and applications.	7
Text Books		
i)	Information Theory and Coding, Muralidhar Kulkarni, K S Shivaprakasha, John Wiley and Sons.	
ii)	Communication Systems: Analog and digital, Singh and Sapre, Tata McGraw Hill.	
Reference Books		
i)	Fundamentals in information theory and coding, Monica Borda, Springer.	
ii)	Information Theory, Coding and Cryptography R Bose.	
Iii]	Multi-media System Design, Prabhat K Andleigh and Kiran Thakrar.	
Assessment		
	a) ISE has a total weightage of 30 marks which is a (20+10) marks pattern. Theory paper examination will be conducted at central level for 20 marks. 10 marks will be given based on the assignments on each unit. It consists of assignments, quiz, seminars, presentations, research papers and research articles, developing working models, surveys and activities related to course as designed by the course coordinator to suit the needs of the course and to complement program outcomes. The practical work and its journal is not part of course work. b) ESE will be conducted at central level at the end of the semester. It will be theory paper for 100 Marks and then it will be scaled down for 70 marks.	

Year, Program, Semester	Specialization Minor I, 4th Semester onwards					
Course Code	SPM 2.2					
Course Category	Specialization Minor Program Core					
Course title	**Data Encryption**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**
	03	-	-	03		03
Evaluation Scheme	**ISE**		**ESE**	**IE**	**EE**	**Total**
	40		60	00	00	100
Pre-requisites(if any)	Basic Mathematics					
Course Objectives	The Course is aimed to- 1. Provide knowledge of basics of cryptography, and some key encryption techniques. 2. Explain modern cryptosystems and public key cryptography 3. Discuss case studies and security policies such as authentication, integrity and confidentiality, Provide Knowledge of key management and key distribution 4. Introduce the concept of data compression 5. Discuss in detail the entropy encoding 6. Discuss recent trends in encryption and data compression techniques.					
Course Outcomes	Upon completion of this course, student should be able to – 1. Describe basic terminology in cryptography, and classical cryptosystems. 2. Explain modern cryptosystems. concepts of public key cryptography 3. Discuss case studies and analyse security policies such as authentication, integrity and confidentiality and key management and key distribution 4. Understand the concept of data compression 5. Analyse the entropy encoding. 6. Explain recent trends in encryption and data compression techniques.					

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	1	1		1								1		
CO 2	2	2	1	1	1								1		
CO 3	2	2	1	1	1								1		
CO 4	2	2		1	1										
CO 5	2	2	2	2	1										
CO6	2	2	2	2	2								1		

Level of Mapping as: Low 1, Moderate 2, High

Specialization Minor [B. Tech (Computer Science and Technology)] Detailed Curriculum

Unit No.	Course Content	Hours
I	Introduction to Security: Need for security, Security approaches, Principles of security, Types of attacks. Encryption Techniques: Plaintext, Cipher text, Substitution; Transposition techniques, Encryption; Decryption, Types of attacks, Key range; Size.	7
II	Symmetric ; Asymmetric Key Cryptography: Algorithm types; Modes, DES, IDEA, Differential; Linear Cryptanalysis, RSA, Symmetric; Asymmetric key together, Digital signature, Knapsack algorithm.	6
III	Case Studies of Cryptography: Denial of service attacks, IP spoofing attacks, Conventional Encryption and Message Confidentiality, Conventional Encryption Algorithms, Key Distribution. Public Key Cryptography and Message Authentication: Approaches to Message Authentication, SHA-1, MD5, Public-Key Cryptography Principles, RSA, Digital, Signatures, Key Management, Firewall..	8
IV	Introduction: Need for data compression, Fundamental concept of data compression coding, Communication model, Compression ratio, Requirements of data compression, Classification. Methods of Data Compression: Data compression-- Loss less; Lossy.	7
v	Entropy encoding-- Repetitive character encoding, Run length encoding, Zero/Blank encoding; Statistical encoding-- Huffman, Arithmetic ; Lempel-Ziv coding; Source encoding-- Vector quantization (Simple vector quantization ; with error term).	7
vi	Recent trends in encryption and data compression techniques.	4
	Text Books	
i)	Cryptography and Network Security, Mohammad Amjad, John Wiley and Sons.	
ii)	Cryptography and Network Security by Atul Kahate, TMH.	
	Reference Books	
i)	Information Theory and Coding, Muralidhar Kulkarni, K S Shivaprakasha, John Wiley and Sons.	
ii)	Cryptography and Network Security by B. Forouzan, McGraw-Hill.	
Iii]	The Data Compression Book by Nelson, BPB.	
	Assessment	
	a) ISE has a total weightage of 30 marks which is a (20+10) marks pattern. Theory paper examination will be conducted at central level for 20 marks. 10 marks will be given based on the assignments on each unit. It consists of assignments, quiz, seminars, presentations, research papers and research articles, developing working models, surveys and activities related to course as designed by the course coordinator to suit the needs of the course and to complement program outcomes. The practical work and its journal is not part of course work. b) ESE will be conducted at central level at the end of the semester. It will be theory paper for 100 Marks and then it will be scaled down for 70 marks.	

