Curriculum for M.Tech

Mechanical Engineering with Specialization in Smart Manufacturing

From The Academic Year 2025

(Approved in Senate 61)

Indian Institute of Information Technology Design and Manufacturing, Kancheepuram
Chennai-600 127

Semester 1					
Category	**Course Name**	**L**	**T**	**P**	**C**
PCC	Data Science	3	0	2	4
PCC	Manufacturing Systems Engineering	3	0	2	4
PCC	Manufacturing Automation	3	1	0	4
PCC	Manufacturing Automation Practice	0	0	4	2
PCC	Additive and Hybrid Manufacturing Processes	3	0	2	4
PEC	Program Elective Course 1	3	1	0	4
					22
Semester 2					
Category	**Course Name**	**L**	**T**	**P**	**C**
PCC	IIOT and Information Systems in Manufacturing	3	0	2	4
PCC	Sustainable Manufacturing	3	0	2	4
PEC	Program Elective Course 2	3	1	0	4
PEC	Program Elective Course 3	3	1	0	4
PEC	Program Elective Course 4	3	1	0	4
PEC	Program Elective Course 5	3	1	0	4
					24
Summer					
PCD	M Tech Dissertation (MTD) Phase I	0	0	8	4
					4
Semester 3					
Category	**Course Name**	**L**	**T**	**P**	**C**
PCD	M Tech Dissertation (MTD) Phase II	0	0	24	12
					12
Semester 4					
Category	**Course Name**	**L**	**T**	**P**	**C**
PCD	M Tech Dissertation (MTD) Phase III	0	0	28	14
					76

Semester wise Credit Distribution	**Credits**						
Category	**S1**	**S2**	**Summer**	**S3**	**S4**	**Total**	**%**
Program Core Course (PCC)	18	8	0	0	0	26	34.2
Program Elective Course (PEC)	4	16	0	0	0	20	26.3
Professional Career Development (PCD)	0	0	4	12	14	30	39.5
Total	22	24	4	12	14	76	100
Cumulative Credits	**22**	**46**	**50**	**62**	**76**	**76**	

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY
DESIGN AND MANUFACTURING (IIITDM) KANCHEEPURAM

<table>
<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Data Science</td></tr>
<tr><td rowspan="2">Dept./Faculty proposing the course</td><td rowspan="2">ME</td><td rowspan="2">Structure (LTPC)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>3</td><td>0</td><td>2</td><td>4</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">M.Tech:
ME(IMSD)/ME(SM)</td><td>Type</td><td colspan="2">Core ■</td><td colspan="2">Elective □</td></tr>
<tr><td>Status</td><td colspan="2">New ■</td><td colspan="2">Modification □</td></tr>
<tr><td>Pre-requisite</td><td></td><td colspan="3">Submitted for approval</td><td colspan="2">Senate 62</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">This course covers the basic concepts of Data Science to help the student to learn, understand and practice data analytics encompassing concepts from descriptive, inferential statistics and predictive techniques and big data concepts.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">• Ability to identify the characteristics of datasets
• Ability to select and implement machine learning techniques suitable for the respective application
• Ability to solve problems associated with big data characteristics such as high dimensionality
• Ability to integrate machine learning libraries and mathematical and statistical tools</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours for L/T/P)</td><td colspan="6">Introduction to data science and relevant industry applications in the field of mechanical engineering; quick review of essential mathematics (linear algebra, statistics and probability), introduction to programming platforms (Python, TensorFlow and R) (L6 + P2)
Databases and management: data preprocessing; data cleaning; data exploration; data wrangling; introduction to relational databases (SQL), NoSQL databases (L8 + P4)
Descriptive Statistics: Data visualization & interpretation; measures of central tendency & dispersion; basic and advanced plots; merits & demerits of Interpretation (L7 + P4)
Inferential Statistics: Hypothesis testing; tests of significance; analysis of variance; introduction to regression (L6 + P4)
Predictive Analytics (concept of machine learning): Supervised and unsupervised; association rules, classification, clustering, outlier analysis, time series modelling (L12 + P10)
Big Data Characteristics: Map reduce; deduplication; distributed storage, implementation using Hadoop/Pyspark platforms (L3 + P4)
Term project related to mechanical engineering applications may be pursued throughout the semester along with the regular lab practice. Term project may be discussed during the lab hours</td></tr>
<tr><td>Text Books</td><td colspan="6">1. J Han, J Pei, and H Tong, Data Mining Concepts and Techniques, Elsevier, 4th Edition, 2022. ISBN: 9780128117606
2. J Grus, Data Science from Scratch, O'Reilly Media, Inc. 2nd Edition, 2019. ISBN: 9781492041139</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. P Bruce, A Bruce, P Gedeck, Practical Statistics for Data Scientists, O'Reilly, 2nd Edition, 2019. ISBN: 8194435005
2. A Geron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, O'Reilly Media, 3rd Edition, 2022. ISBN: 9355421982
3. J Leskovec, A Rajaraman, and J D Ullman, Mining of Massive Data Sets, Cambridge University Press, Open-source free version, 3rd edition, 2014. ISBN: 9781316147313</td></tr>
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INDIAN INSTITUTE OF INFORMATION TECHNOLOGY
DESIGN AND MANUFACTURING (IIITDM) KANCHEEPURAM

