PG PROGRAMME

MASTERS OF TECHNOLOGY MANAGEMENT (MTM)

REGULATIONS 2024

CURRICULUM AND SYLLABUS

I - IV Semester

Department of Textile Technology

KUMARAGURU COLLEGE OF TECHNOLOGY

COIMBATORE

MASTERS OF TECHNOLOGY MANAGEMENT

Program Educational Objectives (PEO)

At the end of the program

PEO 1: Graduates shall become management professionals with the ability to plan, evaluate, deploy, and manage emerging technologies.

PEO 2: Graduates shall be able to lead technology teams in an organisation to create business value with rigorous execution capabilities.

PEO 3 Graduates shall become professionals in leading research and innovation initiatives in academia, government & industry.

Program Outcomes (PO)

Upon completion of the Master of Technology Management program, the student will be able to:

PO 1: Independently carry out research / investigation and work to solve practical problems.

PO 2: Write and present a substantial technical report / document.

PO 3: Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.

PO 4: Apply their capabilities acquired in technology management to identify and integrate business solutions that would enhance internal efficiency and external market growth across various sectors.

PO 5: Adapt and work efficiently with multidisciplinary teams across various organizational levels.

PO 6: Exhibit an ethical and responsible behaviours in all business decisions throughout their life.

KUMARAGURU COLLEGE OF TECHNOLOGY, COIMBATORE – 641 049

REGULATIONS 2024

Master of Technology Management (MTM)

CURRICULUM AND SYLLABUS

SEMESTER I							
Course Code	**Course Title**	**Course Mode**	**L**	**T**	**P**	**J**	**C**
24TMT501	Technology Innovation And Management	Theory	4	0	0	0	4
24TMT502	Advanced Digital Production Technologies	Theory	4	0	0	0	4
24TMT503	Lean Manufacturing	Theory	3	0	0	0	3
24TMT504	Business Communication	Theory	2	0	0	0	2
24TMI505	Rapid Prototyping Techniques	Embedded	1	0	6	0	4
24TMI506	Data Analysis Using Excel	Embedded	1	0	4	0	3
Total Credits							**20**
Total Hours per week							**25**

SEMESTER-II							
Course Code	**Course Title**	**Course Mode**	**L**	**T**	**P**	**J**	**C**
24TMT507	Manufacturing Analytics	Theory	3	0	0	0	3
24TMT508	Strategic Leadership	Theory	3	0	0	0	3
24TME__	Professional Elective - 1	Theory	3	0	0	0	3
24TMC__	Specialisation Elective - 1	Embedded	1	0	4	0	3
24TMI511	Manufacturing Analytics Lab	Embedded	1	0	4	0	3
24TMJ512	Future Factories Launchpad - Discover Phase	Project	0	0	0	8	4
Total Credits							**19**
Total Hours per week							**27**

SEMESTER-III							
Course code	**Course Title**	**Course Mode**	**L**	**T**	**P**	**J**	**C**
24TME__	Professional Elective - 2	Theory	3	0	0	0	3
24TME__	Professional Elective - 3	Theory	3	0	0	0	3
24TMC__	Specialisation Elective - 2	Embedded	1	0	4	0	3
24TMJ513	Industry Immersion	Project	0	0	0	4	2
24TMJ514	Future Factories Launchpad - Design Phase	Project	0	0	0	20	10
Total credits							**21**
Total Hours per week							**35**

SEMESTER-IV							
Course code	**Course Title**	**Course Mode**	**L**	**T**	**P**	**J**	**C**
24TMC__	Specialisation Elective - 3	Embedded	1	0	6	0	4
24TMJ515	Future Factories Launchpad - Develop Phase	Project	0	0	0	32	16
Total credits							**20**
Total Hours per week							**39**
Grand Total Credits							**80**

Course Code	List of Electives
Specialisation Elective	
24TMC001	Industrial IoT Essentials
24TMC002	Industrial IoT Design And Development
24TMC003	Advanced Industrial IoT Applications
24TMC004	Industrial Automation And Robotics Fundamentals
24TMC005	Industrial Automation Control Systems And Programming
24TMC006	Advanced Industrial Automation System Design And Integration
Professional Elective	
24TME001	Finance For Engineers
24TME002	Supply Chain Management
24TME003	New Product Strategies
24TME004	Artificial Intelligence
24TME005	Block Chain Technology
24TME006	Industrial Sustainability
24TME007	Supply Chain And Procurement Sustainability
24TME008	Textile Sustainability And Innovaton
24TME009	Circular Economy For Enterprise Innovation
24TME010	Industrial Design & Development
24TME011	Project Management

Semester I

24TMT501	Technology Innovation & Management	L	T	P	J	C
		4	0	0	0	4
Professional Core		SDG	4, 8 & 9			

Pre-requisite courses	NA	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	Understand the Fundamentals of Technology Innovation
2	Master Technology Readiness Levels (TRLs) and Innovation Metrics
3	Explore Digital Transformation in Industry
4	Apply Principles of Product Management and Innovation Frameworks
5	Develop Comprehensive Innovation Strategies

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Develop strategies for managing technology innovation within industrial settings	Ap
CO 2	Assess and manage technology readiness levels (TRLs) and development progress indicators	An
CO 3	Analyze the design principles and patterns used in product design and assess the suitability of different prototyping methods for specific design challenges.	An
CO 4	Apply product management principles to technology-driven projects	Ap
CO 5	Create an end-to-end innovation management project through the Forge Innovation Handbook	C

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research/investigation and work to solve practical problems.	Write and present a substantial technical report/document.	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.	Apply their capabilities acquired in technology management to identify and integrate business solutions that would enhance internal efficiency and external market growth across various sectors.	Adapt and work efficiently with multidisciplinary teams across various organizational levels.	Exhibit an ethical and responsible behaviours in all business decisions throughout their life.
1				3	2	
2			2	3		
3				3	2	
4	2	3		3	2	
5	2	3		3	2	

Course Content

INTRODUCTION TO TECHNOLOGY INNOVATION MANAGEMENT Fundamentals of Technology Innovation - Differentiation between innovation types: disruptive, incremental, and radical innovation - Role of innovation in competitive advantage and market positioning - Closed innovation: internal R&D, proprietary technologies - Open innovation: collaboration with external partners, crowdsourcing, and knowledge sharing - Stages of the technology life cycle - Diffusion of innovations theory - Factors influencing the adoption and diffusion of new technologies in industrial settings	**12 Hours**
TECHNOLOGY READINESS LEVELS AND PROJECT MANAGEMENT Technology Maturity Assessment using TRL, Application of TRLs in industry to guide decision-making and resource allocation, Techniques for advancing technologies through different TRLs, Challenges and considerations at each TRL stage - Stakeholder engagement and risk management across the TRL spectrum - Key performance indicators (KPIs) for tracking the progress of technology development - Methods for measuring Innovation Outcomes, Time-to-market, ROI, User Adoption - Tools for monitoring and reporting project progress - Project management methodologies suited for innovation projects - Analysis of real-world projects	**15 Hours**
DIGITAL TRANSFORMATION & INDUSTRIAL INNOVATION Overview of digital transformation and its impact on industries - Key drivers of digital transformation - The role of leadership and culture in driving successful digital transformation - Key Technologies Driving Industrial Innovation: IoT, AI,	**15 Hours**

Big Data - Frameworks and methodologies for managing digital transformation initiatives - Strategies for aligning organizational structure, culture, and processes with digital goals - Role of training and development in building a digitally capable workforce - Case Studies	
PRODUCT MANAGEMENT & FORGE INNOVATION HANDBOOK(FIH) IN TECHNOLOGY INNOVATION Product Management Fundamentals - Technology Roadmapping and Portfolio Management - Product Lifecycle Management in Technology Innovation - Introduction to Forge Innovation Handbook: Product Innovation Hypothesis, Forge Innovation Rubric, Problem Validation and Customer Discovery, Challenge Brief, Value Proposition Canvas, Minimum Usable Product Concept Generation & Assessment - Intellectual Property Rights (IPR) in Product Management - Case Studies	**18 Hours**

Theory Hours:	**60**	**Tutorial Hours:**	**Practical Hours:**	**Project Hours:**	**Total Hours:** **60**

Learning Resources
Textbooks:
1. "Managing Innovation: Integrating Technological, Market, and Organizational Change" by Joe Tidd, John Bessant 2. "The Innovator's Dilemma: When New Technologies Cause Great Firms to Fail" by Clayton M. Christensen 3. "Technology Management: Activities and Tools" by Norma Harrison, Danny Samson 4. "Digital Transformation: Survive and Thrive in an Era of Mass Extinction" by Thomas M. Siebel
References:
1. Product Management Approach https://www.idex.gov.in/sites/default/files/2020-11/PMA_Guidelines_IDEX.pdf 2. Forge Innovation Handbook
Online Educational Resources:
1.https://www.coursera.org/learn/innovation-management

Assessment
• CAT • End Semester Examination (ESE)

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Jagadeesh B, Sr. Manager, Ashok Leyland	Dr. Mani Bharathi, Professor, GCE Salem		Aravind A, Specialist, Forge
Recommended by BoS on	14/08/2024		
Academic Council Approval	No.27	**Date**	24.08.2024

24TMT502	Advanced Digital Production Technologies	L	T	P	J	C
		4	0	0	0	4
Professional Core		SDG	4, 8 & 9			

Pre-requisite courses	NA	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	Understand and Apply Key Digital Production Technologies
2	Implement Industry 4.0 Concepts with the ADP Framework
3	Analyze and Optimize Production Using Digital Twins and Simulation Tools
4	Evaluate the Impact of Additive Manufacturing and Robotics
5	Develop and Manage Digital Production Projects for Sustainability

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Understand and apply key digital production technologies in alignment with global industrial development trends	Ap
CO 2	Implement Industry 4.0 concepts as per the UNIDO Advanced Digital Production (ADP) framework	Ap
CO 3	Analyze and optimize production processes using digital twins, advanced simulation tools, and ADP technologies	An
CO 4	Evaluate the impact of additive manufacturing and robotics on production efficiency, flexibility, and sustainability	E
CO 5	Develop and manage digital production projects, integrating ADP technologies for sustainable industrial growth	C

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research/investigation and work to solve practical problems.	Write and present a substantial technical report/document.	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.	Apply their capabilities acquired in technology management to identify and integrate business solutions that would enhance internal efficiency and external market growth across various sectors.	Adapt and work efficiently with multidisciplinary teams across various organizational levels.	Exhibit an ethical and responsible behaviours in all business decisions throughout their life.
1				3	2	

2			2	3	2	
3	2	2		3		
4	2		2	3		
5	3	2		3		

Course Content	
INTRODUCTION TO DIGITAL PRODUCTION TECHNOLOGIES Definition and scope of digital production technologies in modern manufacturing - Historical evolution from traditional to digital production - The role of digitalization in enhancing productivity, quality, and sustainability within the context of UNIDO's ADP framework - Introduction to Industry 4.0 and its core components - Understanding the UNIDO ADP framework: Strategic objectives, industrial policy implications, and global benchmarks - Global Trends in Digital Production and UNIDO's Role	**12 Hours**
ADVANCED MANUFACTURING SYSTEMS IN THE ADP FRAMEWORK Cyber-Physical Systems (CPS) in Manufacturing - Integration of physical processes with computational models and digital controls for enhanced production efficiency - Internet of Things (IoT) in Production - Use of IoT for real-time data collection, analysis, and decision-making, emphasizing sustainable production goals - Implementation strategies for IoT in production settings - Automation and Robotics in Digital Production - Case studies	**15 Hours**
DIGITAL TWIN & SIMULATION TECHNOLOGIES IN THE ADP FRAMEWORK Overview of digital transformation and its impact on industries - Key drivers of digital transformation - The role of leadership and culture in driving successful digital transformation - Key Technologies Driving Industrial Innovation: IoT, AI, Big Data - Frameworks and methodologies for managing digital transformation initiatives - Strategies for aligning organizational structure, culture, and processes with digital goals - Role of training and development in building a digitally capable workforce - Case Studies	**15 Hours**
ADDITIVE MANUFACTURING & ADVANCED MATERIALS IN THE ADP FRAMEWORK Overview of additive manufacturing technologies: FDM, SLS, SLA, and others - Applications of AM in prototyping, tooling, and end-use parts production - Advantages and limitations of AM - Introduction to advanced materials used in digital manufacturing, such as composites, metals, and polymers - Strategies for integrating AM technologies into existing production workflows - Use of AM for mass customization and on-demand production - Case studies - Digital Production Implementation within the ADP Framework	**18 Hours**

Theory Hours:	**60**	**Tutorial Hours:**	**Practical Hours:**	**Project Hours:**	**Total Hours:**	**60**

Learning Resources

Textbooks:

1. "Industry 4.0: The Industrial Internet of Things" by Alasdair Gilchrist
2. "Digital Twin: Mitigating Unpredictable, Undesirable Emergent Behavior in Complex Systems" by John Vickers
3. "Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing" by Ian Gibson, David Rosen, Brent Stucker
4. "Smart Manufacturing: Concepts and Methods" by Masoud Soroush

References:

1. UNIDO Industrial Development Report 2020: Industrializing in the Digital Age (UNIDO Website)

Online Educational Resources:

1. https://www.twi-global.com/technical-knowledge/faqs/what-is-additive-manufacturing
2. https://online.stanford.edu/courses/xee100-introduction-internet-things

Assessment

- CAT
- End Semester Examination (ESE)

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Sankar S, Dy-Manager, Ashok Layland	Dr D Jebakani, Professor, GCE Tirunelveli	Aritro Gosh, Forge
Recommended by BoS on	14/08/2024	
Academic Council Approval	No.27	**Date** 24.08.2024

24TMT503	Lean Manufacturing	L	T	P	J	C
		3	0	0	0	3
Professional Core		SDG	4, 8 & 9			

Pre-requisite courses	NA	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	Understand Lean Manufacturing Principles and Methodologies
2	Apply Lean Tools to Eliminate Waste and Improve Processes
3	Analyze Manufacturing Processes and Develop Solutions Using Lean Techniques
4	Evaluate the Effectiveness of Lean Initiatives and Recommend Improvements
5	Lead Lean Transformation Projects for Operational Excellence

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Understand the Lean Manufacturing principles, tools, and methodologies, including Value Stream Mapping, 5S, and Six Sigma.	U
CO 2	Apply Lean tools and techniques to identify and eliminate waste in real-world manufacturing processes, using methodologies like DMAIC and Kaizen.	Ap
CO 3	Analyze manufacturing processes, identify root causes of problems, and develop effective solutions using tools	An
CO 4	Critically evaluate the effectiveness of Lean initiatives and recommend improvements based on data-driven analysis.	E
CO 5	Lead and implement Lean transformation projects within an organization, demonstrating the ability to apply Lean principles to achieve operational excellence.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research/investigation and work to solve practical problems.	Write and present a substantial technical report/document.	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.	Apply their capabilities acquired in technology management to identify and integrate business solutions that would enhance internal efficiency and external market growth across various sectors.	Adapt and work efficiently with multidisciplinary teams across various organizational levels.	Exhibit an ethical and responsible behaviours in all business decisions throughout their life.
1				2	3	
2				3	2	
3	3			2		
4	2			3		
5	2	2			3	

Course Content

INTRODUCTION TO LEAN MANUFACTURING Definition and scope of digital production technologies in modern manufacturing - Historical evolution from traditional to digital production - The role of digitalization in enhancing productivity, quality, and sustainability within the context of UNIDO's ADP framework - Introduction to Industry 4.0 and its core components - Understanding the UNIDO ADP framework: Strategic objectives, industrial policy implications, and global benchmarks - Global Trends in Digital Production and UNIDO's Role	**9 Hours**
LEAN TOOLS Improvement Philosophies and Methodologies - Principles of Lean - Components of Lean - Getting Customer Focus – Understand Value - Understand the High-Level Process Flow (SIPOC) - Map the Value Stream - Improve Flow - Create Pull - MUDA, MURI and MURA Manufacturing Case Study	**9 Hours**
DMAIC APPROACH Introduction to DMAIC phases and approach, Define: Problem definition, improvement activity, opportunity for improvement, project goals, customer (internal and external) requirements, Measure: Parameter(s) considered to measure process performance, Analyse: Determination of root causes of variation or poor performance, Improve: Improvement in the process performance by addressing the root causes, Control: Process monitoring and control	**9 Hours**
OVERVIEW OF SIX SIGMA	**18 Hours**

Introduction to Six Sigma, Understanding Six Sigma, Implementing Lean Six Sigma - KAIZEN methodology - DMAIC Methodology - Define Phase: CTQ, Project Charter, Milestone, SIPOC, QFD Chart, Value Stream Map, Process Flow Diagram, Measure Phase: Ishikawa Diagram, Root cause analysis, Data Collection, Sigma Level Calculation, Analyze Phase: Statistical Hypothesis Testing for Mean, Variance and Proportions, Dealing with non-normal data, Regression Analysis, FMEA, Improve and Control Phase**:** SPC, Kaizen and Mistake Proofing	

Theory Hours: 45	**Tutorial Hours:**	**Practical Hours:**	**Project Hours:**	**Total Hours: 45**

Learning Resources

Textbooks:

1. Agile Project Management For Dummies Paperback – 4 May 2012 by Mark C. Layton
2. Agile Estimating and Planning (Robert C. Martin) Paperback – Illustrated, 1 November 2005 by Mike Cohn
3. Scrum Mastery: From Good to Great Servant Leadership Paperback – 1 June 2013 by Geoff Watts