Specialization Minor [B. Tech (Computer Science and Technology)] Detailed Curriculum

Year, Program, Semester	Specialization Minor I, 4th Semester onwards					
Course Code	SPM 2.3					
Course Category	Specialization Minor Program Core					
Course title	**Security Assessment and Risk Analysis**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**
	03	-	-	03		03
Evaluation Scheme	**ISE**		**ESE**	**IE**	EE	**Total**
	40		60	00	00	100
Pre-requisites(if any)	Basic Mathematics					
Course Objectives	The Course is aimed to- 1. Describe the concepts of security basics, critical information characteristics, and security countermeasures in information security. 2. Explain threats to the system and vulnerabilities of the system. Study concepts of risk management 3. Study security planning and procedures, contingency planning and disaster recovery. 4. Describe concepts of security practices and auditing and monitoring 5. Study operation security concepts and case study to analyse threats and vulnerabilities in the system					
Course Outcomes	After completion of the course, students would be able: 1. Understand Information security basics, critical information characteristics, and security countermeasures. 2. Analyze threats to the system and vulnerabilities of the system and design risk management framework accordingly 3. Plan security practices, contingency planning and disaster recovery 4. Analyze personal security practices and procedure and auditing and monitoring security programs 5. Understand concept of operation security and planning and assess the system with the help of latest tools and technology for threats and vulnerability					

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	3	-	-	-											
CO 2	2	3	2	3	2								2		
CO 3	2	3	2	2	2						1				
CO 4	2	3	2	3	3								2		
CO 5	2	3	2	2	3								2		

Level of Mapping as: Low 1, Moderate 2, High

Specialization Minor [B. Tech (Computer Science and Technology)] Detailed Curriculum

Unit No.	Course Content	Hours
I	SECURITY BASICS: Information Security (INFOSEC) Overview: critical information characteristics – availability information states – processing security countermeasures-education, training and awareness, critical information characteristics confidentiality, critical information characteristics– integrity,information states – storage, information states – transmission, security countermeasures-policy, procedures and practices, threats, vulnerabilities.	8
II	Threats to and Vulnerabilities of Systems: Threats, major categories of threats (e.g., fraud, Hostile Intelligence Service (HOIS). Countermeasures: assessments (e.g., surveys, inspections). Concepts of Risk Management: consequences (e.g., corrective action, risk assessment), cost/benefit analysis and implementation of controls, monitoring the efficiency and effectiveness of controls (e.g., unauthorised or inadvertent disclosure of information).	8
III	Security Planning: directives and procedures for policy mechanism. Contingency Planning/Disaster Recovery: agency response procedures and continuity of operations, contingency plan components, determination of backup requirements, development of plans for recovery actions after a disruptive event.	7
IV	Personnel Security Practices and Procedures: access authorisation/verification (need-to-know), contractors, employee clearances, position sensitivity, security training and awareness, systems maintenance personnel. Auditing and Monitoring: conducting security reviews, effectiveness of security programs, investigation of security breaches, privacy review of accountability controls, review of audit trails and logs.	7
v	Operations Security (OPSEC): OPSEC surveys/OPSEC planning INFOSEC: computer security – audit, cryptography-encryption (e.g., point-to-point, network, link).	6
vi	Case study of threat and vulnerability assessment.	3
Text Books		
i)	Information Systems Security, 2ed: Security Management, Metrics, Frameworks and Best Practices, Nina Godbole, John Wiley ; Sons.	
ii)	Principles of Incident Response and Disaster Recovery, Whitman ; Mattord, Course Technology ISBN: 141883663X.	
Assessment		
	a) ISE has a total weightage of 30 marks which is a (20+10) marks pattern. Theory paper examination will be conducted at central level for 20 marks. 10 marks will be given based on the assignments on each unit. It consists of assignments, quiz, seminars, presentations, research papers and research articles, developing working models, surveys and activities related to course as designed by the course coordinator to suit the needs of the course and to complement program outcomes. The practical work and its journal is not part of course work. b) ESE will be conducted at central level at the end of the semester. It will be theory paper for 100 Marks and then it will be scaled down for 70 marks.	