<table>
<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Manufacturing Systems Engineering</td></tr>
<tr><td rowspan="2">Dept./Faculty proposing the course</td><td rowspan="2">ME</td><td rowspan="2">Structure (LTPC)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>3</td><td>0</td><td>2</td><td>4</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">M.Tech: ME(SM)</td><td>Type</td><td colspan="2">Core ☐</td><td colspan="2">Elective ☐</td></tr>
<tr><td>Status</td><td colspan="2">New ☐</td><td colspan="2">Modification ☐</td></tr>
<tr><td>Pre-requisite</td><td></td><td colspan="2">Submitted for approval</td><td colspan="3">Senate 62</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">• To gain a basic understanding of manufacturing systems and its management, including types of systems, current theories of manufacturing management, including lean thinking, JIT and demand driven manufacturing.
• To develop an understanding of the performance measurement of manufacturing systems through metrics and key performance indicators.
• To analyse manufacturing systems in terms of material flow and storage, information flow using event simulation and Queueing Models</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">• Students will recognize manufacturing systems, including job shops, flow lines, assembly lines, work cells.
• Students will have a basic understanding of performance measurement and management in modern day manufacturing systems.
• Students will have a basic understanding of current manufacturing control theories, such as lean thinking, agile, responsive systems and JIT.
• Students will be able to develop a simulation model to analyse manufacturing systems to improve performance of assembly lines and job shops.</td></tr>
<tr><td>Contents of the course
(With approximate break-up of hours for L/T/P)</td><td colspan="6">Introduction to Manufacturing Systems: Overview, and components of manufacturing systems. Classification of manufacturing industries (L6)
Types of Manufacturing Systems: Single station cells, manual assembly lines, automated production lines, automated assembly systems, group technology and cellular manufacturing, flexible manufacturing cells and systems, Toyota production system. (L18)
Factory Layouts: Types of layouts, systematic layout planning and design (L3)
Production Scheduling: Scheduling process, priority dispatch rules, flow shop and job shop scheduling (L3)
Inventory Control: Inventory control policies, material requirements planning (L3)
Queuing Models: Notation of queues, Key elements, performance measures, The M/M/1 and M/M/m queue, queueing networks (L3)
Simulation of Manufacturing systems: Monte Carlo simulation, system and environment, discrete event simulation (L3)
Intelligent Manufacturing Systems: Introduction to Industry 4.0, digital twins and the role of artificial intelligence in the factory of the future (L3)

Practice: (14 weeks)
Solving queuing problems using simulation techniques, Modelling different types of manufacturing systems, Study the effect of variability on performance of different manufacturing system, Performance analysis of manufacturing cells, Simulation of KANBAN control system, Simulation of push pull production system, Optimization of layouts design, Solving reactive scheduling problems</td></tr>
<tr><td>Text Books</td><td colspan="6">1. M. P. Groover, Automation, Production systems and Computer Integrated Manufacturing. 3rd edition, Pearson Education, 2015. ISBN: 978-9332549814</td></tr>
</table>

	2. K. Hitomi, Manufacturing Systems Engineering. Taylor and Francis, Second Edition, 1996. ISBN: 978-0748403240
Reference Books	1. W. J. Hopp, M. L. Spearman, Factory Physics, 3rd edition, Waveland Press, 2011. ISBN: 978-1577667391 2. R. Askin and C. Standridge, Modeling and Analysis of Manufacturing Systems, 1st edition, John Wiley, 1992. ISBN: 978-0-471-51418-3 3. S. B. Gershwin, Manufacturing Systems Engineering, 1st edition, Prentice Hall PTR, 1993, ISBN: 9780135606087

