Curriculum for B.Tech

Smart Manufacturing

From The Academic Year 2025

(Approved in Senate 60)

Indian Institute of Information Technology Design and Manufacturing, Kancheepuram

Chennai-600 127

Semester 1					
Category	**Course Name**	**L**	**T**	**P**	**C**
BSC	Calculus	3	1	0	4
BSC	Physics for Engineers	3	0	2	4
BEC	Basic Electrical Engineering	3	1	0	4
ITC	Problem Solving and Programming	3	0	2	4
DSC	Concepts in Engineering Design	2	0	2	3
BEC	Engineering Skills Practice	0	0	2	1
HMC	Effective Language and Communication Skills	1	0	2	2
HMC	NSO/NCC/SSG/NSS/YOGA	0	0	2	P/F
					22.0
Semester 2					
Category	**Course Name**	**L**	**T**	**P**	**C**
BSC	Differential Equations	3	1	0	4
SEC	Dept. Specific Science Elective I	3	0	0	3
BEC	Engineering Graphics	1	1	2	3
ITC	Data Structures and Algorithms	3	0	2	4
DSC	Design Realization	2	0	2	3
PCC	Thermal and Fluids Engineering	3	1	0	4
HMC	Earth, Environment and Design	1	0	0	P/F
					21.0
Semester 3					
Category	**Course Name**	**L**	**T**	**P**	**C**
SEC	Dept. Specific Science Elective II (Linear Algebra)	3	0	0	3
ITC	Introduction to AI with Python	2	0	2	3
PCC	Database Management Systems	2	0	2	3
PCC	Applied Mechanics	3	0	2	4
PCC	Casting, Forming and Joining	3	0	0	3
PCC	Sensors and Controls	3	0	0	3
PCC	Production Drawing	0	0	4	2
PCC	Manufacturing Processes Practice	0	1	2	2
HMC	Indian Constitution and Essence of Indian Traditional Knowledge	1	0	0	P/F
					23.0
Semester 4					
Category	**Course Name**	**L**	**T**	**P**	**C**
SEC	Dept. Specific Science Elective III (Numerical and Computational Methods)	3	0	2	4
ITC	Data Science for Mechanical Engineers	2	0	2	3
PDC	Theory of Machines and Design	3	1	0	4
PCC	Machining Technology	3	0	0	3
PCC	Introduction to DevOps	2	0	2	3
PCC	Manufacturing Systems	3	0	0	3
PCC	Machining Technology Practice	0	1	2	2
HMC	Human Values and Stress Management	1	0	0	P / F
					22.0

Semester 5					
Category	**Course Name**	**L**	**T**	**P**	**C**
HMC	Entrepreneurship and Management Functions	1	0	2	2
PCC	Quality Engineering	2	0	2	3
PDC	Embedded Systems Design	2	0	2	3
PCC	Electrical Drives	3	0	2	4
PCC	Fundamentals of IIoT and Cloud Computing	2	0	2	3
PCC	Digital Manufacturing	3	0	2	4
PEC	Program Elective 1	3	0	0	3
HMC	Professional Ethics and Organizational Behaviour	1	0	0	P/F
					22.0
Semester 6					
Category	**Course Name**	**L**	**T**	**P**	**C**
PCD	Product Design and Prototyping	0	0	2	1
PCC	Additive Manufacturing	3	0	0	3
PCC	Operations and Supply Chain Management	3	1	0	4
PDC	Robotics and Automation	3	0	2	4
PCC	Generative AI for Manufacturing	2	0	2	3
PEC	Program Elective 2	3	0	0	3
ELC	Open Elective 1	3	0	0	3
HMC	Professional Communication	1	0	2	2
HMC	Intellectual Property Rights	1	0	0	P/F
					23.0
	Summer				
PCD	**Summer Internship MID MAY to MID JULY**				**P/F**
Semester 7					
Category	**Course Name**	**L**	**T**	**P**	**C**
PEC	Program Elective 3	3	0	0	3
ELC	Open Elective 2	3	0	0	3
ELC	Open Elective 3	3	0	0	3
ELC	Open Elective 4	3	0	0	3
ELC	Open Elective 5	3	0	0	3
PCD	Comprehensive Exam				P/F
HMC	Invited Expert Lectures*	0	0	0	P/F
	*** 6 Expert lectures to be attended from Sem 1 to Sem 7**				**15.0**
Semester 8					
Category	**Course Name**	**L**	**T**	**P**	**C**
PCD	B.Tech. Project (BTP)	0	0	18	9
					9.0

9 Credits for the BTP can be earned by any of the following:

1. Fully In-house BTP at the institute.
2. BTP IITs/IISc/IISERs/TIFR/ISI/DRDO/ISRO, etc if 148 credits are completed by the end of 7th semester.
3. Three Program Elective courses, each with a minimum of three credit, in lieu of BTP.
4. Industry Internship/Training in lieu of BTP at the company selected through the Institute Placement Cell and if 148 credits are completed by the end of 7th semester.