Year, Program, Semester, Specialization, Minor, Type	Super Specialization M.Tech, 4th Sem						
Course Code	SPM 2.4						
Course Category	Specialization Minor Based Internship						
Course Title	**Cyber Security Related Internship**						
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**	
	One Month					03	
Evaluation Scheme	**ISE**	**ESE**		**IOE**	**IPE**	**EOE**	**EPE**	**Total**
	00	00		50	-	50	-	100
Pre-requisites(if any)	Basics of unit processes and unit operations.						
Course Rationale	The Industrial Internship course caters specifically to B.Tech Computer Science and Technology students pursuing additional specialization through the B.Tech Minor program in areas such as Cyber Security. This course offers practical exposure to industry settings aligned with their chosen sub-specialization, aiming to bridge the gap between theoretical knowledge and practical application. By engaging in a one-month internship, students gain firsthand experience, essential skills, and insights crucial for their future careers in specialized sectors of Computer Science and Technology.						
Course Objectives	The course teacher will 1. Help expose students to the 'real' working environment; 2. Promote hands-on experience to the students' in their related field; 3. Develop synergetic collaboration between industry and the university in promoting a knowledgeable society; 4. Assist in providing the opportunity for students to test their interest in a particular career before permanent commitments are made. 5. Elaborate the dynamic and challenging nature of industrial environments.						
Course Outcomes	Upon completion of this course, student should be able to 1. Understand industrial processes and operations related to their minor sub-specializations. 2. Apply theoretical concepts to solve practical problems in the industry. 3. Communicate effectively with industry professionals, colleagues, and supervisors. 4. Collaborate efficiently in team environments to complete tasks and projects. 5. Adapt to the dynamic and challenging nature of industrial environments. 6. Reflect on internship experiences for personal and professional growth.						

Course Outcome and Program Outcome Mapping

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	-	-	-	-	-	-	-	-	-	-	-
CO 2	-	3	2	-	-	-	-	-	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	-	3	-	-
CO 4	-	-	-	-	-	-	-	-	3	-	-	-
CO 5	-	-	-	-	-	2	-	-	-	-	-	3
CO 6	-	-	-	-	-	-	-	-	-	-	-	2

Level of Mapping as: Low 1, Moderate 2, High 3

Course Content	Hours
The course consists of a one-month internship with respect to Cyber Security. Students will be placed in companies or organizations that align with the particular requirement. During the internship, students will engage in various activities, including but not limited to: 1. Shadowing industry professionals to observe and learn about different processes and operations. 2. Assisting with ongoing projects or research initiatives within the organization. 3. Participating in hands-on tasks related to their minor sub-specialization, under the guidance of experienced mentors. 4. Attending training sessions, workshops, and seminars conducted by the industry to enhance their knowledge and skills. 5. Engaging in discussions and meetings with supervisors and colleagues to gain insights into industry practices, challenges, and innovations. 6. Documenting their internship experience through reports, presentations, or reflective journals. The period of one month for this internship will be during the winter or summer vacations, any such slots 4th Semester onwards.	4 weeks

Course Evaluation Method

This particular evaluation will be the part of the structure of 7th Semester.
The evaluation for the Industrial Internship course will be conducted as follows:

- **Internal Evaluation (50 marks):**
  - Assessment by course teachers based on students' performance during the internship, including attendance, participation, attitude, and contribution to assigned tasks.
  - Evaluation by industrial supervisors on students' professional conduct, technical skills, problem-solving abilities, and overall performance in the workplace.
- **External Evaluation (50 marks):**
  - Evaluation by an external examiner appointed by the institute, who will assess students' internship reports, presentations, or any other documentation submitted at the end of the internship period.