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY
DESIGN AND MANUFACTURING (IIITDM) KANCHEEPURAM

<table>
<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Manufacturing Automation</td></tr>
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<tr><td>3</td><td>1</td><td>0</td><td>4</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">M.Tech: ME(SM)</td><td>Type</td><td colspan="2">Core ☒</td><td colspan="2">Elective ☐</td></tr>
<tr><td>Status</td><td colspan="2">New ☐</td><td colspan="2">Modification ☒</td></tr>
<tr><td>Pre-requisite</td><td></td><td colspan="2">Submitted for approval</td><td colspan="3">Senate 62</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">• To provide knowledge and exposure in integrated design practices of mechatronic systems in manufacturing automation</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">At the end of the course student will be able to:
• Understand the basic concepts of mechatronic systems in manufacturing automation
• Design of automation systems using various mechatronic elements
• Understand the application of SCADA, DCS, PLC, HMI in manufacturing automation
• Demonstrate integration of various systems and standards in manufacturing automation</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours for L/T/P)</td><td colspan="6">Introduction: Manufacturing Automation – evolution, Review of mechatronics systems, Fundamentals of digital electronics, microprocessors, control systems, and applications. Panel design, switch gears and accessories, panel protection, cable harness assembly, and busbar selection. (L8 + T2)

Design of Mechatronics System: Mechatronics elements –sensors and actuators, ball screws, solenoids, linear actuators and controllers in manufacturing applications. Motion control-variable frequency drive, remote and local operation, Design of drive control panels, Communication interface, Design and simulation of mechatronic systems. (L10 + T3)

PLC & HMI: Fundamentals of PLC and programming languages, Design of alarms and interlocks; Networking of PLC, PLC protection. Introduction of HMI-I/O's, Programming instructions and interface, GUI in HMI. (L8 + T2)

Computer-based Industrial Automation: Direct digital control, Distributed control system, SCADA for manufacturing industries, RTUs, Automation networking, Industrial standard communication protocols, Real-time testing and runtime application. Communication among HMI, PLC, SCADA, Fault diagnostics/troubleshooting, Smart/IIoT sensor, Digital twin, Cybersecurity in automation. (L10 + T3)

Industrial Practices and Case Studies: Integration of robotic systems, vision systems, fluid power systems in manufacturing; Case studies on manufacturing automation and design; Safety considerations, National/International standards. (L8 + T2)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. W Bolton, Mechatronics: Electronics Control Systems in Mechanical and Electrical Engineering, Pearson Education Ltd., 7th Edition, 2018. ISBN-13. 978-1292250977</td></tr>
</table>

	2. J E Carryer, M Ohline and T Kenny, Introduction to Mechatronic Design, Prentice Hall, 2nd edition, 2011. ISBN-13:978-0-13-143356-4
Reference Books	1. D G Alciatore and M B Histand, Introduction to Mechatronics and Measurement Systems, McGraw-Hill, 4th Edition, 2014. ISBN-13: 978-0073380230 2. K Wang, Y Wang, J O Strandhagen and T Yu, Advanced Manufacturing and Automation VIII (Lecture Notes), Springer, 1st Edition, 2019. ISBN-13:978-9811323751 3. R Mehra and V Vij, PLCs & SCADA - Theory and Practice, Laxmi Publications, 2nd edition, 2017. ISBN-13: 978-9381159118 4. J W Webb and R A Reis, Programmable Logic Controllers: Principles and Applications, Prentice Hall Inc., 5th Edition, 2003. ISBN-13:978-0136794080 5. T Bartely, Industrial Automated Systems: Instrumentation and Motion Control, Cengage learning, 2011. ISBN: 9781133721437