References:

1. Lean Manufacturing In The Developing World - Garcia-Alcaraz - SPRINGER - April 2014

Online Educational Resources:

1. https://herovired.com/learning-hub/blogs/lean-manufacturing/
2. https://leansmarts.com/lean-101/

Assessment

- CAT
- End Semester Examination (ESE)

Course Curated by

Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**
Sankar S, Dy-Manager, Ashok Layland	Dr D Jebakani, Professor, GCE Tirunelveli	Dr Lakshmi Meera, VP, Forge
Recommended by BoS on	14/08/2024	
Academic Council Approval	No.27	**Date** 24.08.2024

24TMT504	Business Communication	L	T	P	J	C
		2	0	0	0	2
Professional Core		SDG	4, 8 & 9			

Pre-requisite courses	NA	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	Effective Communication Principles in Business Contexts
2	Adapting Communication Styles for Technical and Non-Technical Audiences
3	Professional Business Document Production and Writing Skills
4	Strategic Communication of Technology Initiatives
5	Advocacy for Industry 4.0 Concepts Using Data-Driven Narratives

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Apply principles of effective communication in business contexts.	Ap
CO 2	Adapt communication styles for technical and non-technical audiences.	Ap
CO 3	Produce professional business documents with proficient writing skills.	Ap
CO 4	Communicate technology initiatives strategically to align with business goals.	Ap
CO 5	Explain and advocate for Industry 4.0 concepts, using data-driven narratives to support organisational transformation and technological adoption	An

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research/investigation and work to solve practical problems.	Write and present a substantial technical report/document.	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.	Apply their capabilities acquired in technology management to identify and integrate business solutions that would enhance internal efficiency and external market growth across various sectors.	Adapt and work efficiently with multidisciplinary teams across various organizational levels.	Exhibit an ethical and responsible behaviours in all business decisions throughout their life.
1		2			2	3

2		2			3	
3		3			3	2
4		2			2	3
5		2			3	

Course Content	
FOUNDATION OF BUSINESS COMMUNICATION The importance of effective communication - Communication models and barriers - Qualities of Good Communication - Understanding communication styles and adapting your approach (technical vs. non-technical) - The 7Cs of Communication - Communication in different contexts - Your responsibilities as a communicator - Principles of verbal communication - Getting to Know Your Audience - Listening and Reading for Understanding - Group discussion on effective communication strategies	**8 Hours**
EFFECTIVE BUSINESS WRITING Effective Business Writing - Oral versus Written Communication - How Is Writing Learned? Good Writing - Style in Written Communication - Principles of Written Communication - Overcoming Barriers to Effective Written Communication - Ethics, Plagiarism, and Reliable Sources - Reading and Analyzing - Evaluating the Work of Others - Proofreading and Design Evaluation - Business Writing Exercise - Text, E-mail, and Netiquette, Memorandums, Business Proposal, Report, Résumé, Sales Message, Case Study, Presentations	**12 Hours**
COMMUNICATION FOR TECHNOLOGY LEADERS Strategic communication for technology leaders: aligning technology initiatives with business goals - Communicating the value proposition of new technologies to stakeholders - Managing stakeholder expectations - Negotiation and persuasion techniques - Identifying and addressing stakeholder concerns - Developing win-win solutions - Effective communication for conflict resolution	**8 Hours**
INTRAPERSONAL & INTERPERSONAL BUSINESS COMMUNICATIONS Intrapersonal and Interpersonal Business Communications - Intrapersonal Communication Self-Concept and Dimensions of Self -Interpersonal Needs - Social Penetration Theory - Rituals of Conversation and Interviews - Conflict in the Work Environment - Crisis Communication Plan	**8 Hours**
COMMUNICATING INDUSTRY 4.0 Intrapersonal and Interpersonal Business Communications - Intrapersonal Communication Self-Concept and Dimensions of Self -Interpersonal Needs - Social Penetration Theory - Rituals of Conversation and Interviews - Conflict in the Work Environment - Crisis Communication Plan	**9 Hours**

Theory Hours: 45	Tutorial Hours:	Practical Hours:	Project Hours:	Total Hours: 45

Learning Resources
Textbooks:
1. Business Communication by Peter Hartley and Clive G. Bruckmann 2. Technical Writing for Success by Daniel Riordan 3. The Elements of Style by William Strunk Jr. and E.B. White 4. Crucial Conversations by Kerry Patterson, Joseph Grenny, Ron McMillan, and Al Switzler
References:
5. The Art of Negotiation: How to Get What You Want 6. Influence : The Psychology of Persuasion (New and Expanded) by PhD Robert B. Cialdini
Online Educational Resources:
1. https://www.tangolearn.com/best-business-communication-courses-online/ 2. https://www.edx.org/learn/business-communications 3. https://www.udemy.com/course/professional-communication-and-business-writing/?kw=Business+Communication+Skills%3A+Business+Writing+%26+Grammar&src=sac&couponCode=BFCPSALE24

Assessment
• CAT • End Semester Examination (ESE)

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
Velumani R.N, Head – Employee Relations, Ashok Leyland	Dr. Mani Bharathi, Professor, GCE Salem	Karthik Das, Sr Analyst, Forge	
Recommended by BoS on	14/08/2024		
Academic Council Approval	No.27	**Date**	24.08.2024

24TMI505	Rapid Prototyping Techniques	L	T	P	J	C
		1	0	6	0	4
Professional Core		SDG	4, 8 & 9			

Pre-requisite courses	NA	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	Understand the Fundamentals of Rapid Prototyping
2	Explore Various Prototyping Techniques
3	Master Digital Prototyping Tools and Methods
4	Apply Hardware Prototyping for Functional Development
5	Evaluate and Validate Prototypes Effectively

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Define rapid prototyping, its types, and its significance in the product development process.	U
CO 2	Discover various prototyping techniques, including low and high-fidelity prototypes, wireframing, and CAD modelling, to create functional prototypes.	Ap
CO 3	Analyze the design principles and patterns used in product design and assess the suitability of different prototyping methods for specific design challenges.	An
CO 4	Evaluate the effectiveness of prototypes through validation testing and analysis of metrics to inform design improvements.	E
CO 5	Create innovative product concepts and develop functional prototypes using a combination of digital and hardware prototyping techniques	C

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research/investigation and work to solve practical problems.	Write and present a substantial technical report/document.	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.	Apply their capabilities acquired in technology management to identify and integrate business solutions that would enhance internal efficiency and external market growth across various sectors.	Adapt and work efficiently with multidisciplinary teams across various organizational levels.	Exhibit an ethical and responsible behaviours in all business decisions throughout their life.
1				3	2	
2	2			3		
3	2			3	2	
4		2	2	3	2	
5		2	2	3	2	

Course Content

INTRODUCTION TO RAPID PROTOTYPING Prototyping Basics- The Prototyping: Why, What & How? Rapid Prototyping, Rapid Prototyping & Start-up's, Limits of Prototyping, Rapid Prototyping Steps, Rapid Prototyping Types, Intrapreneur Life Cycle & Prototype Practical: **Prototyping Basics:** ● Create a visual diagram outlining the steps of rapid prototyping and its types. ● Compare and contrast the benefits of rapid prototyping for startups versus established businesses through a short presentation. ● Analyze a given case study to identify the role of prototyping in the intrapreneur life cycle. **Prototyping Steps:** ● Develop a flowchart to represent the rapid prototyping process. ● Identify and document the limitations of prototyping using real-world product examples.	**2 Hours** **10 Hours**
PROTOTYPING TECHNIQUES Prototyping Techniques - Low fidelity prototype, High fidelity prototype, Paper Prototype & Examples, Wireframing & Tool based Prototype, Case Studies to showcase examples Practical:	**2 Hours**

Low and High-Fidelity Prototyping: ● Design a paper prototype for a simple product interface (e.g., a mobile app or website homepage). ● Create a wireframe for a digital application using a prototyping tool (e.g., Figma, Adobe XD). **Tool-Based Prototyping:** ● Develop a functional wireframe using digital tools and compare it to the paper prototype. ● Present a case study showcasing the transition from low-fidelity to high-fidelity prototyping.	**10 Hours**
DIGITAL PROTOTYPING Digital Prototyping - Conceptual Design, Interactive Design Tools, CAD Modelling & Tools foundations, Product Sketching, Additive Manufacturing, Design Principles and Patterns, Examples & Case Studies Practical: **Conceptual Design and Interactive Tools:** ● Sketch a product concept for a consumer device and refine it using CAD software. ● Simulate an interactive design for a product using prototyping software (e.g., Axure or Sketch). **Additive Manufacturing:** ● Use a 3D modelling tool to create a simple product design, such as a phone stand or keychain. ● Export the design for 3D printing and evaluate its usability.	**2 Hours** **10 Hours**
HARDWARE PROTOTYPING Hardware Prototyping- Introduction to EDA, Design & Simulation Tools, Architecture & Schematics basics, Introduction to Development Boards, Sensors, Actuators & Interfaces, Live Examples Practical: **Design and Simulation Tools:** ● Use an EDA tool (e.g., KiCAD, Eagle) to design a simple circuit for a hardware prototype. ● Simulate the functionality of the circuit using software before physical implementation. **Development Boards and Sensors:** ● Program a basic functionality (e.g., LED blink, temperature sensing) using a development board like Arduino or Raspberry Pi. ● Interface sensors and actuators with a development board to create a prototype for a basic IoT device	**2 Hours** **10 Hours**
PROTOTYPE VALIDATION Prototype Validation, Defining Metrics that Matter, Test plan, Validation experiments of Prototypes Practical:	**2 Hours** **10 Hours**

Validation Metrics and Experiments: ● Develop a validation test plan for a selected prototype, identifying key metrics to evaluate its success. ● Conduct validation experiments, document observations, and recommend improvements. **Data-Driven Feedback:** ● Create a report summarizing prototype performance based on user testing and validation experiments. ● Use feedback to refine the prototype and present the improved design.	

Theory Hours: 10	Tutorial Hours:	Practical Hours: 50	Project Hours:	Total Hours: 60

Learning Resources
Textbooks:
1. Rapid Prototyping and Manufacturing: Fundamentals of Stereolithography", by Paul F. Jacobs 2. Rapid Prototyping: 3D Printing and Additive Manufacturing Principles and Applications 5th ed by Chee Kai & K F Leong Chua 3. CAD and Rapid Prototyping for Product Design - 2014 by Douglas Bryden
Online Educational Resources:
1. https://www.coursera.org/specializations/rapid-prototyping-and-tooling 2. https://www.linkedin.com/learning/search?keywords=Rapid%20Prototyping%20for%20Product%20Design

Assessment
● Lab Workbook ● Viva-Voce ● End Semester Examination (ESE)

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
Jagadeesh B, Sr. Manager, Ashok Leyland	Dr S Supriya, Professor, GCE Tirunelveli	Abhishek C, Sr.Engineer, Forge	
Recommended by BoS on	14/08/2024		
Academic Council Approval	No.27	**Date**	24.08.2024

24TMI506	Data Analysis using Excel	L	T	P	J	C
		1	0	4	0	3
Professional Core		SDG		4, 8 & 9		

Pre-requisite courses	NA	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	Understand the basic concepts of spreadsheet software, data types, and cell referencing
2	Interpret and apply statistical functions in Excel to analyze data.
3	Utilize Excel functions to organize, clean, and manipulate data for analysis.
4	Analyze data using descriptive statistics and identify patterns and trends.
5	Evaluate the effectiveness of different data visualization techniques in communicating insights.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Apply key statistical terms and concepts, such as mean, median, mode, standard deviation, and correlation.	Ap
CO 2	Analyse the purpose and usage of various Excel functions, including statistical, logical, and text functions.	An
CO 3	Apply Excel functions to clean, transform, and analyze data.	Ap
CO 4	Interpret data visualizations and draw meaningful conclusions.	Ap
CO 5	Critically evaluate the quality and reliability of data and data sources.	E

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research/investigation and work to solve practical problems.	Write and present a substantial technical report/document.	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.	Apply their capabilities acquired in technology management to identify and integrate business solutions that would enhance internal efficiency and external market growth across various sectors.	Adapt and work efficiently with multidisciplinary teams across various organizational levels.	Exhibit an ethical and responsible behaviours in all business decisions throughout their life.
1	2			2	3	
2	2	2		2	3	
3	2			2	3	

4	2	2		2	3	2
5	2			2	3	2

Course Content

INTRODUCTION TO EXCEL FUNCTIONS Spreadsheet; Data Types - Statistical Functions in Excel; Cell referencing, Arrays – H Lookup - V Lookup; Index and Match; Pivot Table Practical: **1. Data Entry and Manipulation:** ○ Create a spreadsheet with sample data (e.g., sales data, student grades). ○ Practice using various data types (text, numbers, dates, formulas). ○ Calculate summary statistics and perform conditional operations by using basic Excel functions like SUM, AVERAGE, COUNT, and IF. **2. Advanced Excel Functions:** ○ Use VLOOKUP and INDEX-MATCH functions to retrieve data from different tables. ○ Create pivot tables to summarise and analyze large datasets. ○ Explore array formulas for complex calculations.	**2 Hours** **7 Hours**
METHODS OF DATA ANALYTICS Charts - Conditional Formatting - Softing - Filter - Excel functions for Data Analytics; LEN, TRIM, Functions to Organise Data, Financial Functions Practical: **3. Data Formatting and Visualization:** ○ Create different types of charts (e.g., bar, line, pie, scatter) to visualize data effectively. ○ Apply conditional formatting to highlight specific data points or trends. ○ Sort and filter data to extract relevant information. **4. Data Analysis Functions:** Use LEN, TRIM, and other functions to clean and organize data. ○ Apply financial functions like PMT, FV, and PV to calculate loan payments, future values, and present values.	**2 Hours** **10 Hours**
DESCRIPTIVE STATISTICS Measures of Central Tendency-Mean Median Mode; Measures of Position - Five number summary- Outliers; Measures of Dispersion-Standard Deviation - Variance – Range – Skewness-Kurtosis; Measures of Association - Covariance and Correlation Practical: **5. Central Tendency and Dispersion:** ○ Calculate the mean, median, mode, standard deviation, variance, range, skewness, and kurtosis for a given dataset. ○ Interpret the results and conclude the data distribution. **6. Outlier Detection and Handling:** ○ Identify outliers using statistical methods (e.g., Z-score, IQR).	**2 Hours** **10 Hours**

○ Discuss the impact of outliers on data analysis and explore strategies for handling them.	
DATA VISUALIZATION Summarizing Data and Crosstabs, Graphical representation of data; Dashboards - Sales, Management, Histograms Practical: **7. Dashboard Creation:** ○ Create a dashboard using various Excel tools to summarise and visualize key performance indicators (KPIs). ○ Choose appropriate chart types and formatting to communicate insights effectively. **8. Data Storytelling:** ○ Use storytelling techniques to convey data-driven insights compellingly and engagingly. ○ Create narratives that highlight key trends, patterns, and conclusions.	**2 Hours** **10 Hours**

Theory Hours: 8	Tutorial Hours: 0	Practical Hours: 37	Project Hours: 0	Total Hours:45

Learning Resources

Textbooks:

1. David M. Levine, David F. Stephan, Kathryn A. Szabat, "Statistics for Managers using Microsoft Excel", 8th Edition, Pearson, 2017

References:

1. David Ray Anderson, Dennis J. Sweeney, Thomas Arthur Williams, "Essentials of Statistics for Business and Economics",12/e, Cengage learning, 2018
2. Kirupa Priyadarsini, S. Jaisankar, A. Latha, B. Poongodi, "Business Statistics – Workbook using Excel", Trinity Press, New Delhi, 2017

Online Educational Resources:

1. Excel Practice - https://excel-practice-online.com/
2. Excel Training - https://support.microsoft.com/en-us/office/excel-video-training-9bc05390-e94c-46af-a5b3-d7c22f6990bb

Assessment

- Lab Workbook
- Viva-Voce
- End Semester Examination (ESE)

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institutions	Internal Expert(s)

Velumani R.N, Head – Employee Relations, Ashok Leyland	Dr. Mani Bharathi, Professor, GCE Salem	Dinesh S, Manager, Forge	
Recommended by BoS on	14/08/2024		
Academic Council Approval	No.27	**Date**	24.08.2024

Semester II

24TMT507	MANUFACTURING ANALYTICS	L	T	P	J	C
		3	0	0	0	3
Professional Core		SDG	4, 8 & 9			

Pre-requisite courses	NA	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	Provide foundational knowledge of Industry 4.0, Smart Manufacturing, and Digital Transformation, focusing on the Indian manufacturing landscape.
2	Explain data collection, processing, and storage methods relevant to manufacturing units in India, including MSMEs that operate on legacy systems.
3	Introduce predictive maintenance and asset performance analytics to optimize uptime and reduce machine failures, crucial for cost-sensitive industries.
4	Discuss process optimisation and quality analytics, emphasizing Indian challenges such as resource constraints, manual interventions, and compliance with national standards (e.g., BIS, ISO).
5	Highlight real-world implementation challenges such as digital adoption, workforce skill gaps, cybersecurity risks, and ROI measurement for Indian factories.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Understand Manufacturing Analytics Concepts – Comprehend the role of data-driven decision-making in improving efficiency, cost savings, and sustainability in Indian manufacturing.	U
CO 2	Evaluate Data Sources & Infrastructure – Identify key data sources (IoT, PLCs, MES, ERP) and determine suitable data storage strategies for Indian factories, including cloud and on-premise solutions.	Ev
CO 3	Apply Predictive Maintenance Strategies – Analyze and implement data-driven maintenance models to minimise breakdowns, extending machine life in cost-sensitive environments.	Ap
CO 4	Optimize Manufacturing Processes – Leverage analytics to enhance process quality, reduce defects, and improve efficiency in Indian SMEs and large-scale industries.	An