- The external examiner will review the quality of students' reflections on their internship experience, their ability to apply learned knowledge to real-world situations, and the depth of their understanding of industry practices and challenges.

The final grades for the Industrial Internship course will be determined based on the combined assessment from both internal and external evaluations.

Year, Program, Semester	Specialization Minor I, 4th Semester onwards						
Course Code	SPM 2.5						
Course Category	Project Based Learning						
Course Title	**Mini Project**						
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**	
	-	-	-	-		02	
Evaluation Scheme	**ISE**	**ESE**		**IOE**	**IPE**	**EOE**	**EPE**	**Total**
	00	00		50	-	50	-	100
Pre-requisites(if any)	Basics of Computers and programming						
Course Rationale	This course aims to provide students with practical exposure and hands-on experience in real-world industrial settings, fostering a deeper understanding of theoretical concepts through application. By engaging in this field project, students will develop essential skills such as problem-solving, teamwork, and communication, preparing them for future challenges in the professional arena .						
Course Objectives	The course teacher will 1. Facilitate application of theoretical knowledge. 2. Guide the students about enhancement of practical skills. 3. Explain about development of industry-relevant competencies.						
Course Outcomes	Upon completion of this course, student should be able to 1. Demonstrate application of theoretical concepts with instructor guidance. 2. Collaborate effectively in instructor-led team-based projects. 3. Communicate findings and insights professionally under instructor supervision.						

Course Outcome and Program Outcome Mapping

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	-	-	2	-	-	-	2	-	-	-
CO 2	-	-	3	-	-	-	-	-	3	-	2	1
CO 3	-	-	-	-	-	-	-	-	-	3	-	2

Level of Mapping as: Low 1, Moderate 2, High 3

Course Content

Specialization Minor Program Based Mini Project is a dynamic course designed to bridge the gap between classroom learning and real-world application. All the students will engage themselves in a series of tasks and challenge that will enable them to apply theoretical concepts learned in previous courses to solve practical

problems. The project work need to be carried out independently covering a range of topics relevant to their field of study allowing them to explore different facets of the particular discipline and develop versatile skill sets with respect to application of AI & ML.

This activity may be planned after 4th Semester and can be completed prior to 8th Semester of their Major studies.

Course Assessment Process

This particular evaluation will be the part of 8th Semester of the major structure.

The course evaluation for the internals will be at the course teacher end while there will also be the external evaluation of the Project work.

The teachers will follow the instructions as below:

Evaluation Format: The evaluation may be conducted using a combination of assessment methods, including:

- Rubric-based assessment for the project work and its report.
- Peer evaluation for project.
- Instructor-led discussions or presentations to evaluate communication skills and critical thinking.
- Overall course grading based on a weighted average of individual assessments and participation.

The evaluation format should be transparent, fair, and aligned with the course objectives and outcomes. Regular feedback and communication with students will ensure that the evaluation process remains supportive of their learning journey.

Specialization Minor
In
Data Science
For
B.Tech (Computer Science and Technology)

Shivaji University, Kolhapur
Department of Technology

Specialization Minor in Data Science

Teaching & Evaluation Scheme

Sr. No.	Category	Code	Course Title	Hours per week			Contact Hours	Credits	Evaluation scheme	
									Theory	Practical
				L	T	P			ISE:ESE	IE:EE
1.	Preferably on SWAYAM (NPTEL) or any other MOOCs (Minor Program Core) Or In a Face-to-Face mode	SPM 3.1	Introduction to Data Science	03	-	-	03	03	40:60	00:00
2.		SPM 3.2	Introduction to AI and ML	03	-	-	03	03	40:60	00:00
3.		SPM 3.3	Computational Data analytics	03	-	-	03	03	40:60	00:00
4.	Program Based Internship	SPM 3.4	Data Science Related Internship	One Month				03	-	50:50
5.	Project Based Learning	SPM 3.5	Mini Project	-	-	-	-	02	-	50:50
				-	-	-	-	14	300	200
			Total Hours	09	00	00	09	-	-	-

Note: If opted the Specialization Minor Program, Internship and Mini Project may be planned during winter or summer vacation days after 4th semester while respective evaluations will appear on a separate mark sheet.