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY
DESIGN AND MANUFACTURING (IIITDM) KANCHEEPURAM

<table>
<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Manufacturing Automation Lab</td></tr>
<tr><td rowspan="2">Dept./Faculty proposing the course</td><td rowspan="2">ME</td><td rowspan="2">Structure (LTPC)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
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<tr><td>Status</td><td colspan="2">New ☐</td><td colspan="2">Modification ▬</td></tr>
<tr><td>Pre-requisite</td><td></td><td colspan="3">Submitted for approval</td><td colspan="2">Senate 62</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">• To provide knowledge and exposure in integrated design practices of mechatronic systems in manufacturing automation</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">At the end of the course student will able to:
• Understand the basic concepts of mechatronic systems and implementation in manufacturing automation
• Design of automation systems using various mechatronic elements
• Understand the application of SCADA, DCS, PLC, HMI in manufacturing automation
• Demonstrate integration of various systems in manufacturing automation</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours for L/T/P)</td><td colspan="6">Design and simulation of mechatronic systems for manufacturing applications using CAD packages etc.
Programming and simulation of various microcontrollers and logic gates using Proteus software/ Tinker CAD etc.
Control system simulation in Python tool, MATLAB-Simulink, and LabVIEW.
SCADA, PLC & HMI -Programming, simulation, and implementation using RSlogix, CODESYS, Rapid SCADA, etc.
Design and implementation of manufacturing automation systems using Tecnomatix and other automation-specific software, etc.</td></tr>
<tr><td>Text Books</td><td colspan="6">1. W Bolton, Mechatronics: Electronics Control Systems in Mechanical and Electrical Engineering, Pearson Education Ltd., 7th Edition, 2018. ISBN-13. 978-1292250977
2. J E Carryer, M Ohline and T Kenny, Introduction to Mechatronic Design, Prentice Hall, 2nd edition, 2011. ISBN-13:978-0-13-143356-4</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. D G Alciatore and M B Histand, Introduction to Mechatronics and Measurement Systems, McGraw-Hill, 4th Edition, 2014, ISBN: 978-0073380230
2. K Wang, Y Wang, J O Strandhagen and T Yu, Advanced Manufacturing and Automation VIII (Lecture Notes), Springer, 1st Edition, 2019. ISBN:978-9811323751
3. R Mehra and V Vij, PLCs & SCADA - Theory and Practice, Laxmi Publications, 2nd edition, 2017. ISBN: 978-9381159118
4. J W Webb and R A Reis, Programmable Logic Controllers: Principles and Applications, Prentice Hall Inc., 5th Edition, 2003. ISBN-13:978-0136794080
5. T Bartely, Industrial Automated Systems: Instrumentation and Motion Control, Cengage learning, 2011. ISBN: 9781133721437</td></tr>
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INDIAN INSTITUTE OF INFORMATION TECHNOLOGY DESIGN AND MANUFACTURING (IIITDM) KANCHEEPURAM

<table>
<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Additive and Hybrid Manufacturing Processes</td></tr>
<tr><td rowspan="2">Dept./Faculty proposing the course</td><td rowspan="2">ME</td><td rowspan="2">Structure (LTPC)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>3</td><td>0</td><td>2</td><td>4</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">M.Tech: ME(SM)</td><td>Type</td><td colspan="2">Core ☐</td><td colspan="2">Elective</td></tr>
<tr><td>Status</td><td colspan="2">New ☐</td><td colspan="2">Modification</td></tr>
<tr><td>Pre-requisite</td><td></td><td colspan="3">Submitted for approval</td><td colspan="2">Senate 62</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">• To make the students understand the fundamental principles, process classifications and operational mechanisms of key additive and hybrid manufacturing technologies and thus enables informed techno-commercial decisions for application-specific component manufacturing.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">• At the end of this course, students will be able to differentiate the major additive and hybrid manufacturing processes in terms of working principles, materials used, and application.
• Also the students will be able to evaluate the suitability and performance of additive and hybrid manufacturing processes to use in practice based on mechanical properties, size, cost, and lead time.</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours for L/T/P)</td><td colspan="6">Introduction: Layered Digital Manufacturing, Fundamentals of advanced subtractive manufacturing processes, history and evolution of 3D and 4D additive manufacturing processes, comparison among subtractive, additive, and hybrid additive and formative processes, AM workflow and slicing techniques, Additive manufacturing classification in reference to ASTM F42 standard, Applications in aerospace, automotive, biomedical with example case studies. (L6)