CO 5	Address Implementation Challenges – Assess digital transformation barriers in Indian manufacturing, including skill gaps, cultural resistance, and cybersecurity threats.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research/investigation and work to solve practical problems.	Write and present a substantial technical report/document.	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.	Apply their capabilities acquired in technology management to identify and integrate business solutions that would enhance internal efficiency and external market growth across various sectors.	Adapt and work efficiently with multidisciplinary teams across various organizational levels.	Exhibit an ethical and responsible behaviours in all business decisions throughout their life.
1	2			2	3	
2	2			3		
3		2		2	2	2
4			2	2	2	2
5	2			2	2	

Course Content	
Fundamentals of Manufacturing Analytics Introduction to Industry 4.0 and Smart Manufacturing - Role of data in modern manufacturing - Types and sources of manufacturing data (IoT, sensors, ERP, MES, SCADA) - Data collection, storage, and management strategies - Statistical process control (SPC) and Six Sigma basics	**9 Hours**
Predictive Maintenance & Asset Performance Analytics Importance of predictive maintenance in manufacturing - Machine learning models for failure prediction - Condition monitoring & anomaly detection techniques - Case studies on predictive maintenance implementation- Cybersecurity and data privacy concerns in industrial analytics	**9 Hours**
Process Optimization and Quality Analytics Root Cause Analysis (RCA) & Failure Mode Effect Analysis (FMEA) - AI-powered defect detection and quality control- Real-time process monitoring & control- Digital twins & process simulation for optimization- AI-driven automation and its impact on manufacturing efficiency	**9 Hours**
Supply Chain & Inventory Analytics	**9 Hours**

Data-driven inventory management and demand forecasting - Supply chain risk analytics & disruption prediction - Real-time tracking & warehouse optimization using AI - Vendor analytics & procurement optimization - Emerging trends in supply chain analytics	
Implementation Challenges and Future Trends Key barriers to manufacturing analytics adoption - Change management & workforce upskilling strategies- Future of manufacturing analytics: Edge computing, quantum analytics - Industrial AI and autonomous manufacturing systems - Ethical and regulatory considerations in manufacturing analytics	**9 Hours**

Theory Hours: 45	Tutorial Hours:	Practical Hours:	Project Hours:	Total Hours: 45

Learning Resources

Textbooks:

Case Studies

1. **Predictive Maintenance Implementation at a Automotive Assembly Plant:** A case study detailing how an automotive manufacturer implemented a predictive maintenance system using sensor data and machine learning to reduce unplanned downtime of critical machinery. This could explore the types of sensors used, the ML algorithms applied, the challenges faced during implementation, and the resulting benefits (e.g., reduced maintenance costs, increased production uptime).

2. **AI-Powered Quality Control in Electronics Manufacturing:** A case focusing on an electronics company that implemented an AI-driven visual inspection system for defect detection on circuit boards. The case could highlight the types of defects identified, the AI techniques used (e.g., computer vision, deep learning), the accuracy achieved compared to manual inspection, and the impact on product quality and yield.

3. **Data-Driven Inventory Optimization in a Consumer Goods Company:** A case study illustrating how a consumer goods manufacturer used demand forecasting techniques and real-time sales data to optimize their inventory levels across a complex supply chain. This could delve into the forecasting models used, the integration of different data sources, the reduction in holding costs, and the improvement in order fulfillment rates.

4. **Supply Chain Disruption Prediction in the Pharmaceutical Industry:** A case examining how a pharmaceutical company utilized data analytics to identify potential risks and predict disruptions in their global supply chain (e.g., supplier issues, logistical bottlenecks, geopolitical events). The case could discuss the data sources analyzed, the predictive models employed, and the strategies implemented to mitigate these risks.

References:

1. "Industry 4.0: The Industrial Internet of Things" by Alasdair Gilchrist

2. "Statistical Process Control" by Douglas C. Montgomery

3. "Supply Chain Analytics: The Science of Demand-Driven Supply Chains" by Chad W. Autry, John T. Mentzer, and Thomas J. Goldsby

Online Educational Resources:

1. Data Science for Manufacturing, Predictive Analytics, Supply Chain Management - Coursera & EdX

2. Manufacturing Analytics - MIT OpenCourseware

Assessment

- CAT
- End Semester Examination (ESE)

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Velumani R.N, Head – Employee Relations, Ashok Leyland	Dr D Jebakani, Professor, GCE Tirunelveli	Dr Lakshmi Meera, VP, Forge

Recommended by BoS on	14/08/2024		
Academic Council Approval	No.27	**Date**	24.08.2024

24TMT508	STRATEGIC LEADERSHIP	L	T	P	J	C
		3	0	0	0	3
Professional Core		SDG	4, 8 & 9			

Pre-requisite courses	NA	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	Understand fundamental strategic leadership concepts and apply diverse leadership theories and frameworks.
2	Develop strategic thinking, apply decision models, and lead innovation in technology-driven organizations.
3	Effectively manage organizational change and lead technological transformations.
4	Integrate ethical considerations, CSR, and sustainability into strategic leadership.
5	Navigate the challenges and opportunities of digital technologies and AI in leadership.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Explain the fundamentals of strategic leadership and its significance in technology-driven businesses.	U
CO 2	Analyze leadership styles, strategic thinking models, and their alignment with business objective	An
CO 3	Evaluate different decision-making frameworks and their application in dynamic business environments.	Ev
CO 4	Apply innovation leadership and change management frameworks to real-world business challenges.	Ap
CO 5	Create a strategic leadership roadmap for a technology-based enterprise	Cr

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research/investigation and work to solve practical problems.	Write and present a substantial technical report/document.	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.	Apply their capabilities acquired in technology management to identify and integrate business solutions that would enhance internal efficiency and external market growth across various sectors.	Adapt and work efficiently with multidisciplinary teams across various organizational levels.	Exhibit an ethical and responsible behaviours in all business decisions throughout their life.

1				2	3	2
2	2			2	3	
3			2	2		2
4	2	2		3	2	2
5	3			2	2	

Course Content	
STRATEGIC LEADERSHIP AND FRAMEWORKS Definition and Scope of Strategic Leadership - Characteristics of a Strategic Leader - Leadership vs. Management - Strategic Leadership in the Digital Era – Importance in a fast-changing business environment - Classical and Modern Leadership Theories; Transformational vs. Transactional Leadership - Servant Leadership & Authentic Leadership - Distributed Leadership in Tech Enterprises - Leadership Competency Frameworks – What makes a great leader? - Case Study: Elon Musk's Leadership Style at Tesla and SpaceX	**9 Hours**
STRATEGIC THINKING, LEADERSHIP DECISION-MAKING AND TECHNOLOGY LEADERSHIP Strategic Thinking vs. Operational Thinking - Frameworks for Strategic Leadership: The Five Elements of Strategic Thinking - McKinsey 7-S Framework - Decision-Making Models in Leadership: Rational Model vs. Intuitive Decision-Making - Data-Driven Decision-Making in the Age of AI - Leading Innovation in Technology-Driven Organizations - Managing Disruptive Innovation - Risk-Taking and Failure Management - Case Study: Google's 20% Rule – Encouraging Innovation	**9 Hours**
CHANGE MANAGEMENT AND ORGANIZATIONAL TRANSFORMATION Understanding Organizational Change and Resistance - Kotter's 8-Step Change Management Model - Role of Leadership in Change Management - Adapting Leadership to Technological Disruptions - Case Study: Satya Nadella's Transformation of Microsoft	**9 Hours**
ETHICAL LEADERSHIP AND CORPORATE STRATEGY Ethical Decision-Making in Leadership - Corporate Social Responsibility (CSR) and Sustainability Leadership - Balancing Profitability with Ethical Leadership - Global Leadership Challenges in the Age of AI and Automation - Case Study: Narayana Murthy's Leadership at Infosys	**9 Hours**
STRATEGIC LEADERSHIP IN THE DIGITAL AND AI ERA The Role of AI in Leadership Decision-Making - Automation and the Future of Work – How Leaders Must Adapt - Digital Transformation and Strategic Leadership - Case Study: Developing a Strategic Leadership Model for a Tech Enterprise	**9 Hours**

Theory Hours: 45	**Tutorial Hours:**	**Practical Hours:**	**Project Hours:**	**Total Hours: 45**

Learning Resources
Textbooks:

1. "The Leadership Challenge" – James Kouzes & Barry Posner, 5th Edition, 2012
2. "Good to Great" – Jim Collins, 2001
3. "The Innovator's Dilemma" – Clayton Christensen, 2013
4. "Blue Ocean Strategy" – W. Chan Kim & Renée Mauborgne, 2015
5. "HBR's 10 Must Reads on Leadership" – Harvard Business Review, 2011

Case Studies for Analysis

1. Apple's Strategic Leadership under Steve Jobs
2. Tesla's Growth Strategy and Elon Musk's Leadership
3. Microsoft's Digital Transformation under Satya Nadella
4. Netflix's Strategic Shift from DVDs to Streaming
5. Google's Innovation Strategy and Leadership Model

References:

1. McKinsey & Co. Reports on Leadership Trends
2. MIT Sloan Review on Technology Leadership
3. Research Papers on AI-Driven Strategic Leadership

Online Educational Resources:

1. **Strategic Leadership: What Makes a Great Leader?** – Harvard Business Review
2. **Elon Musk's Leadership Explained** – Business Insider
3. **Kotter's 8-Step Change Model Explained** – MindTools
4. **Satya Nadella's Leadership at Microsoft** – Stanford Business School

Assessment

- CAT
- End Semester Examination (ESE)

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Velumani R.N, Head – Employee Relations, Ashok Leyland	Dr. Mani Bharathi, Professor, GCE Salem	Dr Lakshmi Meera, VP, Forge

Recommended by BoS on	14/08/2024		
Academic Council Approval	No.27	**Date**	24.08.2024

24TMI511	MANUFACTURING ANALYTICS LAB	L	T	P	J	C
		1	0	4	0	3
Professional Core		SDG	4, 8 & 9			

Pre-requisite courses	NA	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	Enable hands-on experience with data acquisition from real-time sensors, IoT devices, MES, and ERP systems commonly used in Indian factories.
2	Develop skills in exploratory data analysis (EDA) and visualization using tools like Power BI, Tableau, and Python for real-world factory floor applications.
3	Train participants in machine learning techniques for predictive maintenance, applying them to case studies from Indian industries.
4	Provide expertise in AI-powered defect detection and process optimization, integrating digital twins for Indian manufacturing challenges.
5	Offer a capstone project where learners analyze real-world datasets from Indian manufacturing sectors, developing analytics-driven solutions for MSMEs, auto, pharma, or textile industries.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Collect & Process Manufacturing Data – Acquire real-time production data using IoT-enabled sensors and legacy systems common in Indian manufacturing.	U
CO 2	Perform Exploratory Data Analysis (EDA) – Use visualization tools (Power BI, Tableau, Python) to analyze trends, detect anomalies, and improve production efficiency.	AP
CO 3	Develop Predictive Models for Maintenance – Build and deploy machine learning models to predict failures and reduce unplanned downtime in manufacturing setups.	Ap
CO 4	Implement AI-Based Process Optimization – Apply AI-based quality analytics and defect detection to enhance precision manufacturing in Indian industries.	AP
CO 5	Execute a Real-World Industry Project – Conduct an end-to-end data analytics project using Indian manufacturing datasets, delivering actionable insights and improvement recommendations.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research/investigation and work to solve practical problems.	Write and present a substantial technical report/document.	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.	Apply their capabilities acquired in technology management to identify and integrate business solutions that would enhance internal efficiency and external market growth across various sectors.	Adapt and work efficiently with multidisciplinary teams across various organizational levels.	Exhibit an ethical and responsible behaviours in all business decisions throughout their life.
1	2			2	3	
2	2			2	3	
3				2	3	2
4				2	3	2
5	2			2	2	

Course Content	
Data Acquisition & Preprocessing	**9 Hours**
Collecting data from IoT devices, PLCs, MES systems - Data cleaning, transformation, and feature engineering - Using Python/R for preprocessing manufacturing datasets ● Hands-on: Exploring real-world manufacturing datasets	
Exploratory Data Analysis & Visualization	**9 Hours**
Statistical analysis of machine and process data - Detecting trends & anomalies through data visualization - Case study: Factory downtime analysis using EDA ● Hands-on: Using Power BI/Tableau for factory floor analytics	
Machine Learning for Predictive Maintenance	**9 Hours**
Time-series analysis for predictive maintenance - Training & testing ML models with real-world sensor data - Case study: Predicting equipment failures using historical data ● Hands-on: Building ML models for failure prediction (Python, Scikit-learn)	
Process Optimization & Defect Detection	**9 Hours**
Implementing statistical process control (SPC) with Python - AI-powered defect detection using image recognition models - Running simulations using digital twins for process optimization.	

• Hands-On: AI-driven quality assurance in manufacturing	
Capstone Project – Real-World Industrial Analytics Implementation	**9 Hours**
Analyzing factory datasets to generate insights - Proposing & implementing a data-driven improvement strategy	

Theory Hours:	**15**	**Tutorial Hours:**		**Practical Hours:**	**60**	**Project Hours:**	**Total Hours:** **75**

Learning Resources

Textbooks:

1. "Manufacturing Analytics: The Path to Data-Driven Manufacturing Operations" – *Stephan Mohr*
2. "Predictive Analytics for Manufacturing: Forecasting & Preventive Maintenance" – *Lev Klebanov*
3. "Industrial AI: Applications with Sustainable Performance" – *Jay Lee*
4. "Python Machine Learning for Manufacturing: Data-Driven Solutions for Industry 4.0" – *Qing Chang*
5. "Data Science for Business: What You Need to Know About Data Mining and Data-Analytic Thinking" – *Foster Provost & Tom Fawcett*

References:

1. "Statistical Process Control" by Douglas C. Montgomery
2. "Supply Chain Analytics: The Science of Demand-Driven Supply Chains" by Chad W. Autry, John T. Mentzer, and Thomas J. Goldsby

Online Educational Resources:

1. Data Science for Manufacturing, Predictive Analytics, Supply Chain Management - Coursera & EdX
2. Manufacturing Analytics - MIT OpenCourseware

Assessment

- CAT
- End Semester Examination (ESE)

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Sankar S, Dy-Manager, Ashok Layland	Dr S Supriya, Professor, GCE Tirunelveli	Aravind A, Specialist, Forge

Recommended by BoS on	14/08/2024		
Academic Council Approval	No.27	**Date**	24.08.2024

24TMJ512	FUTURE FACTORIES LAUNCHPAD - DISCOVER PHASE	L	T	P	J	C
		0	0	0	8	4
PRJ		SDG	4, 8 & 9			

Pre-requisite courses	NA	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	To equip students with the skills to identify industry needs, conduct market research, and discover strategic opportunities for technology adoption.
2	To guide students in developing a systematic framework for evaluating startups based on their innovation, market fit, and financial viability.
3	To train students in creating comprehensive project documentation, including use case documents and business cases with detailed cost-benefit analysis.
4	To familiarize students with foundational program management principles and techniques necessary for the successful execution of technology consulting projects.
5	To provide students with a real-world project experience, exposing them to industry practices and the roles of technology managers and consultants through mentorship.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Analyze market trends and identify strategic opportunities for technology adoption within various industries.	An
CO 2	Formulate and justify a business case for a proposed technology solution by conducting a thorough cost-benefit analysis.	An
CO 3	Develop a complete business proposal that outlines a technology solution, implementation plan, and project management strategy for a client.	C
CO 4	Apply foundational program management principles to navigate the project lifecycle and mitigate risks	Ap
CO 5	Manage the technology consulting lifecycle from initial prospecting to project delivery, effectively applying learned skills in a real-world, mentored environment.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research/investigation and work to solve practical problems.	Write and present a substantial technical report/document.	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.	Apply their capabilities acquired in technology management to identify and integrate business solutions that would enhance internal efficiency and external market growth across various sectors.	Adapt and work efficiently with multidisciplinary teams across various organizational levels.	Exhibit an ethical and responsible behaviours in all business decisions throughout their life.
1	2	2		3	2	
2		3	2	3		
3	2	3		3		2
4			2		2	2
5	2	2		3	2	2

Course Content

60 Hours

The students will be equipped with the essential skills to thrive in the dynamic world of technology consulting. Through a project-based approach, students will gain hands-on experience in identifying industry needs and challenges, crafting compelling business cases, and managing the entire consulting lifecycle.