Specialization Minor III: Data Science

Year, Program, Semester	Specialization Minor I, 4th Semester onwards					
Course Code	SPM 3.1					
Course Category	Specialization Minor Program Core					
Course title	**Introduction to Data Science**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**
	03	-	-	03		03
Evaluation Scheme	**ISE**		**ESE**	**IE**	EE	**Total**
	40		60	00	00	100
Pre-requisites(if any)	Database Engineering					
Course Objectives	The Course is aimed to- 1. Provide the knowledge and expertise to become a proficient data scientist. 2. Demonstrate an understanding of statistics and machine learning concepts thatare vital for data science. 3. Produce Python code to statistically analyse a dataset. 4. Critically evaluate data visualizations based on their design and use forcommunicating stories from data.					
Course Outcomes	After completion of course, students would be able: 1. To explain how data is collected, managed and stored for data science. 2. To understand the key concepts in data science, including their real-worldapplications and the toolkit used by data scientists. 3. To implement data collection and management scripts using MongoDB.					

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	2	1												
CO 2		2	2		3		2								
CO 3				2	2	3		3							

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	Introduction to Data Science, Different Sectors using Data science, Purpose and Components of Python in Data Science.	7
II	Data Analytics Process, Knowledge Check, Exploratory Data Analysis (EDA), EDA- Quantitative technique, EDA- Graphical Technique, Data Analytics Conclusion and Predictions.).	7
III	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	9
IV	Data Visualization- Basic principles, ideas and tools for data visualization, Examples of inspiring (industry) projects- Exercise: create your own visualization of a complex dataset.	9
V	Applications of Data Science, Data Science and Ethical Issues- Discussions on privacy, security, ethics- A look back at Data Science- Next-generation data scientists.	7
	Text Books	
i	Business Analytics: The Science of Data - Driven Decision Making, U Dinesh Kumar, John Wiley & Sons.	
ii	Introducing Data Science: Big Data, Machine Learning, and More, Using Python Tools, Davy Cielen, John Wiley & Sons.	
	Reference Books	
i	Joel Grus, Data Science from Scratch, Shroff Publisher/O'Reilly Publisher Media	
ii	Annalyn Ng, Kenneth Soo, Numsense! Data Science for the Layman, Shroff Publisher Publisher	
iii	Cathy O'Neil and Rachel Schutt. Doing Data Science, Straight Talk from The Frontline. O'Reilly Publisher.	
iv	Jure Leskovek, Anand Rajaraman and Jeffrey Ullman. Mining of Massive Datasets. v2.1, Cambridge University Press.	
v	Jake VanderPlas, Python Data Science Handbook, Shroff Publisher/O'Reilly Publisher Media.	
vi	Philipp Janert, Data Analysis with Open Source Tools, Shroff Publisher/O'Reilly Publisher Media.	
	Lab work	
i	Python Environment setup and Essentials.	
ii	Mathematical computing with Python (NumPy).	
iii	Scientific Computing with Python (SciPy).	
iv	Data Manipulation with Pandas.	
v	Prediction using Scikit-Learn	
vi	Data Visualization in python using matplotlib	
	Assessment	
	a) ISE has a total weightage of 30 marks which is a (20+10) marks pattern. Theory paper examination	

	will be conducted at central level for 20 marks. **10 marks will be given based on the assignments of lab work.** It consists of assignments, quiz, seminars, presentations, research papers and research articles, developing working models, surveys and activities related to course as designed by the course coordinator to suit the needs of the course and to complement program outcomes. The practical work and its journal is not part of course work. b) ESE will be conducted at central level at the end of the semester. It will be theory paper for 100 Marks and then it will be scaled down for 70 marks.