Additive Manufacturing Processes: Details of process mechanism with machine components, materials with case studies - Binder jetting, Material jetting, Vat photo-polymerization (SLA, DLP), Material extrusion (FDM/FFF), Powder bed fusion (SLS, SLM, EBM), Directed energy deposition (DED), Laminated object manufacturing (LOM). Fundamentals of design for additive manufacturing - Topology optimization, Lattice structures and generative design, Support structures and part orientation, Build strategy and file formats (STL, AMF, 3MF). Materials in Additive Manufacturing - Polymers, metals, ceramics, composites, Material properties and selection, Pre-processing and post-processing of materials, Case studies. Practice in Advanced Manufacturing Lab: Fused deposition modelling, Vat photo-polymerization, Powder bed fusion, and Design for additive manufacturing. (L16 + P10)

Hybrid Manufacturing Processes: Advanced subtractive manufacturing processes, Definition and need for hybrid manufacturing processes. Different hybrid additive and hybrid subtractive manufacturing processes. Comprehensive study on Additive Subtractive Hybrid Processes, Additive Formative Process, Additive Inspection process. Electro-Mechanical Hybrid Processes, Mechanical + Ultrasonic Hybrid Processes, Mechanical + Laser Hybrid Processes, Case studies and industrial applications. (L10). Practice in Advanced Manufacturing Lab: Additive-CNC, Electro-Chemical Honing, Mechanical + Ultrasonic Milling/Drilling, and Mechanical + Laser-Assisted Machining. (L10 + P10)

Quality Inspection and Economic Aspects: Surface finish and dimensional accuracy, In-situ monitoring and NDT techniques, Standards (ASTM, ISO) and certifications, Qualification and validation of AM parts, Cost estimation and break-even analysis, Environmental impact and recycling, Comparison with conventional processes, Case studies. Practice in Advanced Manufacturing Lab: Surface finish and dimensional accuracy, and Case studies (L10 + P8)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. J Zhang, and YG Jung, Additive Manufacturing: Materials, Processes, Quantifications and Applications, Butterworth-Heinemann, 1st Edition, 2018. ISBN: 978-0128121559
2. E Celik, Additive Manufacturing: Science and Technology, De Gruyter, 1st Edition, 2020. ISBN: 978-1501518775</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. I Gibson, D Rosen, et al., B Stucker, Additive Manufacturing Technologies: 3D Printing, Rapid Prototyping, and Direct Digital Manufacturing, Springer, 3rd Edition, 2020. ISBN: 9783030561277
2. E Toyserkani, D Sarker, et al., Metal Additive Manufacturing, John Wiley & Sons Ltd., 1st edition, 2021. ISBN: 9781119210788</td></tr>
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INDIAN INSTITUTE OF INFORMATION TECHNOLOGY DESIGN AND MANUFACTURING (IIITDM) KANCHEEPURAM

<table>
<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">IIOT and Information Systems in Manufacturing</td></tr>
<tr><td rowspan="2">Department</td><td rowspan="2">ME</td><td rowspan="2">Structure (LTPC)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
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<tr><td>Status</td><td colspan="2">New ■</td><td colspan="2">Modification □</td></tr>
<tr><td>Pre-requisite</td><td></td><td colspan="3">Submitted for approval</td><td colspan="2">Senate 62</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">• This course is designed to give students an appreciation for the issues surrounding the development and use of information technology in organizations, with a particular focus on manufacturing applications.
• Understand/implement computer models of common engineering information types.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">• Students will be able understand the IIOT implementation and IT+OT integration in digital enterprises.
• Students will be able to critically analyze and implement information systems for design, engineering and manufacturing.
• Students will be able to apply engineering data management principles across the extended enterprise.</td></tr>
<tr><td>Contents of the course</td><td colspan="6">Smart manufacturing and connected enterprise, Cyber-Physical Systems (CPS), Digital Twins, ISA-95 functional/physical hierarchy, IT/OT convergence, Global connected manufacturing and Digital Thread, extended enterprise, cloud/edge ecosystems (L5)
IIoT concepts, Architectures, Service oriented architecture (SoA), distributed architecture (SoDA), fog/edge vs cloud and other emerging IIOT architectures (L5)
Edge devices and systems: Gateways (Raspberry Pi/Arduino for OT data acquisition and Commercial off-the-shelf gateways for IIoT), Ports and hardware Interfaces, Database, Networking (L7)
Communication protocols and data exchange: MQTT, MTConnect, OPC/UA, CANbus, Modbus, BACnet and others (L5)
Introduction to cloud computing: virtualization and cloud models, cloud service examples - PaaS, SaaS, IaaS and others, cloud-based information/computing services & applications, elastic storage, dockets, Servitization of manufacturing functions and cloud manufacturing (L5)
Data historians, Data curation and storage, distributed file systems, Extract Transform Load (ETL), MapReduce, B2MML, PMML, and analytics engine (L6)
Life cycle, Value chain and Enterprise information systems: Case studies of information systems for key manufacturing functions: Life cycle (PLM), Supply chain, Enterprise (ERP), Quality (QMS), Maintenance (CMMS), Materials, Energy (ISO50001 and IoT energy analytics), and Sustainability information systems, domain specific ontologies, open data, linked data, visual analytics (L5)
Standards for IIoT, agent-based systems, AI applications and case studies in manufacturing (L5)