Key Coursework:

1. **Industry Prospecting**: Develop a keen eye for identifying emerging technologies and their potential applications across various industries. You'll actively research current market trends, conduct competitor analysis, and discover strategic opportunities for technology adoption.
2. **Startup Scouting & Evaluation:** Learn to assess promising startups with disruptive potential. You'll develop frameworks for evaluating innovation, market fit, and financial viability of early-stage ventures.
3. **Use Case Document:** Craft clear and concise use case documents that accurately depict a specific industry challenge and how a particular technology can address it. These documents will be crucial for presenting solutions to potential clients.
4. **Business Case (Cost-Benefit Analysis):** Master the art of cost-benefit analysis, a critical skill for justifying technology investments. You'll learn to quantify the potential benefits and risks of a proposed solution, building a strong case for return on investment (ROI).
5. **Business Proposal**: Develop comprehensive business proposals that outline your proposed technology solution, implementation plan, and

project management strategies. These proposals will be tailored to specific industry needs and client requirements. 6. **Case Studies**: Analyze real-world technology consulting case studies to gain valuable insights into successful project execution. By dissecting past successes and failures, you'll learn valuable lessons for navigating the complexities of technology implementation within different industries. 7. **Program Management:** Gain foundational knowledge of program management principles essential for ensuring successful technology consulting projects. This includes understanding project lifecycles, risk management techniques, and effective communication strategies for stakeholder engagement. During this coursework, students shall get exposed to real-time industrial work, culture, and practices to become able technology managers. Students shall be jointly supervised and mentored by a team consisting of a Company supervisor and Industry Mentor.	

Theory Hours:	**Tutorial Hours:**	**Practical Hours:**	**Project Hours: 60**	**Total Hours:**	**60**

Assessment
● Periodic presentations ● End semester presentation and viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
Jagadeesh B, Ashok Leyland	Dr S Supriya, Professor, GCE Tirunelveli	Karthik Das, Sr Analyst, Forge	
Recommended by BoS on	14/08/2024		
Academic Council Approval	No.27	**Date**	24.08.2024

Semester III

24TMJ513	INDUSTRY IMMERSION	L	T	P	J	C
		0	0	0	4	2
PRJ		SDG	4, 8 & 9			

Pre-requisite courses	NA	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	To enable students to gain firsthand experience with the operational challenges and opportunities within MSME organizations through a real-world internship.
2	To guide students in identifying and analyzing the scope for digital transformation and technology interventions to address specific needs within MSMEs.
3	To train students to develop and present comprehensive and well-reasoned solutions for technology interventions in a professional, industry-oriented context.

Course Outcomes		
After successful completion of this course, the students shall be able to		**Revised Bloom's Taxonomy Levels (RBT)**
CO 1	Understand the operations of MSME organisations	U
CO 2	Identify the scope of technology interventions in MSME organisations	Ap
CO 3	Analyse and present solutions for technology interventions in MSME organisations	An

Course Outcomes (CO)	**Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)**					
	1	**2**	**3**	**4**	**5**	**6**
	Independently carry out research/investigation and work to solve practical problems.	Write and present a substantial technical report/document.	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.	Apply their capabilities acquired in technology management to identify and integrate business solutions that would enhance internal efficiency and external market growth across various sectors.	Adapt and work efficiently with multidisciplinary teams across various organizational levels.	Exhibit an ethical and responsible behaviours in all business decisions throughout their life.
1	2	2		3	2	
2	2			3	2	
3	2	2		3	2	2

Course Content	
The students shall seek their internship in Industry during their summer vacation and shall work part-time/full time as technology managers to understand the operation, study the challenges, and define the opportunities for changes and scope for industrial digital transformation. During this, the students shall get exposed to real-time industrial work, culture, and practices to become able technology managers. Students shall be jointly supervised and mentored by a team consisting of Academic mentor/company supervisor and Industry Mentor	**30 Hours**

Theory Hours:	**Tutorial Hours:**	**Practical Hours:**	**Project Hours: 30**	**Total Hours:**	**30**

Assessment
● Periodic presentations ● End semester presentation and viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
Jagadeesh B, Ashok Leyland	Dr S Supriya, Professor, GCE Tirunelveli	Karthik Das, Sr Analyst, Forge	
Recommended by BoS on	14/08/2024		
Academic Council Approval	No.27	**Date**	24.08.2024

24TMJ514	FUTURE FACTORIES LAUNCHPAD - DESIGN PHASE	L	T	P	J	C
		0	0	0	20	10
PRJ		SDG	4, 8 & 9			

Pre-requisite courses	NA	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	To analyze and synthesize existing solutions and methodologies through comprehensive literature review, thereby framing engineering problems effectively.
2	To apply design thinking frameworks and innovative brainstorming techniques to generate a diverse range of feasible and impactful engineering solutions.
3	To select and utilize modern engineering tools and software, and to plan projects in accordance with established project management principles.
4	To implement innovation project management techniques to develop a detailed project roadmap, including milestones, deliverables, resource allocation, budget, and success metrics.
5	To construct and deliver compelling presentations and a comprehensive project proposal that effectively communicate the problem framing, design thinking process, project plan, and prototype development strategy.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Critically Evaluate and review the existing solutions and methodologies by reviewing the literature to solve engineering problems.	Ev
CO 2	Utilize design thinking frameworks to effectively brainstorm and generate diverse, feasible solutions.	Ap
CO 3	Identify the modern tools and plan the project according to principles of project management.	Ap
CO 4	Implement innovation project management techniques to create a clear roadmap with defined milestones, deliverables, resource allocation, and budget.	Ap
CO 5	Craft a comprehensive final project proposal outlining the design thinking process, project plan, and detailed prototype development plan.	C

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research/investigation and work to solve practical problems.	Write and present a substantial technical report/document.	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.	Apply their capabilities acquired in technology management to identify and integrate business solutions that would enhance internal efficiency and external market growth across various sectors.	Adapt and work efficiently with multidisciplinary teams across various organizational levels.	Exhibit an ethical and responsible behaviours in all business decisions throughout their life.
1	2	2		3	2	
2	2	2		3	2	2
3	2			3	2	
4		2		3	2	2
5	2	2		2	2	

Course Content

10 Hours

By the end of the discovery phase, the students will have chosen a project based on industry feedback. In the design phase, they will hone their skills in Problem Framing & Research, Design Thinking, Innovation Project Management, Validation, Feasibility Reports, and Value Proposition of their innovation. Finally, they will submit a Project Report and present their innovation project plan.

Key Coursework:

1. **Problem Framing & Research**
    a. Hone your research skills to critically analyze existing solutions and methodologies for your chosen engineering challenge.
    b. Master literature review techniques to synthesize information from academic journals, engineering reports, and industry publications.
    c. Identify and refine your project focus based on a deep understanding of the current landscape and potential gaps.

2. **Design Thinking**
    a. Explore design thinking frameworks tailored specifically for engineering challenges.
    b. Learn to brainstorm effectively, generating a diverse range of feasible and impactful engineering solutions.
    c. Learn tools and techniques to implement innovation projects.

3. **Project Management**

a. Identify modern engineering tools and software relevant to your specific project, such as computer-aided design (CAD) software, simulation tools, and data analysis platforms. b. Develop a clear and concise project roadmap, outlining key milestones, deliverables, and resource allocation. c. Plan the budget requirements for the program. d. Create metrics to measure the success of innovation products/projects. **4. Documentation & Presentation** a. Develop compelling and concise presentations that effectively communicate the technical aspects and value proposition of your innovation. b. Develop a comprehensive final project proposal outlining your design thinking process, project plan, and detailed prototype development. c. Present your project literature review and project plan to a committee comprised of engineering professionals, course guides, and industry mentors.	

Theory Hours:	**Tutorial Hours:**	**Practical Hours:**	**Project Hours: 20**	**Total Hours:**	**300**

Assessment
● Periodic presentations ● End semester presentation and viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
Jagadeesh B, Ashok Leyland	Dr S Supriya, Professor, GCE Tirunelveli	Dinesh S, Manager, Forge	
Recommended by BoS on	14/08/2024		
Academic Council Approval	No.27	**Date**	24.08.2024

Semester IV

24TMJ515	FUTURE FACTORIES LAUNCHPAD - DEVELOP PHASE	L	T	P	J	C
		0	0	0	32	16
PRJ		SDG	4, 8 & 9			

Pre-requisite courses	NA	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	To enable students to execute a defined project plan, utilizing the methodologies and tools selected in the design phase, resulting in a functional prototype or proof-of-concept.
2	To train students in meticulously documenting their innovation journey, including problem definition, literature review, design thinking process, project management, prototype development, and analysis of results.
3	To develop students' ability to critically evaluate and justify the technical aspects, value proposition, and impact of their project work.
4	To enhance students' communication skills through the effective oral presentation of their project to internal and external examiners.
5	To guide students in ensuring their solutions meet ethical, societal, and legal considerations, reflecting responsible engineering practices.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Devise original solutions to complex engineering problems by successfully implementing a project plan and developing a working prototype or proof-of-concept using modern engineering tools.	An
CO 2	Justify the outcomes of their project work through a comprehensive final report that details the entire innovation process and analysis of results.	Ap
CO 3	Organize and communicate their project ideas and findings effectively through both a well-structured written report and a compelling oral presentation to a panel of experts.	Ap
CO 4	Develop solutions that demonstrably meet ethical, societal, and legal considerations, as evidenced in their project implementation and documentation.	C
CO 5	Critically reflect on their project journey, identifying challenges, adaptations, and learnings throughout the implementation phase.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research/investigation and work to solve practical problems.	Write and present a substantial technical report/document.	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.	Apply their capabilities acquired in technology management to identify and integrate business solutions that would enhance internal efficiency and external market growth across various sectors.	Adapt and work efficiently with multidisciplinary teams across various organizational levels.	Exhibit an ethical and responsible behaviours in all business decisions throughout their life.
1	2	2		3	2	
2	2	2		3	2	2
3		2		3	2	
4	2			3	2	2
5	2	2		2	2	

Course Content

16 Hours

Students implement their respective projects based on the problem identified, and the methodology and tools suggested in the synopsis prepared and presented in Design Phase. They prepare the final project reports according to the provided format. Each student is required to present their project work to both the internal project guide and an external examiner appointed by the Controller of Examinations.

Key Coursework:

1. **Project Implementation:**
    a. Execute the project plan outlined in your proposal, utilizing the methodologies and tools identified during the design phase.
    b. Develop a working prototype or proof-of-concept for your innovation.
    c. Document the implementation process meticulously, capturing learnings, challenges, and adaptations made along the way.
2. **Final Project Report:**
    a. Prepare a comprehensive final report adhering to the provided format.
    b. The report should document your entire innovation journey, encompassing the problem definition, literature review, design thinking process, project management plan, detailed prototype development, and analysis of results.
3. **Final Presentation:**

a. Deliver a final presentation of your project to both an internal project guide and an external examiner appointed by the Controller of Examination. b. During the presentation, effectively communicate the technical aspects, value proposition, and impact of your innovation. Be prepared to address questions and feedback from the examiners.	

Theory Hours:	**Tutorial Hours:**	**Practical Hours:**	**Project Hours: 32**	**Total Hours:**	**500**

Assessment
● Periodic presentations ● End semester presentation and viva-voce

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
Jagadeesh B, Ashok Leyland	Dr. Mani Bharathi, Professor, GCE Salem	Deepak N, Program Manager, Forge	
Recommended by BoS on	14/08/2024		
Academic Council Approval	No.27	**Date**	24.08.2024

Specialisation Elective

24TMC001	INDUSTRIAL IOT ESSENTIALS	L	T	P	J	C
		1	0	4	0	3
Elective		SDG	4, 8 & 9			

Pre-requisite courses	NA	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	To enable students to articulate the defining characteristics, historical progression, and key distinctions among the major industrial revolutions, understanding their technological drivers and societal impacts.
2	To equip students with the ability to recognize, classify, and analyze the diverse spectrum of manufacturing industries based on various parameters such as product type, manufacturing process, and technological intensity.
3	To provide students with a comprehensive understanding of the fundamental principles of smart manufacturing and how the Industrial Internet of Things (IIoT) acts as a key enabler for achieving real-time, interconnected, and optimized industrial operations.
4	To empower students to delineate the layered architectural framework of a typical IIoT system, clearly explaining the roles and functionalities of each component from edge devices to cloud applications.
5	To familiarize students with a broad range of practical industrial applications of IIoT across various sectors, enabling them to identify the specific benefits and potential of this technology in addressing real-world challenges and driving innovation.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Define and differentiate between the various industrial technological evolutions	U
CO 2	Identify and categorize different manufacturing industries	AP
CO 3	Explain the core concepts of smart manufacturing enabled by IIoT	Ap
CO 4	Describe the architecture of any IIoT system and their functions	AP
CO 5	Recognize industrial use cases of IIoT for industrial applications	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research/investigation and work to solve practical problems.	Write and present a substantial technical report/document.	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.	Apply their capabilities acquired in technology management to identify and integrate business solutions that would enhance internal efficiency and external market growth across various sectors.	Adapt and work efficiently with multidisciplinary teams across various organizational levels.	Exhibit an ethical and responsible behaviours in all business decisions throughout their life.
1	2			2	3	
2	2			2	3	
3				2	3	2
4				2	3	2
5	2			2	2	

Course Content

Introduction to Industrial IoT (IIoT) Systems	**15 Hours**
The Various Industrial Revolutions, Role of Internet of Things (IoT) & Industrial Internet of Things (IIoT) in Industry, Industry 4.0 revolutions, Support System for Industry 4.0, Smart Factories.	
Manufacturing Industries and Machineries	**15 Hours**
Overview of Different Manufacturing Industries - Discrete Manufacturing: CNC Milling Machines, Assembly lines and workstations-Injection Molding Machines - Process Manufacturing: chemicals, oil, Textiles - Automation & Robotics in Manufacturing ● Hands-on: Paper mill, 3D printers	
Smart Manufacturing with IIoT	**15 Hours**
Smart Manufacturing Concepts - IIoT Applications in QC, QA, PC - Cloud Computing, Edge Computing, Fog Computing, IIoT Data Management and Analytics - Predictive Analytics ● Hands-on: Real Time & Data-Driven Decision Making with IIoT	
Embedded System for IIoT	**15 Hours**
Sensors and Actuators for Industrial Processes, Sensor networks, Process automation and Data Acquisitions on IoT Platform, Microcontrollers and Embedded PC roles in IIoT, Cybersecurity Challenges in IIoT - IIoT Security Best Practices ● Handa-On: Wireless Sensor nodes with Bluetooth, WiFi, and LoRa Protocols and IoT Hub systems.	
Industrial IoT Applications	**15 Hours**

Healthcare, Power Plants, Inventory Management & Quality Control, Plant Safety and Security (Including AR and VR safety applications), and Facility Management. ● Handa-On: Inventory Management & Quality Control for the Manufacturing Industry	

Theory Hours:	**15**	**Tutorial Hours:**		**Practical Hours:**	**60**	**Project Hours:**	**Total Hours:** **75**

Learning Resources

Textbooks:

1. Industry 4.0: The Fourth Industrial Revolution by Kagermann, H., et al., 2016
2. Digital Manufacturing: Technology, Management and Applications by Karafyllis, I., & Giannopoulos, C., 2019
3. The Industrial Internet of Things: A Cyberphysical Systems Approach by Hedeler, C., & Sudra, A., 2016

References:

1. Smart Manufacturing Concepts by GE Digital: https://www.ge.com/digital/industry/manufacturing-digital-plant
2.

Online Educational Resources:

1. IIoT Data Management and Analytics by IBM: https://www.ibm.com/blog/real-time-analytics-on-iot-data/

Assessment

- CAT
- End Semester Examination (ESE)

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Jagadeesh B, Sr. Manager, Ashok Leyland	Dr D Jebakani, Professor, GCE Tirunelveli	Guna D, Sr.Engineer, Forge
Recommended by BoS on	14/08/2024	
Academic Council Approval	No.27	**Date** 24.08.2024

24TMC002	INDUSTRIAL IOT DESIGN AND DEVELOPMENT	L	T	P	J	C
		1	0	4	0	3
Elective		SDG	4, 8 & 9			

Pre-requisite courses	NA	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	To provide students with the skills to design, program, and implement microcontroller-based solutions for specific industrial challenges.
2	To enable students to apply principles of industrial control to effectively utilize actuators and sensors within integrated systems.
3	To equip students with the ability to set up and manage IIoT platforms for the collection, processing, and control of industrial data.
4	To equip students with the ability to set up and manage IIoT platforms for the collection, processing, and control of industrial data.
5	To familiarize students with foundational concepts and best practices of cybersecurity essential for protecting industrial IoT environments.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Develop microcontroller-based systems for industrial applications.	Ap
CO 2	Leverage industrial control systems using actuators and sensors	An
CO 3	Configure and utilize IIoT platforms for data processing and control.	An
CO 4	Leverage low-code platforms for rapid IIoT prototyping and testing	Ap
CO 5	Understand essential cybersecurity measures to safeguard industrial IoT systems.	C

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research/investigation and work to solve practical problems.	Write and present a substantial technical report/document.	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.	Apply their capabilities acquired in technology management to identify and integrate business solutions that would enhance internal efficiency and external market growth across various sectors.	Adapt and work efficiently with multidisciplinary teams across various organizational levels.	Exhibit an ethical and responsible behaviours in all business decisions throughout their life.
1	2			3	2	
2			2	3		
3		2		3	2	
4	2	2		3		
5	2	2		3	2	

Course Content

Microcontroller and Programming Embedded Platforms: Atmel Microcontroller: Series and its Architectures - Embedded Programming: C, C++, RTOS - IDE: Benefits and Features, - Electronics Simulation - Hands-on: TinkerCAD simulations, Protocol Visualization using Logic Analyzer	**15 Hours**
Implementation systems for IIoT Overview of Different Industrial Actuators: Pneumatics, Hydraulic, Electric - Digital and Analog sensors interfacing with Microcontroller- Signal Conditioning Circuits - Hands-on: Interfacing sensor and actuators, Implementing intranet data exchange, IoT with cloud, MODBUS Data Processing	**15 Hours**
IIoT Data Processing & Control IoT Gateway, IoT Edge Systems and Its Programming, Cloud computing, Real-Time Dashboard for Data Monitoring, Data Analytics and Predictive Maintenance with IIoT technology-. Hands-on: Mesh network Implementation	**15 Hours**
Low Code Platform for Industrial IoT Integration Introduction to Node-RED - Why Node-RED for IIoT - Case Studies - Setting up Node-RED, Node-RED Dashboard - Device Integration & Data Acquisition - Dashboard Development - API Integration Overview - Cloud-based data storage and analysis - Automate Actions Based Events - Other Advanced Features Hands-on: Upgrade Module 3 Project with Dashboard & Automation Features	**15 Hours**
Advanced Industrial Cybersecurity Industrial Networking & Protocols, Introduction to Cybersecurity Best Practices: Secure Communication, Access Control-Security vulnerabilities in Industrial IoT	**15 Hours**

Systems-Risk Assessment and Security Considerations for IIoT Networks - Data Encryption: DES, AES -Case Study: Risk Assessment and Security Monitoring for Industrial IoT Networks. Hands-on Lab: Implementing Security Measures in an IIoT System	

Theory Hours:	**15**	**Tutorial Hours:**		**Practical Hours:**	**60**	**Project Hours:**	**Total Hours:** **75**

Learning Resources

Textbooks:

1. Industry 4.0: The Industrial Internet of Things Alasdair Gilchrist, Publications: Apress
2. The Concept Industry 4.0 An Empirical Analysis of Technologies and Applications in Production Logistics Authors: Bartodziej, Christoph Jan Springer: Publication in the field of economic science.
3. Embedded System: Architecture, Programming and Design by Rajkamal, TMH3.