Year, Program, Semester	Specialization Minor I, 4th Semester onwards				
Course Code	SPM 3.2				
Course Category	Specialization Minor Program Core				
Course title	**Introduction to AI and ML**				
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**	**Total Credits**
	03	-	-	03	03
Evaluation Scheme	**ISE**	**ESE**	**IE**	**EE**	**Total**
	40	60	00	00	100
Pre-requisites(if any)	Database, networking, Basic Mathematics				
Course Objectives	The Course is aimed to- 1. Understand basics of machine learning in data science. 2. Understand various basic machine learning algorithm that can be used with various type of data.				
Course Outcomes	After completion of course, students would be able: 1. To explain how data is collected, managed and stored for data science. 2. To use various type of Machine learning model. 3. To implement various ML algorithms on data models.				

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	2	1												
CO 2				2	2										
CO 3					2	2	2								

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	Linear Regression: Basic facts of linear regression, implementation of linear regression, case studies of linear regression using data set.	6
II	Logistic Regression: Basic facts and implementation of logistic regression, solve a case study to predict output using existing data set.	8
III	Clustering and Principle Component Analysis: K means and hierarchical clustering, how to make market strategies using clustering, recommendation and PCA	9
IV	Support Vector Machine: basics of SVM and use it to detect the spam emails and recognize alphabets.	8
V	Model Selection and advanced regression: use of Lasso and Ridge	8
Text Books		
i	Machine Learning using Python , U Dinesh Kumar and Manaranjan Pradhan, John Wiley & Sons.	
ii	Advanced Data Analytics Using Python: With Machine Learning, Deep Learning by By Sayan Mukhopadhyay, Apress.	
iii	Practical Data Mining" by Monte F. Hancock, Auerbach Publication.	
iv	"Machine Learning for Absolute Beginners: A Plain English Introduction (Second Edition)" by Oliver Theobald.	
Reference Books		
i	Practical Data Science with R, Nina Zumel, John Wiley & Sons	
ii	Python for Data Science for Dummies, John Paul Mueller, Luca Massaron, John Wiley	
iii	Big Data and Analytics, Seema Acharya and Subhashini Chellappan, Wiley Publication.	
Lab work		
i	Use python to predict employee attrition in a firm and help them plan their manpower. (take data set from kaggle).	
ii	Create customer clusters using different market strategies on a data set.	
iii	Make a movie recommendation system.	
iv	Develop a prediction mechanism to predict which employee can go on leave in a company in near future.	
v	Recognizing alphabets using SVM.	
Assessment		
	a) ISE has a total weightage of 30 marks which is a (20+10) marks pattern. Theory paper examination will be conducted at central level for 20 marks. **10 marks will be given based on the assignments of lab work.** It consists of assignments, quiz, seminars, presentations, research papers and research articles, developing working models, surveys and activities related to course as designed by the course coordinator to suit the needs of the course and to complement program outcomes. The practical work and its journal is not part of course work.	

	b) ESE will be conducted at central level at the end of the semester. It will be theory paper for 100 Marks and then it will be scaled down for 70 marks.

Year, Program, Semester	Specialization Minor I, 4th Semester onwards					
Course Code	SPM 3.3					
Course Category	Specialization Minor Program Core					
Course title	**Computational Data Analytics**					
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**
	03	-	-	03		03
Evaluation Scheme	**ISE**		**ESE**	**IE**	**EE**	**Total**
	40		60	00	00	100
Pre-requisites(if any)	Introduction to Data Science, Introduction to AI and ML					
Course Objectives	The Course is aimed to- 1. Learn how to think about your study system and research question of interest in asystematic way in order to design an efficient sampling and experimental research program. 2. Understand how to analyze collected data to derive the most information possibleabout your research questions.					
Course Outcomes	Upon completion of this course, student should be able to – 1. Explain how data is collected, managed and stored for data science 2. When to use which type of Machine learning model. 3. Implement various ML algorithms on data models.					

Course Outcome and Program Outcome Mapping

	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO 1	1	2	1												
CO 2				2	2										
CO 3					2	2	2								