Practice
Reference architecture study for Industry 4.0 (RAMI 4.0) (P3)
Hand-on session on edge devices – Raspberry Pi/Arduino for OT data acquisition (P9)
AWS cloud and MQTT - MQTT data pipeline from sensor to cloud (AWS IoT Core and IIITDM cloud platform enbox.co.in for energy monitoring of machines at IIITDM ME Dept. labs) (P6)
Data curation and Data historian: extract-transform-load examples using time-series data (ETL), business to modelling mark-up language (B2MML) (P6)</td></tr>
</table>

	KPI dashboarding – energy monitoring of 3D printers, predictive maintenance examples (P6) Interoperability and information exchange between information systems (P6)
Text Books	1. S. Misra, C. Roy, C., and A. Mukherjee. Introduction to Industrial Internet of Things and Industry 4.0 (1st ed.). CRC Press, 2021. ISBN: 978-0367897581
Reference Books	1. M. Soroush, M. Baldea, and T. F. Edgar. Smart Manufacturing: Concepts and Methods. Elsevier, 2020. ISBN: 978-0128200278 2. G. Veneri, A. Capasso. Hands-on Industrial Internet of Things: Create a Powerful Industrial IoT Infrastructure using Industry 4.0. Packt Publishing Ltd, 2018. ISBN: 978-1789537222

INDIAN INSTITUTE OF INFORMATION TECHNOLOGY DESIGN AND MANUFACTURING (IIITDM) KANCHEEPURAM

<table>
<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Sustainable Manufacturing</td></tr>
<tr><td rowspan="2">Dept</td><td rowspan="2">ME</td><td rowspan="2">Structure (LTPC)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
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<tr><td>Pre-requisite</td><td></td><td colspan="3">Submitted for approval</td><td colspan="2">Senate 62</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">The objectives of this course are to train the students.
• To introduce the concept of sustainable manufacturing
• To enable them to analyse the impact of various decisions on sustainability.
• To evaluate options in a global context that minimize the impact of manufacturing activities on society, the environment, and resources</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">• Students would be able to identify various alternatives in design, materials, and process to make informed trade-off decisions that will minimize energy use, water use and emissions during product life cycle stages</td></tr>
<tr><td>Contents of the course</td><td colspan="6">Three pillars of sustainability, sustainable manufacturing practices in manufacturing industries, product life cycle stages, sustainable materials, resource efficiency in manufacturing, transportation, use and disposal (L5 +P3)
Environmental regulations and emission reduction, energy efficiency and Javon's paradox, Sankey diagram, industrial symbiosis (L5+P3)
Circular economy: energy, and material flow analysis in factory operations, remanufacturing, and recycling (L5 +P3)
Life Cycle Analysis (LCA) and other environment management tools (L5+P6)
Unit process analysis, exergy analysis of manufacturing processes, life cycle inventory for manufacturing processes (L5 +P3)
Product life cycle and Sustainable product design and development, life cycle costing, regulations and certifications (L5 +P3)
Product category rules, environment product declarations, and ecolabels (L3 +P3)
Green supply chain, extended producers' responsibility, sustainability in transportation and packaging, critical minerals and conflict materials (L6+P3)
Techniques for sustainability measurement and key performance indicators, Case studies on sustainability reporting and information systems (L5+ P3)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. M. F. Ashby. Materials and the Environment: Eco-informed Material Choice. Elsevier. 2022. ISBN: 978-1856176088</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. Ashby, Michael F. Materials and Sustainable Development. Butterworth-Heinemann, 2022. ISBN: 978-0323983617
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