References:

1. Dr. Ovidiu Vermesan, Dr. Peter Friess, “Internet of Things: Converging Technologies for Smart Environments and Integrated Ecosystems”, River Publishers
2. Using Low-code Solutions to Make the Most of Industrial IoT, Siemens
3. An Executive’s Guide To Industrial Cybersecurity, Dragos

Online Educational Resources:

1. **Coursera:** Interfacing with the Arduino (University of California, Irvine), Industrial Internet of Things (IIoT) (Indian Institute of Technology, Madras), and Developing Industrial IoT Applications (NPTEL).
2. **edX:** IIoT: Leveraging the Cloud, Low-Code and Cybersecurity (The Linux Foundation), and Cybersecurity for Industrial Control Systems (ISA).

Assessment

- CAT
- End Semester Examination (ESE)

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Jagadeesh B, Sr. Manager, Ashok Leyland	Dr S Supriya, Professor, GCE Tirunelveli	Guna D, Sr.Engineer, Forge

Recommended by BoS on	14/08/2024		
Academic Council Approval	No.27	**Date**	24.08.2024

24TMC003	ADVANCED INDUSTRIAL IOT APPLICATIONS	L	T	P	J	C
		1	0	6	0	4
Elective		SDG	4, 8 & 9			

Pre-requisite courses	NA	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	**To equip students with the comprehensive skills** needed to design, implement, and seamlessly integrate IIoT systems within an industrial automation environment.
2	**To enable students to master the principles** of integrating industrial robots and collaborative robots (cobots) with advanced IIoT systems for enhanced productivity and safety.
3	**To guide students in the creation and application** of digital twin models for the simulation, analysis, and optimization of real-world industrial processes.
4	**To familiarize students with the end-to-end product management lifecycle** specifically for industrial hardware, covering aspects from ideation and development to market entry.
5	**To provide students with a guided framework** for conceiving, planning, and executing a complete, end-to-end IIoT capstone project.

Course Outcomes		
After successful completion of this course, the students shall be able to		**Revised Bloom's Taxonomy Levels (RBT)**
CO 1	Design, implement & integrate IIoT-enabled industrial automation system	Ap
CO 2	Integrate industrial robots and cobots with advanced IIoT systems	An
CO 3	Develop and utilize digital twins for advanced industrial applications	An
CO 4	Learn Product Management Approach for Industrial Hardware Solutions	Ap
CO 5	Develop an End-to-End IIoT Capstone Project	C

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research/investigation and work to solve practical problems.	Write and present a substantial technical report/document.	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.	Apply their capabilities acquired in technology management to identify and integrate business solutions that would enhance internal efficiency and external market growth across various sectors.	Adapt and work efficiently with multidisciplinary teams across various organizational levels.	Exhibit an ethical and responsible behaviours in all business decisions throughout their life.
1	2			3	2	
2			2	3		
3				3	2	
4	2	2		3	2	
5	2	2		3	2	

Course Content

Advanced Industrial Automation and Control Systems Industrial Control Systems (SCADA, DCS) and their Integration with IIoT - Programmable Logic Controllers (PLCs) and their role in Industrial Automation - Remote Monitoring and Control of Industrial Processes using IIoT-Case Studies: Implementing Industrial Automation Applications with IIoT	**25 Hours**
Advanced Industrial Robotics with IIoT Industrial Robotics and Cobots: Overview, Types and Applications-Integration of Industrial Robots and Cobots with IIoT systems - Industrial robotics fundamentals, robot kinematics and path planning, communication protocols between robots and IIoT platforms, Collaborative Robotics and Remote Control using IIoT	**25 Hours**
Industrial Digital Twin Technology Introduction to Digital Twins - Benefits and applications in engineering - Convergence of Digital Twins and IIoT for Intelligent Systems - IIoT Sensors and Data Acquisition Systems - Digital Twin Creation Tools and Platforms - Robot Simulation Platforms - Brief overview of Gazebo as a simulation platform - Hands-on: Simple Robot Model.	**25 Hours**
Subsystem IIoT Implementation for Industry Product Management Approach: Technology management, Technology Readiness Levels, Development Progress Indicator - Case Study - Practicals: Do a Subsystem implementation using IIoT for a chosen industry sector	**30 Hours**

Theory Hours: 15	Tutorial Hours:	Practical Hours: 90	Project Hours:	Total Hours: 105

Learning Resources

Textbooks:

1. "Advanced Control Systems: Theory and Applications" by Yuriy P. Kondratenko
2. Industrial Internet of Things (IIoT): Intelligent Analytics for Predictive Maintenance, Souvik Pal, Noor Zaman
3. Digital twin: a state-of-the-art review of its enabling technologies, applications and challenges

References:

1. Innovations in the Industrial Internet of Things (IIoT) and Smart Factory, Sam Goundar, J. Avanija, Gurram Sunitha
2. Product Management Approach https://www.idex.gov.in/sites/default/files/2020-11/PMA_Guidelines_IDEX.pdf

Online Educational Resources:

1. **Coursera:** Digital Twins (University of Michigan), Industrial IoT (Indian Institute of Technology, Madras), and Digital Manufacturing & Design Technology Specialization (University at Buffalo, The State University of New York).
2. **Coursera:** Mechatronics Capstone: An IIoT Capstone Project (University of Pennsylvania), and Digital Product Management Specialization (University of Virginia).

Assessment

- CAT
- End Semester Examination (ESE)

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Jagadeesh B, Sr. Manager, Ashok Leyland	Dr. Mani Bharathi, Professor, GCE Salem	Guna D, Sr.Engineer, Forge
Recommended by BoS on	14/08/2024	
Academic Council Approval	No.27	**Date** 24.08.2024

24TMC004	INDUSTRIAL AUTOMATION AND ROBOTICS FUNDAMENTALS	L	T	P	J	C
		1	0	4	0	3
Elective		SDG	4, 8 & 9			

Pre-requisite courses	NA	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	To provide students with a foundational understanding of the core principles and technologies that underpin industrial automation and robotics.
2	To equip students with the skills to apply the principles of pneumatic systems and design functional pneumatic circuits.
3	To familiarize students with the structural components and fundamental movements of industrial robots.
4	To introduce students to the key components of automation systems, including sensors, drives, and actuators, and explain their specific functions.
5	To facilitate students' ability to critically analyze and evaluate the strategic importance of automation within different manufacturing industries.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Explain the fundamental concepts of industrial automation and robotics	Ap
CO 2	Demonstrate knowledge of pneumatic systems and design basic pneumatic circuits	An
CO 3	Describe the anatomy and basic movements of robots	An
CO 4	Identify the role of sensors, drives, and actuators in industrial automation	Ap
CO 5	Analyze the significance of automation across various manufacturing sectors	C

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research/investigation and work to solve practical problems.	Write and present a substantial technical report/document.	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.	Apply their capabilities acquired in technology management to identify and integrate business solutions that would enhance internal efficiency and external market growth across various sectors.	Adapt and work efficiently with multidisciplinary teams across various organizational levels.	Exhibit an ethical and responsible behaviours in all business decisions throughout their life.
1	2			3	2	
2			2	3		
3		2		3		
4	2	2		3		
5	2			3	2	

Course Content

Industrial Automation & Robotics 101 Introduction to industrial automation and robotics - applications & benefits - Basic safety protocols in industrial environments - Lockout/Tagout procedures (LOTO), Hazard identification and risk assessment - Introduction to pneumatics - core components, Basic principles - Introduction to robot anatomy and basic movements - pick and place, rotation, Articulation - Kinematics Basics	**15 Hours**
Building Blocks of Industrial Automation In-depth exploration of pneumatic components - Compressors, Actuators and Valves - Working Principle, Types, Selection Considerations - Understanding pneumatic circuits - Design - Designing pneumatic circuits using symbols and schematics - Analysis - Analyze pneumatic circuits to predict their behaviour and performance - Troubleshooting - Identify and diagnose common pneumatic system problems	**15 Hours**
Building Blocks of Robotics Introduction to robot anatomy - types, concept of robot axes of movement, robot payload capacity and its significance, Introduction to robot kinematics - basic robot movements - pick-and-place, linear motion, and circular motion - Concept of robot degrees of freedom (DOF) fundamental actions for various tasks - Robot Simulation software setup for robots (basic user interface)	**15 Hours**
Sensors, Drives, and Actuators for Industrial Automation Importance of sensors, drives, and actuators in process control and monitoring - Definition and classification of sensors - active vs. passive, analog vs. digital -	**15 Hours**

Common types of industrial sensors, requirements - Definition and classification of actuators - linear vs. rotary, electric vs. pneumatic vs. hydraulic - Principles of operation for common industrial actuators - Definition and function of drives in industrial automation - Types of drives, Selection criteria for sensors, drives, and actuators based on application - Examples of sensor-drive-actuator applications in industrial processes - pick-and-place robots, conveyor systems, material handling	
Industrial Applications Importance of industrial technologies in modern manufacturing and processing. Common Industrial Automation Applications - Case Studies by Industry: Automotive, Food & Beverage, Pharmaceutical, Electronics, Logistics & Warehousing - Benefits & Challenges of Automation - Challenges in implementation.	**15 Hours**

Theory Hours:	**15**	**Tutorial Hours:**		**Practical Hours:**	**60**	**Project Hours:**	**Total Hours:** **75**

Learning Resources

Textbooks:

1. Industrial Automation and Robotics: An Introduction by A.K. Gupta, S.K. Arora, and Jean Riescher Westcott
2. Pneumatic Systems: Principles and Maintenance by S.R. Majumdar

References:

1. Robot Manipulators: Trends and Development by Agustin Jimenez and Basil M. Al Hadithi
2. Sensors and Actuators: Engineering System Instrumentation by Clarence W. de Silva

Online Educational Resources:

1. **NPTEL:** *Hydraulics and Pneumatics*.
2. **Coursera:** *Robotics* (University of Pennsylvania), *Introduction to Robotics* (University of Adelaide), and *Sensors and Actuators* (University of California, Irvine).

Assessment

- CAT
- End Semester Examination (ESE)

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
S Ravichandran, AGM, Ashok Leyland	Dr D Jebakani, Professor, GCE Tirunelveli	Abhishek C, Sr.Engineer, Forge

Recommended by BoS on	14/08/2024		
Academic Council Approval	No.27	**Date**	24.08.2024

24TMC005	INDUSTRIAL AUTOMATION CONTROL SYSTEMS AND PROGRAMMING	L	T	P	J	C
		1	0	4	0	3
Elective		SDG	4, 8 & 9			

Pre-requisite courses	NA	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	To provide students with an understanding of the critical role that reliable communication networks play in modern industrial automation systems.
2	To equip students with foundational skills for developing basic PLC programs.
3	To enable students to apply core robot programming concepts to solve practical problems in industrial settings.
4	To familiarize students with the fundamental principles of Human-Machine Interface (HMI) design and to provide hands-on experience in creating basic, user-friendly interfaces.
5	To guide students in integrating advanced pneumatic components with robotic systems to achieve complex automated tasks.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Explain the importance of reliable communication in industrial automation	Ap
CO 2	Demonstrate basic PLC programming skills	An
CO 3	Apply robot programming concepts to industrial applications	An
CO 4	Explain the fundamentals of HMI & develop basic user-friendly HMIs	Ap
CO 5	Integrate advanced pneumatic and robotic systems	C

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research/investigation and work to solve practical problems.	Write and present a substantial technical report/document.	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.	Apply their capabilities acquired in technology management to identify and integrate business solutions that would enhance internal efficiency and external market growth across various sectors.	Adapt and work efficiently with multidisciplinary teams across various organizational levels.	Exhibit an ethical and responsible behaviours in all business decisions throughout their life.
1	2			3	2	
2			2	3		
3				3	2	
4	2	2		3	2	
5	2	2		3	2	

Course Content

Industrial Communication Importance of Reliable Communication in Industrial Automation - Interface: Introduction, Principles of interface, serial interface and its standards, Parallel interfaces and buses - Fieldbus - Instrumentation network design - PROFIBUS-PA - Basics, architecture, model, network design - HART and MODBUS - Concept of Highway Addressable Remote Transducer (HART), HART and smart Instrumentation, HART protocol - Overview of Modbus protocol, Modbus protocol structure. Overview of OPC, CAN - Ethernet, HTTP, TCP/UDI, WiFi, Cloud data logging. Multi-sensor communication, Data parsing between Embedded platforms. Comparative study of Industrial communication protocols	**15 Hours**
Industrial Programming Fundamentals Introduction to PLCs - role of PLCs in industrial automation systems - basic components of a PLC system - types of PLC inputs and outputs - Basic PLC programming and sequence control - Introduction to IEC 61131 - Understanding PLC input/output modules and addressing Programming a PLC - Ladder Programming Basics - Understanding data types, variables, and memory organisation in PLCs - timers, counters, arithmetic operations, and data manipulation. Hands-on exercises: Developing ladder logic and SFC programs for various industrial scenarios Hands-on exercises: Basic troubleshooting techniques on mobile workstation kit.	**15 Hours**

Robotics Applications & Programming Introduction to path planning concepts for robot movement - Robot programming for different industrial applications (welding, painting, pick & place) - Definition of Teach Pendant - Teach Pendant Purpose & Functionalities - Home Position - Roboto Programming Techniques - Programming Robot Using Cartesian Coordinates - Hands-on exercises: Creation & Execution of Painting Motion & Welding Path Planning	**15 Hours**
Human-Machine Interface Development Introduction to Human Machine Interface (HMI) - Understanding the significance of HMIs - HMI design principles - HMI Software Tools - HMI best practices & safety considerations - Basic HMI scripting and programming - Hands-on session: Creating a user-friendly HMI interface for an Industrial Application	**15 Hours**
Advanced Pneumatics & Robotics Advanced pneumatic circuits - cascading circuits, sequential actuation, signal amplification, circuit design techniques - Integration of electrical and pneumatic components for complex tasks - Sequencing and Control Strategies - Introduction to various industrial sensors (proximity, pressure, etc.) used in automation - Interfacing sensors with PLCs for data acquisition and control - Advanced robot programming concepts - path planning, error handling and recovery Hands-on exercises: Integrating sensors with PLC programs for robot control	**15 Hours**

Theory Hours:	**15**	**Tutorial Hours:**		**Practical Hours:**	**60**	**Project Hours:**	**Total Hours:** **75**

Learning Resources

Textbooks:

1. Willian Bolton, Programmable Logic Controllers, 6th edition, Newnes Publications, 2015
2. Richard Zurawski, Industrial Communication Technology Handbook, Second edition, CRC Press, 2014

References:

1. Mikell P. Groover, Automation, Production Systems, and Computer-integrated Manufacturing, Fourth edition, Pearson Education, 2016
2. Michael J. Hamill, Industrial Communications and Control Protocols, PDH centre, 2016

Online Educational Resources:

1. **Siemens SITRAIN:** SIMATIC TIA Portal Programming 1, SIMATIC WinCC Unified PC Runtime, and Industrial Communication with PROFINET.
2. **ABB Robotics Online:** RobotStudio for Robot Programming, SafeMove2 Basic, and Basic Robot Operations.