Level of Mapping as: Low 1, Moderate 2, High 3

Unit No.	Course Content	Hours
I	Introduction to R Computing language. Best practices in executing Reproducible Research in data science, Sampling and Simulation. Descriptive statistics, and the creation of good observational sampling designs.	6
II	Data visualization, Data import and visualization, Introduction to various plots.	8
III	Frequentist Hypothesis Testing, Z-Tests, Power Analysis	8
IV	Linear regression, diagnostics, visualization, Likelihoodist Inference, Fitting a line with Likelihood, Model Selection with one predictor	9
V	Bayesian Inference, Fitting a line with Bayesian techniques, Multiple Regression and Interaction Effects, Information Theoretic Approaches	8
Text Books		
i	Practical Data Science with R, Nina Zumel, John Wiley & Sons.	
ii	N. C. Das, Experimental Designs in Data Science with Least Resources, Shroff Publisher Publisher..	
Reference Books		
i	Hadley Wickham, Garret Grolemund, R for Data Science, Shroff Publisher/O'Reilly Publisher Publisher	
ii	Benjamin M. Bolker. Ecological Models and Data in R. Princeton University Press, 2008. ISBN 978-0-691-12522-0.	
iii	John Fox and Sanford Weisberg. An R Companion to Applied Regression. Sage Publications, Thousand Oaks, CA, USA, second edition, 2011. ISBN 978-1-4129-7514-8.	
Lab work		
i	To give a basic insight of R and its various libraries.	
ii	Libraries in R. R as a Data Importing Tool, Dplyr. Forcats.	
iii	Simulation and Frequentist Hypothesis testing, Simulation and Power.	
iv	Bayesian computation in R, Fitting a line with Bayesian techniques.	
Assessment		
	a) ISE has a total weightage of 30 marks which is a (20+10) marks pattern. Theory paper examination will be conducted at central level for 20 marks. **10 marks will be given based on the assignments of lab work.** It consists of assignments, quiz, seminars, presentations, research papers and research articles, developing working models, surveys and activities related to course as designed by the course coordinator to suit the needs of the course and to complement program outcomes. The practical work and its journal is not part of course work. b) ESE will be conducted at central level at the end of the semester. It will be theory paper for 100 Marks and then it will be scaled down for 70 marks.	

Year, Program, Semester	Specialization Minor I, 4th Semester onwards						
Course Code	SPM 3.4						
Course Category	Specialization Minor Based Internship						
Course Title	**Data Science Related Internship**						
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**	
	One Month					03	
Evaluation Scheme	**ISE**	**ESE**	**IOE**	**IPE**	**EOE**	**EPE**	**Total**
	00	00	50	-	50	-	100
Pre-requisites(if any)	Basics of unit processes and unit operations.						
Course Rationale	The Industrial Internship course caters specifically to B.Tech Computer Science and Technology students pursuing additional specialization through the B.Tech Minor program in areas such as Cyber Security. This course offers practical exposure to industry settings aligned with their chosen sub-specialization, aiming to bridge the gap between theoretical knowledge and practical application. By engaging in a one-month internship, students gain firsthand experience, essential skills, and insights crucial for their future careers in specialized sectors of Computer Science and Technology.						
Course Objectives	The course teacher will 1. Help expose students to the 'real' working environment; 2. Promote hands-on experience to the students' in their related field; 3. Develop synergetic collaboration between industry and the university in promoting a knowledgeable society; 4. Assist in providing the opportunity for students to test their interest in a particular career before permanent commitments are made. 5. Elaborate the dynamic and challenging nature of industrial environments.						
Course Outcomes	Upon completion of this course, student should be able to 1. Understand industrial processes and operations related to their minor sub-specializations. 2. Apply theoretical concepts to solve practical problems in the industry. 3. Communicate effectively with industry professionals, colleagues, and supervisors. 4. Collaborate efficiently in team environments to complete tasks and projects. 5. Adapt to the dynamic and challenging nature of industrial environments. 6. Reflect on internship experiences for personal and professional growth.						

Course Outcome and Program Outcome Mapping

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	-	-	-	-	-	-	-	-	-	-	-
CO 2	-	3	2	-	-	-	-	-	-	-	-	-
CO 3	-	-	-	-	-	-	-	-	-	3	-	-
CO 4	-	-	-	-	-	-	-	-	3	-	-	-
CO 5	-	-	-	-	-	2	-	-	-	-	-	3
CO 6	-	-	-	-	-	-	-	-	-	-	-	2