Assessment

- CAT
- End Semester Examination (ESE)

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
S Ravichandran, AGM, Ashok Leyland	Dr. Mani Bharathi, Professor, GCE Salem	Abhishek C, Sr.Engineer, Forge	
Recommended by BoS on	14/08/2024		
Academic Council Approval	No.27	**Date**	24.08.2024

24TMC006	ADVANCED INDUSTRIAL AUTOMATION SYSTEM DESIGN AND INTEGRATION	L	T	P	J	C
		1	0	6	0	4
Elective		SDG	4, 8 & 9			

Pre-requisite courses	NA	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	To provide students with a detailed understanding of the components, architecture, and operational principles of SCADA systems.
2	To equip students with the systematic approach and practical techniques required for effective troubleshooting of complex automation issues.
3	To guide students through the project lifecycle, teaching them the essential management skills needed to lead a team in an advanced industrial automation or robotics project.
4	To enable students to synthesize and apply a comprehensive set of advanced concepts to solve complex, real-world problems in automation and robotics.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Explain the components and architecture of SCADA systems	Ap
CO 2	Apply systematic troubleshooting techniques to resolve automation problems	An
CO 3	Manage an advanced industrial automation or robotics project	An
CO 4	Demonstrate mastery of advanced automation and robotics concepts	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research/investigation and work to solve practical problems.	Write and present a substantial technical report/document.	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.	Apply their capabilities acquired in technology management to identify and integrate business solutions that would enhance internal efficiency and external market growth across various sectors.	Adapt and work efficiently with multidisciplinary teams across various organizational levels.	Exhibit an ethical and responsible behaviours in all business decisions throughout their life.

1				2	2	
2			2	3		
3	2			2	2	
4	2	3		2	2	

Course Content	
Advanced Automation Introduction to SCADA systems - Components of a SCADA system (RTUs, PLCs, HMI) - Basic SCADA Architecture - Integrating PLCs, HMIs, and SCADA systems for Advanced automation - Introduction to DCS (Distributed Control Systems) & Overview of MES (Manufacturing Execution Systems) and their role in industrial automation - Case studies and real-world examples of successful automation and control system implementations, emphasising efficiency and precision.	**25 Hours**
Systematic Troubleshooting Introduction to troubleshooting techniques - Systematic approaches to problem identification and resolution - Importance of safety protocols during troubleshooting - Electrical Systems: Common electrical faults, troubleshooting tools & techniques - Pneumatic Systems: Identifying malfunctions in pneumatic circuits, troubleshooting pneumatic components - PLC Programming: Common errors and issues in PLC programs, debugging techniques, utilizing diagnostic tools - Robotics: Identifying mechanical and programming issues in robots, utilizing robot diagnostics and error codes - Hands-on troubleshooting exercises on a dedicated industrial automation workstation	**25 Hours**
System Integration for Industrial Automation Principles of system integration for industrial automation and robotics - Designing integrated systems for specific production processes or applications - Hardware and software selection for integrated systems - Communication networks between PLCs, robots, and other devices - Handson_ design, build, and test a system integrating robots, PLCs, and communication for a specific application (e.g., sorting, palletizing).	**25 Hours**
Advanced Industrial Automation & Robotics Identify a real-world industrial automation or robotics challenge - defining the problem statement, solution overview, and scope - Research existing solutions and identify relevant technologies - Practical: Design an integrated system architecture, including hardware and software components - Select appropriate PLCs, robots, sensors, and communication protocols based on technical specificationsIntegrate system components and ensure proper communication - comprehensive testing plan for functionality, performance, and safety.	**30 Hours**

Theory Hours: 15	Tutorial Hours:	Practical Hours: 90	Project Hours:	Total Hours: 105

Learning Resources

Textbooks:

1. Industrial Automation with SCADA: Concepts, Communications and Security by K S Manoj
2. Process Control: Engineering Analyses and Best Practices by Steve S. Niu and Deyun Xia

References:

1. Robotics: Modelling, Planning and Control (Advanced Textbooks in Control and Signal Processing) by Bruno Siciliano and Giuseppe Oriolo
2. Integration Technologies for Industrial Automated Systems by Richard Zurawski

Online Educational Resources:

1. Rockwell Automation: FactoryTalk View ME/SE System Operations and Troubleshooting, FactoryTalk View SE System Design, and ControlLogix Maintenance and Troubleshooting.
2. Coursera / edX: Robotics Capstone (University of Pennsylvania), Robot Vision, and Project Management Professional Certificate (Google).

Assessment

- CAT
- End Semester Examination (ESE)

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
S Ravichandran, AGM, Ashok Leyland	Dr D Jebakani, Professor, GCE Tirunelveli	Abhishek C, Sr.Engineer, Forge

Recommended by BoS on	14/08/2024		
Academic Council Approval	No.27	**Date**	24.08.2024

Professional Electives

24TME001	FINANCE FOR ENGINEERS	L	T	P	J	C
		3	0	0	0	3
Professional Elective		SDG	4, 8 & 9			

Pre-requisite courses	NA	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	Recall and define key financial accounting terms, the structure of major financial statements, and fundamental management accounting concepts.
2	Explain the purpose and interrelationship of different financial statements and management accounting techniques in business decision-making and planning.
3	Utilize financial statement analysis techniques and investment appraisal methods to evaluate a company's financial health and the feasibility of investment projects.
4	Differentiate between various sources of working capital and critically assess strategies for efficient management of cash, receivables, and inventory.
5	Compare and contrast different capital budgeting techniques and capital structures, and justify their suitability for various business scenarios, considering the time value of money.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Describe the components and purpose of key financial statements (Balance Sheet, Income Statement, Cash Flow Statement) and fundamental management accounting principles.	U
CO 2	Interpret financial statements and explain how management accounting tools like budgeting and marginal costing support business operations.	An
CO 3	Apply appropriate financial statement analysis tools and investment appraisal techniques (Payback Period, NPV, IRR) to solve practical business problems..	Ap
CO 4	Break down working capital management into its core components (cash, receivables, inventory) and analyze strategies for optimizing each.	An
CO 5	Formulate recommendations on investment decisions and working capital strategies based on financial analysis, considering the cost of capital and different financing options.	Ev

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research/investigation and work to solve practical problems.	Write and present a substantial technical report/document.	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.	Apply their capabilities acquired in technology management to identify and integrate business solutions that would enhance internal efficiency and external market growth across various sectors.	Adapt and work efficiently with multidisciplinary teams across various organizational levels.	Exhibit an ethical and responsible behaviours in all business decisions throughout their life.
1	2			2	3	
2	2			2	3	
3				2	3	2
4				2	3	2
5	2			2	2	

Course Content

Financial Statement The terminology of understanding and the structure and control of the main financial statement used by business organisations – the role and use of different financial statements -Different techniques of financial statement analysis.	**9 Hours**
Accounting Techniques The use of Management accounting techniques for business planning and decision making – Business budgeting and budgetary control – applications of marginal costing	**9 Hours**
Financial Management Financial management – objectives – scope – profit vs wealth maximisation – Time value of money- recent trends in primary and capital. - role and functions of financial administration	**9 Hours**
Investment Appraisal Techniques The use of investment appraisal techniques in business undertakings – pay back periods –Net present value – Internal rate of return - Average rate of return – Profitability index – capital rationing. - cost of capital – capital structure	**9 Hours**
Working Capital Management of working capital – sources of working capital – Estimation of working capital – Management of working capital – cash, receivables, and inventory management. - venture capital	**9 Hours**

Theory Hours: 45	Tutorial Hours:	Practical Hours:	Project Hours:	Total Hours: 45

Learning Resources

Textbooks:

1. Shashi K.Gupta ; Management Accounting Principles and Practice , Kalyani publishers 13th edition
2. Pandey.I.M.; Financial Management, Vikas Publishing House Pvt Ltd,2015 edition

Case Studies

1. **Analyzing the Financial Health of a Manufacturing Company:** A case study involving the financial statements of a manufacturing firm where students need to apply ratio analysis to assess its liquidity, solvency, profitability, and efficiency.

2. **Capital Budgeting Decision for a New Product Line:** A scenario where an engineering company needs to decide whether to invest in a new product line, requiring students to apply NPV, IRR, and payback period analysis.

3. **Working Capital Management Challenges in a Startup:** A case focusing on a new technology venture facing challenges in managing its cash flow, inventory, and receivables during its growth phase.

4. **Evaluating Different Financing Options for Expansion:** A case where an established engineering firm is considering different sources of financing (debt vs. equity) for a plant expansion, requiring an analysis of the cost of capital and capital structure implications.

References:

1. "Financial Accounting" by Robert Libby, Patricia Libby, and Daniel Short

2. "Management Accounting" by Anthony A. Atkinson, Rajiv D. Banker, Robert S. Kaplan, and S. Mark Young

3. "Principles of Corporate Finance" by Richard A. Brealey, Stewart C. Myers, and Franklin Allen

Online Educational Resources:

1. Financial Accounting for Beginners - Coursera
2. Management Accounting Fundamentals - EdX
3. Finance and Capital Markets - Khan Academy

Assessment

- CAT
- End Semester Examination (ESE)

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Sankar S, Dy-Manager, Ashok Layland	Dr S Supriya, Professor, GCE Tirunelveli		Dr Lakshmi Meera, VP, Forge
Recommended by BoS on	14/08/2024		
Academic Council Approval	No.27	**Date**	24.08.2024

24TME002	SUPPLY CHAIN MANAGEMENT	L	T	P	J	C
		3	0	0	0	3
Elective		SDG	4, 8 & 9			

Pre-requisite courses	NA	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	To enable students to define and describe the operational environment of a business and to accurately identify the flow of information within it.
2	To guide students in differentiating between logistics and supply chain management and to help them understand and explain the growing importance of logistics in modern business.
3	To equip students with the ability to construct a model representing the key elements of supply chain management and to recall and articulate its recent trends and developments.
4	To facilitate students' capacity to critically analyze the impact of inventory on supply chain performance and to discuss common inventory-related challenges.
5	To familiarize students with various software packages used for supply chain planning and to enable them to model the sequential steps involved in effective supply chain planning.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Outline operations management environment and label the business information flows.	Ap
CO 2	Contrast logistics and supply chain management and infer the increasing significance of logistics.	An
CO 3	Model the elements of supply chain management and recall its recent trends.	An
CO 4	Analyze impact of inventory on supply chain management and discuss its major issues.	Ap
CO 5	List software packages involved in supply chain planning and model the various steps involved.	C

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research/investigation and work to solve practical problems.	Write and present a substantial technical report/document.	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.	Apply their capabilities acquired in technology management to identify and integrate business solutions that would enhance internal efficiency and external market growth across various sectors.	Adapt and work efficiently with multidisciplinary teams across various organizational levels.	Exhibit an ethical and responsible behaviours in all business decisions throughout their life.
1	2			3	2	
2			2	3		
3	2			2	2	
4					2	2
5		2		2	2	

Course Content

Operations Management Basics Operations Management definition – Transformation Role – Organizational charts - Manufacture versus service organizations – growth of service sectors – Operations management decisions – Historical development – Operations Management environment – Business information flow.	**9 Hours**
Logistics Overview Logistics versus Supply Chain Management – Contemporary Logistics terms – Logistics and Supply Chain Mission – Physical Distribution costs - Logistics Strategy and Planning – Logistics Strategy Triangle – Increasing significance of logistics – IT and Logistics.	**9 Hours**
Supply Chain Management Overview Supply Chain Overview - Goals and Importance of Supply Chain Management -Flows in a Supply Chain – Typical Supply Chains –Elements of Supply Chain Management – Strategies for Supply Chain Management – Trends in Supply Chain management – Global concerns.	**9 Hours**
Supply Chain Inventory Inventory and Inventory systems – Inventory positions in the supply chain – Reasons for inventories – Inventory and value – Functional roles of inventory – Reasons against inventory – Macro and micro issues in inventory management –Inventory management models - Planning supply chain activities.	**9 Hours**

Supply Chain Planning	**9 Hours**
Dynamics of material flow – Dynamics of order flow – Supply chain planning – definitions, processes and decisions – Software packages – Planning results – Supply Chain Design – Mass customization – Design for Logistics – Supplier Base design.	

Theory Hours: 45	**Tutorial Hours:**	**Practical Hours:**	**Project Hours:**	**Total Hours: 45**

Learning Resources

Textbooks:

1. Janat Shah, Supply Chain Management – Text and Cases, Pearson Education, 5 th edition, 2012.
2. Sunil Chopra and Peter Meind l, Supply Chain Management-Strategy Planning and Operation, PHI Learning / Pearson Education, 5 th edition, 2012.

References:

1. Ballou Ronald H, Business Logistics and Supply Chain Management, Pearson Education, 5 th edition, 2013.
2. David Simchi-Levi, Philip Kaminsky, Edith Simchi-Levi, Designing and Managing the Supply Chain: Concepts, Strategies, and Cases, Tata McGraw-Hill,3 rd edition, 2007.
3. Altekar Rahul V, Supply Chain Management-Concept and Cases, PHI, 3 rd edition, 2005.
4. Shapiro Jeremy F, Modeling the Supply Chain, Thomson Learning, Second Reprint, 2013.
5. Joel D. Wisner, G. Keong Leong, Keah-Choon Tan, Principles of Supply Chain Management A Balanced Approach, South-Western, Cengage Learning, 3rd edition, 2011

Online Educational Resources:

1. **MITx (on edX):** The Supply Chain Management MicroMasters® Program covers fundamental concepts, analytics, design, and technology. It includes courses like Supply Chain Fundamentals and Supply Chain Design.
2. **Coursera:** Supply Chain Logistics (Rutgers University) focuses on transportation, warehousing, and inventory, and the Operations Management Specialization (Wharton, University of Pennsylvania) covers operations and business flow.

Assessment

- CAT
- End Semester Examination (ESE)

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**		**Internal Expert(s)**
Velumani R.N, Head – Employee Relations, Ashok Leyland	Dr D Jebakani, Professor, GCE Tirunelveli		Deepak N, Program Manager, Forge
Recommended by BoS on	14/08/2024		
Academic Council Approval	No.27	**Date**	24.08.2024

24TME003	NEW PRODUCT STRATEGIES	L	T	P	J	C
		3	0	0	0	3
Elective		SDG	4, 8 & 9			

Pre-requisite courses	NA	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	To equip students with the necessary tools and methodologies for identifying market gaps and generating innovative product ideas.
2	To enable students to define the layered architecture of product design and development, specifying requirements for hardware, software, and their seamless integration.
3	To guide students in understanding the strategic approach to managing a product or service across its entire lifecycle, from initial discovery to market growth.
4	To familiarize students with the principles and benefits of the agile methodology in the context of modern product development.
5	To empower students with the skills to create a comprehensive roadmap for a new product and to predict its future evolution and growth trajectory.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Apply tools & techniques to identify new opportunities and develop new ideas	Ap
CO 2	Determine the layers in the design & development of the product, with specific classification on the requirements on software, hardware and integration.	An
CO 3	Explain the approach for any product/services throughout its lifecycle - discovery, development, manage & market	An
CO 4	Discuss the advantages of agile product development	Ap
CO 5	Develop a roadmap for a new innovative product and predict its evolution & growth.	C

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research/investigation and work to solve practical problems.	Write and present a substantial technical report/document.	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.	Apply their capabilities acquired in technology management to identify and integrate business solutions that would enhance internal efficiency and external market growth across various sectors.	Adapt and work efficiently with multidisciplinary teams across various organizational levels.	Exhibit an ethical and responsible behaviours in all business decisions throughout their life.
1	2	2		2	2	
2			2	3		
3				3	2	
4	2	2		2		
5	2			2	2	

Course Content

Understanding concept of New Product How to Come Up with New Product Ideas - What is a New Product? Is it a New feature on an existing product? A new add-on to an existing product? A brand-new company? A sister product? Learn to understand, observe the market, client, the technology, and the limitations and solve an existing problem for people.	**10 Hours**
Deep Dive into Solutions Components Deep Dive into Solutions Components- Advantages and Disadvantages of a S/W only product, Open Source issues, IP Protection Issues, Cloud Vs. On-Premise - Advantages and Disadvantages of a H/W only product, issues of manufacturing, lead time, forecasting, Inventory, and supply chain - migration strategies from one to the other.	**10 Hours**
Deep Dive into Business Solutions Deep Dive into Business Solutions-Introduction to all 5 types: Product, PAAS, Service, Service-As-A-Result, Results only. Product: upfront recognition of revenue Vs. Delayed gratification. Product as a service: Reuse of product downstream. Service: Pay as you go, Time of use model, Downside of cost recovery. Service - as a - Results: Frictionless customer	**10 Hours**
Which Strategy Is Right for You? Which Strategy is right for you? Manage the operations across the entire supply chain from associating with the vendors, sourcing components to meet the	**15 Hours**

requirements, handle delivery and logistic operations, identify and return defective parts, etc and also build stronger linkages with supply-chain to optimise working capital needs. Sense opportunities by identifying where profit will be as your industry evolves and determine which operations are critical to be done in-house and which operations can be outsourced.	

Theory Hours: 45	Tutorial Hours:	Practical Hours:	Project Hours:	Total Hours: 45

Learning Resources

Textbooks:

1. Founders at Work: Stories of Startups' Early Days" by Jessica Livingston, 2007

References:

1. Crossing the Chasm - A Book by Geoffrey Moore, 1991

Online Educational Resources:

1. **Coursera & edX:** Digital Product Management Specialization (University of Virginia) covers product roadmaps and agile development. The Innovation Through Design course from the University of Sydney is excellent for ideation and design thinking. For hardware and software specifics, look for courses within specializations like Engineering and Product Design Processes (Arizona State University).
2. **Stanford Online & University of Cambridge:** The Mastering Generative AI for Product Innovation course from Stanford is a great example of advanced product development. The University of Cambridge's Product-Technology Roadmapping course is a fantastic resource for learning to build a new product roadmap and predict its evolution.

Assessment

- CAT
- End Semester Examination (ESE)

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
S Ravichandran, AGM, Ashok Leyland	Dr. Mani Bharathi, Professor, GCE Salem	Dr Mahesh V, AVP, Forge
Recommended by BoS on	14/08/2024	
Academic Council Approval	No.27	**Date** 24.08.2024

24TME004	ARTIFICIAL INTELLIGENCE	L	T	P	J	C
		3	0	0	0	3
Elective		SDG	4, 8 & 9			

Pre-requisite courses	NA	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	To provide students with a foundational understanding of the core principles of artificial intelligence and its common applications to enable the identification of problems suitable for AI solutions.
2	To guide students in selecting and justifying the most appropriate AI methodologies, such as machine learning, deep learning, or expert systems, to address a given problem.
3	To equip students with the ability to translate a real-world problem into a formal structure or framework compatible with various AI models.
4	To enable students to implement and evaluate fundamental AI algorithms, building a practical skill set in AI development.
5	To help students articulate and summarize the essential role of artificial intelligence in enhancing the autonomy, perception, and decision-making capabilities of robotic systems.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Identify problems that are amenable to solution by AI methods.	Ap
CO 2	Identify appropriate AI methods to solve a given problem.	An
CO 3	Formalize a given problem in the language/framework of different AI methods.	An
CO 4	Implement basic AI algorithms.	Ap
CO 5	Summarize the need for AI in Robotics	C

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research/investigation and work to solve practical problems.	Write and present a substantial technical report/document.	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.	Apply their capabilities acquired in technology management to identify and integrate business solutions that would enhance internal efficiency and external market growth across various sectors.	Adapt and work efficiently with multidisciplinary teams across various organizational levels.	Exhibit an ethical and responsible behaviours in all business decisions throughout their life.
1	2			3	2	
2			2	3		
3		2		3	2	
4	2			3	2	
5	2			3	2	

Course Content

Introduction to AI and Production Systems Introduction to AI-Problem formulation, Problem Definition -Production systems, Control strategies, Search strategies. Problem characteristics, Production system characteristics - Specialized production system- Problem solving methods - Problem graphs, Matching, Indexing and Heuristic functions -Hill Climbing-Depth first and Breath first, Constraints satisfaction - Related algorithms, Measure of performance and analysis of search algorithms.	**9 Hours**
Representation Knowledge Game playing - Knowledge representation, Knowledge representation using Predicate logic, Introduction to predicate calculus, Resolution, Use of predicate calculus, Knowledge representation using other logic-Structured representation of knowledge.	**9 Hours**
Knowledge Inference Knowledge representation -Production based system, Frame based system. Inference - Backward chaining, Forward chaining, Rule value approach, Fuzzy reasoning - Certainty factors, Bayesian Theory-Bayesian Network-Dempster - Shafer theory	**9 Hours**
Learning Forms of learning – Knowledge in learning – Statistical learning methods –reinforcement learning, communication, perceiving and acting, Probabilistic language processing, perception.	**9 Hours**
AI In Robotics	**9 Hours**

Robotic perception, localization, mapping- configuring space, planning uncertain movements, dynamics and control of movement, Ethics and risks of artificial intelligence in robotics	

Theory Hours: 45	Tutorial Hours:	Practical Hours:	Project Hours:	Total Hours: 45

Learning Resources

Textbooks:

1. Kevin Night and Elaine Rich, Nair B., "Artificial Intelligence (SIE)", Mc Graw Hill 2008
2. Dan W. Patterson, "Introduction to AI and ES", Pearson Education, 2007.
3. David Jefferis, "Artificial Intelligence: Robotics and Machine Evolution", Crabtree Publishing Company, 19992
4. Peter Jackson, "Introduction to Expert Systems", 3 rd Edition, Pearson Education, 2007.

References:

1. Stuart Russel and Peter Norvig "AI – A Modern Approach", 2 nd Edition, Pearson Education 2007.
2. Deepak Khemani "Artificial Intelligence", Tata Mc Graw Hill Education 2013.

Online Educational Resources:

1. **Coursera:** *AI For Everyone* (DeepLearning.AI), *Introduction to Artificial Intelligence (AI)* (IBM), and *AI for Autonomous Vehicles and Robotics* (University of Michigan).
2. **NPTEL:** *Robotics* (IIT Kharagpur) and *Intelligent Control of Robotic Systems* (IIT Roorkee).
3. **edX:** *CS50's Introduction to Artificial Intelligence with Python* (Harvard University) and *Machine Learning with Python: From Linear Models to Deep Learning* (MIT).

Assessment

- CAT
- End Semester Examination (ESE)

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Velumani R.N, Head – Employee Relations, Ashok Leyland	Dr S Supriya, Professor, GCE Tirunelveli	Aravind A, Specialist, Forge
Recommended by BoS on	14/08/2024	
Academic Council Approval	No.27	**Date** 24.08.2024

24TME005	BLOCK CHAIN TECHNOLOGY	L	T	P	J	C
		3	0	0	0	3
Elective		SDG	4, 8 & 9			

Pre-requisite courses	NA	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	**To provide students with a foundational understanding** of the secure and efficient transaction processes on the Bitcoin blockchain.
2	**To equip students with the knowledge** to identify and analyze the practical applications of Bitcoin Script for various use cases.
3	**To provide students with practical, hands-on experience** in the process and underlying principles of Bitcoin mining.
4	**To guide students through the process** of developing a private blockchain environment and creating a smart contract on the Ethereum platform.
5	**To familiarize students with the architectural components** of Hyperledger and the various consensus mechanisms applied within the Hyperledger ecosystem.

Course Outcomes		
After successful completion of this course, the students shall be able to		**Revised Bloom's Taxonomy Levels (RBT)**
CO 1	Discover the secure and efficient transactions with Bitcoin	Ap
CO 2	Identify and analyze the applications of Bitcoin script	An
CO 3	Experiment with Bitcoin mining	An
CO 4	Develop private Block chain environment and develop a smart contract on Ethereum	Ap
CO 5	Build the Hyperledger architecture and the consensus mechanism applied in the Hyperledger	C

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research/investigation and work to solve practical problems.	Write and present a substantial technical report/document.	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.	Apply their capabilities acquired in technology management to identify and integrate business solutions that would enhance internal efficiency and external market growth across various sectors.	Adapt and work efficiently with multidisciplinary teams across various organizational levels.	Exhibit an ethical and responsible behaviours in all business decisions throughout their life.
1	2			2	2	
2			2	2		
3					2	
4	2	3		3	2	
5		2		3	2	

Course Content

Cryptocurrency and Blockchain - Introduction Cryptography and Cryptocurrency- Anonymity and Pseudonymity in Cryptocurrencies-Digital Signatures-Crypto currency Hash Codes. Distributed networks-Block chain- An Introduction Distinction between databases and Block chain- Distributed Ledger-Block chain ecosystem - Block chain structure- Block chain technology- Working -Permissioned and permission-less Block chain	**9 Hours**
Bitcoin and Blockchain Bitcoin – history- Bitcoin- usage, storage, selling, transactions, working- Invalid Transactions- Parameters that invalidate the transactions- Scripting language in Bitcoin Applications of Bitcoin script- Nodes and network of Bitcoin- Bitcoin ecosystem	**9 Hours**
Bitcoin Mining Purpose of mining- Algorithm used in mining- Mining hardware- Bitcoin mining pools- cloud mining of Bitcoin -Mining Incentives-Security and centralizations	**9 Hours**
Ethereum The Ethereum ecosystem, DApps and DAOs - Ethereum working- Solidity- Contract classes, functions, and conditionals- Inheritance & abstract contracts- Libraries- Types & optimization of Ether- Global variables- Debugging- Future of Ethereum- Smart Contracts on Ethereum different stages of a contract deployment- Viewing Information about blocks in Blockchain Developing smart contract on private Blockchain- Deploying contract from web and consol	**9 Hours**

Hyperledger Hyperledger Architecture- Consensus- Consensus & its interaction with architectural layers - Application programming interface- Application model -Hyperledger frameworks - Hyperledger Fabric -Various ways to create Hyperledger Fabric Blockchain network- Creating and Deploying a business network on Hyperledger Composer Playground- Testing the business network definition- Transferring the commodity between the participants	**9 Hours**

Theory Hours: 45	**Tutorial Hours:**	**Practical Hours:**	**Project Hours:**	**Total Hours: 45**

Learning Resources

Textbooks:

1. Mastering Bitcoin: Unlocking Digital Cryptocurrencies, by Andreas M Antonopoulos 2018

References:

1. Ethereum: Blockchains, Digital Assets, Smart Contracts, Decentralized Autonomous Organizations-2016.

Online Educational Resources:

1. **Coursera:** Bitcoin and Cryptocurrency Technologies (Princeton University) provides a foundational overview of Bitcoin, including its transaction process and mining. The Blockchain Basics course (University at Buffalo) is great for both Bitcoin and Ethereum, with hands-on exercises for creating an Ethereum test chain and smart contracts.
2. **edX:** The Blockchain Fundamentals Professional Certificate (UC Berkeley) has a dedicated course on Bitcoin and cryptocurrencies. For a deeper dive into smart contracts, the IBM: Blockchain Frameworks & Platforms course covers developing with Solidity on Ethereum.

Assessment

- CAT
- End Semester Examination (ESE)

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Sankar S, Dy-Manager, Ashok Layland	Dr S Supriya, Professor, GCE Tirunelveli	Dinesh S, Manager, Forge
Recommended by BoS on	14/08/2024	

Academic Council Approval	No.27	Date	24.08.2024

24TME006	INDUSTRIAL SUSTAINABILITY	L	T	P	J	C
		3	0	0	0	3
Elective		SDG	4, 8 & 9			

Pre-requisite courses	NA	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	To enable students to comprehend and articulate the key factors and facilitating elements that drive industrial sustainability.
2	To foster students' understanding and appreciation of how cutting-edge technologies are instrumental in achieving industrial sustainability goals.
3	To equip students with the ability to delineate and describe the various systems and methodologies employed in conducting a Life Cycle Analysis (LCA).
4	To develop students' understanding and appreciation of the significant benefits and advantages offered by Clean and Lean Manufacturing practices.
5	To guide students in recognizing the opportunities and challenges presented by Corporate Social Responsibility (CSR) and to prepare them to strategically leverage these for organizational and individual benefit.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Understand the drivers and enablers of Industrial Sustainability	Ap
CO 2	Appreciate the advanced technologies in implementation of Industrial Sustainability	An
CO 3	Able to outline the various systems used in a Life Cycle Analysis	An
CO 4	Appreciate the power of Clean and Lean Manufacturing	Ap
CO 5	Understand the opportunities, challenges brought about by Corporate Social Responsibility and how organizations and individuals should prepare to reap the benefits	C

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research/investigation and work to solve practical problems.	Write and present a substantial technical report/document.	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.	Apply their capabilities acquired in technology management to identify and integrate business solutions that would enhance internal efficiency and external market growth across various sectors.	Adapt and work efficiently with multidisciplinary teams across various organizational levels.	Exhibit an ethical and responsible behaviours in all business decisions throughout their life.
1	2				2	
2	2		2	3		
3				2	2	
4			2			
5		2			2	2

Course Content

Introduction to Life Cycle Analysis Goal Definition & Scoping – Inventory Analysis – Impact Assessment – Interpretation – Full Cost Accounting - Pollution Prevention – Elimination of Downtime – Relation between Lean Manufacturing & Waste Reduction – Ambition of No waste.	**9 Hours**
Waste – Value Stream Mapping (VSM) Identification of waste through VSM – Timelines – Material Lines – Future state maps - Source Reduction & Reuse – Recycling & Compositing – Energy Recovery - Disposal -	**9 Hours**
Beyond Traditional 3R's Reduce – Reuse – Recycle; New Age 3 R's – Rethink – Reject – Recover - Economic Imperative – Energy Security – Environmental Impacts – Energy Efficiency Opportunities – Energy Auditing	**9 Hours**
How Manufacturers Pay for Energy Fuel Costs – Consumption charges – Demand charges – Transmission charges – Power Factor Adjustments – Fuel Adjustment Charges	**9 Hours**
Corporate Social Responsibility Stakeholder Theory – Institutional Theory – Partnerships with NGOs – Dow Jones Sustainability – FSTE4Good – Social Report & Accounting – Shift towards Environmental, Social and Corporate Governance (ESG)	**9 Hours**

Theory Hours: 45	Tutorial Hours:	Practical Hours:	Project Hours:	Total Hours: 45

Learning Resources
Textbooks:
1. Salah M. El -Haggar, “Sustainable industrial Development and Waste Management”, Elsiever, 2007.
References:
1. Gabrie Ibrahim, “Sustainability in Manufacturing Enterprises,” Springer, 2016
Online Educational Resources:
1. **edX:** The **Circular Bio-Economy** MicroMasters program from Wageningen University covers both the business and operational aspects of sustainability. MIT's **Sustainability: Strategies and Opportunities for Industry** course provides a broad view of applying sustainable strategies in business. 2. **NPTEL:** *Sustainability through Green Manufacturing Systems: An Applied Approach* covers core concepts, Life Cycle Analysis (LCA), and Lean Manufacturing. 3. **Coursera:** *Global Sustainability and Corporate Social Responsibility: Be Sustainable* (Macquarie University) and *Corporate Sustainability: Understanding and Seizing the Strategic Opportunity* (Università Bocconi).

Assessment
● CAT ● End Semester Examination (ESE)

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
Jagadeesh B, Sr. Manager, Ashok Leyland	Dr D Jebakani, Professor, GCE Tirunelveli	Dr Mahesh V, AVP, Forge	
Recommended by BoS on	14/08/2024		
Academic Council Approval	No.27	**Date**	24.08.2024

24TME007	SUPPLY CHAIN AND PROCUREMENT SUSTAINABILITY	L	T	P	J	C
		3	0	0	0	3
Elective		SDG	4, 8 & 9			

Pre-requisite courses	NA	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	To enable students to comprehend and analyze the key factors and facilitating elements that drive supply chain sustainability.
2	To foster students' understanding and appreciation of how "smart" technologies and methodologies are implemented in FMCG supply chain, inventory, and logistics to enhance efficiency and sustainability.
3	To equip students with the ability to identify and outline various sustainable systems and practices applicable within a manufacturing industry context.
4	To develop students' understanding and appreciation of the critical role of carbon strategies in mitigating climate change within industrial operations.
5	To guide students in recognizing the opportunities and challenges associated with supply chain and procurement sustainability, and to prepare them to strategically address these for organizational and individual benefit.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Understand the drivers and enablers of Supply chain Sustainability	Ap
CO 2	Appreciate the smartness in FMCG Supply chain, Inventory and Logistics	An
CO 3	Able to outline the various sustainable systems used in a manufacturing industry	Ap
CO 4	Appreciate the power of carbon strategies to fight climate change	Ap
CO 5	Understand the opportunities, challenges brought about by Supply chain and Procurement Sustainability and how organizations and individuals should prepare to reap the benefits	An

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research/investigation and work to solve practical problems.	Write and present a substantial technical report/document.	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.	Apply their capabilities acquired in technology management to identify and integrate business solutions that would enhance internal efficiency and external market growth across various sectors.	Adapt and work efficiently with multidisciplinary teams across various organizational levels.	Exhibit an ethical and responsible behaviours in all business decisions throughout their life.
1				3	2	
2	2		2	3		
3				3	2	
4		2			2	
5	2				2	2

Course Content

Introduction to Supply Chain Management Fundamentals of Supply chain – Customer Management processes – Demand Management Processes - Supply chain structure design – Supply chain uncertainty – Supply chain complexity – Evaluation of Supply chain strategy – Information flow design – Risk and Resilience development in Supply chains – Integration of Sustainability with Supply chain procurement.	**9 Hours**
Green Purchasing Fundamentals Design for environment principles - International green labelling – Ecolabels – Green Information systems – Green product standards -Environmentally preferred purchasing - Green purchasing program development – Principles and standards for Procuring sustainably – BS 8903 – ISO 20400 – Drivers for Sustainable Procurement – Setting Sustainable Procurement Priorities – Sustainable Procurement Plan and Policy – Sustainable Risk assessment – Adoption of sustainable practices in Product design – Ethical Sourcing – Manufacturing – Packaging – Transportation – Warehousing and storage – Wholesale and retail trade – Consumption and customer service – End use – Green reverse logistics.	**9 Hours**
Carbon Strategies Climate strategy and Carbon policy - Supporting GHG emission reduction - Tools for tracking emissions – Carbon Mapping – Carbon footprint – Logistics and Transport Sector Carbon footprint – Total supply chain Carbon footprint – Assessing Value chain emissions – Carbon Emissions Modelling – ISO 14000 – Emission Vs Performance –Emission laws – Waste management – Closed Loop Supply Chain – Concepts and Characteristics – Carbon efficient supply chains – Supply chain decarbonization – Enabling Low Carbon Production – Optimized Networks – Energy Efficient Buildings – Packaging design initiatives – Modal	**9 Hours**

Switches in Transportation – Nearshoring – Carbon Offsetting – Increased Home Delivery – Carbon labelling.	
Green Logistics and Transportation Logistical factors in green Transportation - Energy efficiency in 3PL operations – EPA smart-way program – Changing Internal Company Practices – Impacting Supply chain practices – Environmental Logistic Performance Index – Oil intensity – Emissions Intensity – Transportation modes – Green Transportation Challenges – Reverse Logistics – Renewable Energy & Biofuels – Hybrid Vehicles.	**9 Hours**
Selection Criteria for Sustainable Vendors Sustainable selection criteria – Supplier pre-qualification – Criteria for proposal/tender evaluation – Whole life costing techniques – Developing Key Performance Indicators (KPI) – Upstream partners – Downstream partners – Economic, Social, Environmental and Financial Factors.	**9 Hours**

Theory Hours: 45	**Tutorial Hours:**	**Practical Hours:**	**Project Hours:**	**Total Hours: 45**

Learning Resources

Textbooks:

1. Joelle Moranna, "Sustainable Supply Chain Management," Wiley books, 2013.

References:

1. Bouchery**,** Y., Corbett**,** C.J., Fransoo, J.C., Tan**,** T. (Eds.): Sustainable Supply Chains: A Research based text book on Operations and Strategy

Online Educational Resources:

1. **edX:** The **Circular Bio-Economy** MicroMasters® Program from Wageningen University directly addresses sustainability drivers and strategies in supply chains.
2. **Coursera:** The *Sustainable Supply Chain Management and Logistics* course from the University of California, Irvine, covers the fundamentals and provides a framework for integrating sustainability.