Level of Mapping as: Low 1, Moderate 2, High 3

Course Content	Hours
The course consists of a one-month internship with respect to Cyber Security. Students will be placed in companies or organizations that align with the particular requirement. During the internship, students will engage in various activities, including but not limited to: 1. Shadowing industry professionals to observe and learn about different processes and operations. 2. Assisting with ongoing projects or research initiatives within the organization. 3. Participating in hands-on tasks related to their minor sub-specialization, under the guidance of experienced mentors. 4. Attending training sessions, workshops, and seminars conducted by the industry to enhance their knowledge and skills. 5. Engaging in discussions and meetings with supervisors and colleagues to gain insights into industry practices, challenges, and innovations. 6. Documenting their internship experience through reports, presentations, or reflective journals. The period of one month for this internship will be during the winter or summer vacations, any such slots 4th Semester onwards.	4 weeks

Course Evaluation Method

This particular evaluation will be the part of the structure of 7th Semester.
The evaluation for the Industrial Internship course will be conducted as follows:

- **Internal Evaluation (50 marks):**
    - Assessment by course teachers based on students' performance during the internship, including attendance, participation, attitude, and contribution to assigned tasks.
    - Evaluation by industrial supervisors on students' professional conduct, technical skills, problem-solving abilities, and overall performance in the workplace.
- **External Evaluation (50 marks):**
    - Evaluation by an external examiner appointed by the institute, who will assess students' internship reports, presentations, or any other documentation submitted at the end of the internship period.
    - The external examiner will review the quality of students' reflections on their internship experience, their ability to apply theoretical knowledge to practical situations, and the depth of their understanding of industry practices and challenges.

The final grades for the Industrial Internship course will be determined based on the combined assessment from both internal and external evaluations.

Year, Program, Semester	Specialization Minor I, 4th Semester onwards						
Course Code	SPM 2.5						
Course Category	Project Based Learning						
Course Title	**Mini Project**						
Teaching Scheme and Credits	**L**	**T**	**P**	**Total Contact Hours**		**Total Credits**	
	-	-	-	-		02	
Evaluation Scheme	**ISE**	**ESE**	**IOE**	**IPE**	**EOE**	**EPE**	**Total**
	00	00	50	-	50	-	100
Pre-requisites(if any)	Basics of Computers and programming						
Course Rationale	This course aims to provide students with practical exposure and hands-on experience in real-world industrial settings, fostering a deeper understanding of theoretical concepts through application. By engaging in this field project, students will develop essential skills such as problem-solving, teamwork, and communication, preparing them for future challenges in the professional arena .						
Course Objectives	The course teacher will 1. Facilitate application of theoretical knowledge. 2. Guide the students about enhancement of practical skills. 3. Explain about development of industry-relevant competencies.						
Course Outcomes	Upon completion of this course, student should be able to 1. Demonstrate application of theoretical concepts with instructor guidance. 2. Collaborate effectively in instructor-led team-based projects. 3. Communicate findings and insights professionally under instructor supervision.						

Course Outcome and Program Outcome Mapping

CO/PO	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12
CO 1	3	2	-	-	2	-	-	-	2	-	-	-
CO 2	-	-	3	-	-	-	-	-	3	-	2	1
CO 3	-	-	-	-	-	-	-	-	-	3	-	2

Level of Mapping as: Low 1, Moderate 2, High 3

Course Content

Specialization Minor Program Based Mini Project is a dynamic course designed to bridge the gap between classroom learning and real-world application. All the students will engage themselves in a series of tasks and challenge that will enable them to apply theoretical concepts learned in previous courses to solve practical problems. The project work need to be carried out independently covering a range of topics relevant to their field of study, allowing them to explore different facets of the particular discipline and develop versatile skill sets with respect to application of AI & ML.

This activity may be planned after 4th Semester and can be completed prior to 8th Semester of their Major studies.

Course Assessment Process

This particular evaluation will be the part of 8th Semester of the major structure.

The course evaluation for the internals will be at the course teacher end while there will also be the external evaluation of the Project work.

The teachers will follow the instructions as below:

Evaluation Format: The evaluation may be conducted using a combination of assessment methods, including:
• Rubric-based assessment for the project work and its report.
• Peer evaluation for project.
• Instructor-led discussions or presentations to evaluate communication skills and critical thinking.
• Overall course grading based on a weighted average of individual assessments and participation.
The evaluation format should be transparent, fair, and aligned with the course objectives and outcomes. Regular feedback and communication with students will ensure that the evaluation process remains supportive of their learning journey.