Assessment

- CAT
- End Semester Examination (ESE)

Course Curated by

Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**
S Ravichandran, AGM, Ashok Leyland	Dr. Mani Bharathi, Professor, GCE Salem	Deepak N, Program Manager, Forge
Recommended by BoS on	14/08/2024	
Academic Council Approval	No.27	**Date** 24.08.2024

24TME008	TEXTILE SUSTAINABILITY AND INNOVATON	L	T	P	J	C
		3	0	0	0	3
Elective		SDG	4, 8 & 9			

Pre-requisite courses	NA	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	To provide students with a comprehensive understanding of the foundational concepts and principles that define sustainable textiles.
2	To foster students' appreciation for and ability to articulate the critical importance of sustainable textiles and their business implications.
3	To equip students with the necessary skills and knowledge to design and effectively implement sustainable textile systems.
4	To guide students in developing practical, hands-on skills for the implementation and management of sustainable textile practices in various business contexts.
5	To enable students to understand and apply how Artificial Intelligence and Machine Learning can be leveraged to transform and enhance sustainable practices within the textile industry.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Demonstrate a thorough understanding of Sustainable Textile Concepts	Ap
CO 2	Appreciate the importance of Sustainable Textile and its implications to different businesses.	An
CO 3	Be able to design and implement successful Sustainable Textile systems	An
CO 4	Develop practical skills in the implementation and management of Sustainable Textile practices across different business domains.	Ap
CO 5	Transform Sustainable Textile with Artificial Intelligence / Machine Learning	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research/investigation and work to solve practical problems.	Write and present a substantial technical report/document.	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.	Apply their capabilities acquired in technology management to identify and integrate business solutions that would enhance internal efficiency and external market growth across various sectors.	Adapt and work efficiently with multidisciplinary teams across various organizational levels.	Exhibit an ethical and responsible behaviours in all business decisions throughout their life.
1				3	2	2
2			2	3		
3				3	2	
4	2		2	3	2	2
5	2	2		3	2	

Course Content

Introduction to Sustainable Fashion Agendas of Sustainable Fashion – Social Agenda – Economic Agenda – Economic agenda – Cultural Agenda; Critical Planetary Boundaries – Sustainable Development Goals	**9 Hours**
Hazard Assessment of Effect & Process Chemicals Behaviour of Textile Chemicals in Waste water and Sewage sludge treatment – Waste water relevant characteristics of textile chemicals – Biodegradability or eliminability of textile chemicals	**9 Hours**
Usage and Production of Fibre From Renewable Sources Manmade Cellulosic fibres – Synthetic Fibres from Vegetable oil/starch – Biopolymers – Production Modification – Usage of Textile Chemicals from Biopolymers – Biofuel based Auxiliaries – Natural dyestuffs.	**9 Hours**
Certifications / Eco-Labels Voluntary Certification Schemes for Textile raw materials, textile chemicals and textile products – Cradle to Cradle – Bluesign – Global Organic Textile Standard (GOTS) – OEK – TEX 100 – Biopreffered;	**9 Hours**
Designing of Sustainable Fashion Concepts & Approaches – Dematerialization – Durability – Zero waste – Disassembly – Up-cycling – Mon-materiality.	**9 Hours**

Theory Hours: 45	Tutorial Hours:	Practical Hours:	Project Hours:	Total Hours: 45

Learning Resources

Textbooks:

1. Muthu, Subramanian Senthilkannan, Gardetti, Miguel Ángel, "Sustainability in the Textile and Apparel Industries: Sustainable clothing, Clothing Design and Repurposing", Springer, 2020.

References:

1. Kate Fletcher, "Sustainable Fashion and Textiles: Design Journeys," Earthscan, 2008

Online Educational Resources:

1. **Coursera:** The Sustainable Textile Manufacturing course focuses on the production chain from raw materials to final product, including sustainable solutions. The Sustainable Fashion course (Copenhagen Business School) provides a good overview of sustainability within the fashion industry, which is directly relevant to textiles.
2. **NPTEL:** The Textile Product Design and Development course offers a strong foundation in textile properties and materials, which is key to understanding sustainability. Another relevant course is Science of Clothing Comfort which touches on material properties.
3. **edX:** The Circular Fashion Management - Building Sustainable Value Chains course from SDA Bocconi provides a framework for integrating sustainable practices.

Assessment

- CAT
- End Semester Examination (ESE)

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
S Ravichandran, AGM, Ashok Leyland	Dr S Supriya, Professor, GCE Tirunelveli	Charath C, Specialist, Forge

Recommended by BoS on	14/08/2024		
Academic Council Approval	No.27	**Date**	24.08.2024

24TME009	CIRCULAR ECONOMY FOR ENTERPRISE INNOVATION	L	T	P	J	C
		3	0	0	0	3
Elective		SDG	4, 8 & 9			

Pre-requisite courses	NA	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	To provide students with a comprehensive understanding of the foundational concepts, principles, and business models that define the circular economy.
2	To foster students' appreciation for and ability to articulate the critical importance of the circular economy and its strategic implications for various business sectors.
3	To equip students with the necessary skills and knowledge to design and effectively implement successful circular economy systems and strategies.
4	To guide students in developing practical, hands-on skills for implementing and managing circular economy practices across different business domains.
5	To enable students to understand and apply how Artificial Intelligence and Machine Learning can be leveraged to transform and enhance circular economy models.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Demonstrate a thorough understanding of Circular Economy Concepts	Ap
CO 2	Appreciate the importance of Circular Economy and its implications to different businesses.	An
CO 3	Be able to design and implement successful Circular Economy systems	An
CO 4	Develop practical skills in the implementation and management of Circular Economy practices across different business domains.	C
CO 5	Apply AL&ML to transform and enhance circular economy models.	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research/investigation and work to solve practical problems.	Write and present a substantial technical report/document.	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.	Apply their capabilities acquired in technology management to identify and integrate business solutions that would enhance internal efficiency and external market growth across various sectors.	Adapt and work efficiently with multidisciplinary teams across various organizational levels.	Exhibit an ethical and responsible behaviours in all business decisions throughout their life.
1				3	2	2
2			2	3		
3				3	2	
4	2		2	3	2	2
5	2	2		3	2	

Course Content

Introduction to Circular Economy Business Value in Circular Economy – Longer Lasting Products – Remanufacturing – Thinking in systems - Design out waste – Design for cyclability – Design for durability	**9 Hours**
Incorporate Digital Technology Data & Insights – Digital Platform - Maximise lifetime of products – INUSE; Maximise lifetime of products - AFTERUSE	**9 Hours**
Collaborate to Create Joint Value Industry Collaboration – Customer/Consumer Collaboration – Government Collaboration – Internal Collaboration – Community Collaboration	**9 Hours**
Priortise Regenerative Resources Regenerative Materials – Regenerative Water – Regenerative Energy	**5 Hours**
Use Waste as A Resource Valorise waste streams – Closed Loop; Valorise waste streams – Open Loop – Energy Recovery from waste - Product Business Models – Service Business Models	**13 Hours**

Theory Hours: 45	Tutorial Hours:	Practical Hours:	Project Hours:	Total Hours: 45

Learning Resources
Textbooks:
1. Walter R. Stahel, "The Circular Economy – A user's guide," Routledge, 2019
References:
1. Ken Webster, "The Circular Economy: A Wealth of Flows – 2nd Edition," EllenMacArthur Foundation, 2015
Online Educational Resources:
1. **Coursera:** The Circular Business Models fostering Sustainability course (from Politecnico di Milano) and the Circular Economy: A Business Approach (from the University of London) are great for understanding the foundational concepts and their business implications. The **Ellen MacArthur Foundation** also has an extensive library of free 2. **edX:** Delft University of Technology offers several courses on circular economy, including Circular Economy: An Introduction and Engineering Design for a Circular Economy.

Assessment
● CAT ● End Semester Examination (ESE)

Course Curated by			
Expert(s) from Industry	**Expert(s) from Higher Education Institution**	**Internal Expert(s)**	
Velumani R.N, Head – Employee Relations, Ashok Leyland	Dr D Jebakani, Professor, GCE Tirunelveli	Dr Mahesh V, AVP, Forge	
Recommended by BoS on	14/08/2024		
Academic Council Approval	No.27	**Date**	24.08.2024

24TME010	INDUSTRIAL DESIGN & DEVELOPMENT	L	T	P	J	C
		3	0	0	0	3
Elective		SDG	4, 8 & 9			

Pre-requisite courses	NA	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	To provide students with a comprehensive understanding of the product lifecycle and the core principles of effective product management.
2	To equip students with the fundamental skills to sketch and design user interfaces (UI) and user experiences (UX) for products and prototypes.
3	To enable students to apply modern digital fabrication techniques for building rapid prototypes.
4	To guide students in the safe and effective use of both hand and power tools for constructing mechanical designs for prototypes.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Understand the product life cycle and management.	U
CO 2	Sketch UI and UX for the product / prototypes	Ap
CO 3	Build rapid prototypes using digital fabrication techniques.	C
CO 4	Use hand and power tools for building mechanical design for prototypes	Ap

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research/investigation and work to solve practical problems.	Write and present a substantial technical report/document.	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.	Apply their capabilities acquired in technology management to identify and integrate business solutions that would enhance internal efficiency and external market growth across various sectors.	Adapt and work efficiently with multidisciplinary teams across various organizational levels.	Exhibit an ethical and responsible behaviours in all business decisions throughout their life.
1				3	2	
2	2	2	2	3		2
3		3	3	2	2	
4	2	3		3	2	

Course Content

Integrated Product Design and Development Product life cycle - Product design process - product requirement analysis - Design for manufacturability - design for testability - BoM Optimization & Alternate Vendor List - Optimization of Product parameters – Product Test Plan Generation - Product Testing, Validation and Qualification - Introduction to product design tools - QFD, Computer Aided Design – Product Enclosure, Thermal and Packaging analysis - Rapid Prototyping: Digital fabrication techniques - 3D printers - Hand and power tools for product development	**12 Hours**
UI and UX [User Interface and User Experience] Fundamental concepts in UI & UX - Tools - Fundamentals of design principles - Psychology and Human factors for User Interface Design - Layout and composition for Web, Mobile and Devices - Typography - Information architecture - Colour theory - Design process flow, bet practices in industry - User engagement ethics - Design alternatives	**12 Hours**
Industrial Design 101 Introduction to Industrial Design - Industrial design innovations - Product design animations - Case studies of Industrial design: iPod, iPhone	**10 Hours**
Product Development Cycle Idea generation - Idea screening - Concept testing - Business analysis - Testing - Quality assurance – Managing the Program and risk analysis	**11 Hours**

Theory Hours: 45	Tutorial Hours:	Practical Hours:	Project Hours:	Total Hours: 45

Learning Resources

Textbooks:

1. Integrated Product Design and Development: The product Realisation Process by Edward B. Magrab

References:

1. Industrial Design A-Z by Peter Fiell, Charlotte Fiell
2. Hackernoon blogs on UI & UX

Online Educational Resources:

1. **Coursera:** The **Product Management Professional Certificate** (from Google) covers the entire product lifecycle, from ideation to launch. For UI/UX, the **UI/UX Design Specialization** (California Institute of the Arts) is highly relevant and focuses on sketching, wireframing, and prototyping for both web and mobile.
2. **Purdue University:** Purdue's **Product Lifecycle Management (PLM) Certificate Program** includes courses on digital product definition and using modern software to manage prototypes throughout their lifecycle.

Assessment

- CAT
- End Semester Examination (ESE)

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
Velumani R.N, Head – Employee Relations, Ashok Leyland	Dr. Mani Bharathi, Professor, GCE Salem	Deepak N, Program Manager, Forge

Recommended by BoS on	14/08/2024		
Academic Council Approval	No.27	**Date**	24.08.2024

24TME011	PROJECT MANAGEMENT	L	T	P	J	C
		3	0	0	0	3
Elective		SDG	4, 8 & 9			

Pre-requisite courses	NA	Data Book / Code book (If any)	NA

Course Objectives:	
The purpose of taking this course is to:	
1	To define and differentiate core project management concepts, including operations, programs, portfolios, and their relationship to strategic planning and organizational structures.
2	To develop students' ability to plan and manage project scope, including collecting requirements, creating Work Breakdown Structures (WBS), and validating/controlling scope effectively.
3	To enable students to master project time management techniques, such as developing network models, sequencing activities, estimating durations, and controlling schedules.
4	To equip students with the skills to estimate and control project costs, understand Earned Value Management (EVM), and interpret performance indices for project success.
5	To introduce students to foundational concepts across other critical project management knowledge areas, including human resources, communication, risk, procurement, and stakeholder management, along with basic software application.

Course Outcomes		
After successful completion of this course, the students shall be able to		Revised Bloom's Taxonomy Levels (RBT)
CO 1	Explain fundamental project management definitions, the roles of key stakeholders, and the impact of organizational structures and cultures on projects.	Ev
CO 2	Create a comprehensive project scope management plan, including a Work Breakdown Structure, and effectively validate and control project scope.	C
CO 3	Construct and manage project schedules using network diagrams, accurately define and sequence activities, and estimate resources and durations.	C
CO 4	Analyze project cost performance using Earned Value Management (EVM) and formulate strategies for cost control and performance	An
CO 5	Identify and describe the basic processes and tools associated with project human resource, communication, risk, procurement, and stakeholder management, and utilize introductory project management software.	Ev

Course Outcomes (CO)	Program Outcomes (PO) (Strong-3, Medium – 2, Weak-1)					
	1	2	3	4	5	6
	Independently carry out research/investigation and work to solve practical problems.	Write and present a substantial technical report/document.	Demonstrate a degree of mastery over the area as per the specialization of the program. The mastery should be at a level higher than the requirements in the appropriate bachelor program.	Apply their capabilities acquired in technology management to identify and integrate business solutions that would enhance internal efficiency and external market growth across various sectors.	Adapt and work efficiently with multidisciplinary teams across various organizational levels.	Exhibit an ethical and responsible behaviours in all business decisions throughout their life.
1				3	2	2
2		2	2	3		2
3		2	2	3	2	
4	2	2	3	2	2	
5	2	2		3	2	2

Course Content

Project Management Introduction Definition - Operations and Project Management - Program Management - Portfolio Management - Projects and Strategic Planning - Project Management Office - Role of Project Manager –Processes and Processes Groups –Project Team – Project Life Cycle – Stakeholders - Deliverables – Milestone - Organizational Structures - Organizational - Enterprise Environmental Factors - Project Charter	**9 Hours**
Project Scope Management Define Scope - Project Management Plan - Project Scope Management Processes - Plan Scope Management - Collect Requirements - Create WBS – Work packages - Validate Scope – Control Scope	**9 Hours**
Project Time & Cost Management Network models - Project Time Management Processes - Plan Schedule Management - Define Activities - Sequence Activities - Estimate Activity Resources— Estimate Activity Durations - Develop Schedule- Control Schedule - Managing Project Cost - Plan Cost Management - Estimate Costs— Determine Budget – Control cost – Earned Value Management.	**12 Hours**
Project Quality Management Quality definition – Project Quality Management- Quality Assurance Control	**6 Hours**

Quality, Tools and Techniques	
Basics of Other Knowledge Areas Project Human Resource Management – Project Communication Management - Project Risk Management - Project Procurement Management – Project Stakeholder Management - Introduction and basic concepts - Introduction to Project software	**9 Hours**

Theory Hours: 45	**Tutorial Hours:**	**Practical Hours:**	**Project Hours:**	**Total Hours: 45**

Learning Resources

Textbooks:

1. A. Chandrasekaran, 2013, Road to Success, Info career Pvt. Ltd., 2nd Edition

References:

1. Joseph Phillips, 2013, Project Management Professional, Tata McGraw Hill Ltd.,4th edition

Online Educational Resources:

1. **Coursera:** The **Google Project Management Professional Certificate** covers all the foundational knowledge areas, including scope, time, cost, and quality management. It is ideal for practical application.
2. **edX:** The **Project Management MicroMasters® Program** from Rochester Institute of Technology provides a comprehensive look at planning, scheduling, and controlling projects using industry-standard tools and techniques.
3. **LinkedIn Learning:** Offers specific courses on **Microsoft Project** for hands-on experience, such as MS Project Essential Training.

Assessment

- CAT
- End Semester Examination (ESE)

Course Curated by

Expert(s) from Industry	Expert(s) from Higher Education Institution	Internal Expert(s)
S Ravichandran, AGM, Ashok Leyland	Dr. Mani Bharathi, Professor, GCE Salem	Deepak N, Program Manager, Forge

Recommended by BoS on	14/08/2024		
Academic Council Approval	No.27	**Date**	24.08.2024