Semester wise Credit Distribution	**Credits**									
Category	**S1**	**S2**	**S3**	**S4**	**S5**	**S6**	**S7**	**S8**	**Total**	**%**
Basic Science Course (BSC)	8	4	0	0	0	0	0	0	12	7.6
Science Elective Course (SEC)	0	3	3	4	0	0	0	0	10	6.4
Basic Engineering Course (BEC)	5	3	0	0	0	0	0	0	8	5.1
Design Course (DSC)	3	3	0	0	0	0	0	0	6	3.8
IT Skill Course (ITC)	4	4	3	3	0	0	0	0	14	8.9
Program Core Course (PCC)	0	4	17	11	14	10	0	0	56	35.7
Program Design Course(PDC)				4	3	4			11	7.0
Program Elective Course (PEC)	0	0	0	0	3	3	3	0	9	5.7
Elective Course (ELC)	0	0	0	0	0	3	12	0	15	9.6
Humanities and Management Course (HMC)	2	0	0	0	2	2	0	0	6	3.8
Professional Career Development (PCD)	0	0	0	0	0	1	0	9	10	6.4
Total	22	21	23	22	22	23	15	9	157	100
	22	**43**	**66**	**88**	**110**	**133**	**148**	**157**	**157**	

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

COURSE FORMAT

Course Code		Course Name	Calculus			
Offered by the Department	SH-Mathematics	Structure (LTPC)	3	1	0	4
To be offered for	B Tech	Course type	Core			
Pre-requisite	NIL	Approved In	Senate 61			
Learning Objectives	The course will introduce the students to basic concepts in Calculus, such as convergence, differentiation & integration, and their applications.					
Contents of the Course	➢ Limit and Continuity of functions defined on intervals, Intermediate Value Theorem, Differentiability, Rolle's Theorem, Mean Value Theorem, and Taylor's Formula (5L+2P) ➢ Sequences and series (7L+2P) ➢ Definite integral as the limit of sum, Mean value theorem, Fundamental theorem of integral calculus, and its applications (9L+3P) ➢ Functions of several variables, Limit and Continuity, Geometric representation of partial and total derivatives, Derivatives of composite functions (8L+3P) ➢ Directional derivatives, Gradient, Lagrange multipliers, Optimization problems (7L+2P) ➢ Multiple integrals: Evaluation of line and surface integrals (6L+2P)					
Essential Reading	1. Thomas G B. and Finney R. L., Calculus, Pearson Education, 2007					
Supplementary Reading	1. Piskunov N., Differential and Integral Calculus, Vol. I & II, Mir Publishers, 1981 2. Kreyszig E., Advanced Engineering Mathematics, Wiley Eastern, 2007. 3. Hass J., Weir M. D., Giordano F. R., Thomas Calculus, 11th Edition, Pearson.					

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

COURSE FORMAT

<table>
<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Physics for Engineers</td></tr>
<tr><td>Dept./ Specialization</td><td>SH -Physics</td><td>Structure (LTPC)</td><td>3</td><td>0</td><td>2</td><td>4</td></tr>
<tr><td>To be offered for</td><td>B. Tech. and DD</td><td>Status</td><td colspan="2">Core ■</td><td colspan="2">Elective ☐</td></tr>
<tr><td>Faculty Proposing the course</td><td>SH - Physics</td><td>Type</td><td colspan="2">New ■</td><td colspan="2">Modification ☐</td></tr>
<tr><td>Pre-requisite</td><td>None</td><td colspan="3">Submitted for approval</td><td colspan="2">Senate-61</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">To learn about
• Transformation of three dimensional coordinate systems for scalar and vector fields
• Concepts of gradient, divergence and curl in the context of scalar and vector fields.
• Theories of electrostatics, magnetostatics, magnetism with hands on experience experiments.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">At the end of the course, the student should be able to
• Visualize the three dimensional coordinates transformation of vectors and curved surfaces
• Describe physical meaning of gradient, divergence and curl for practical purposes
• Explain knowledge of electrostatics, magnetostatics and magnetism</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours for L/T/P)</td><td colspan="6">• Vectors-an introduction; Unit vectors in Cartesian, spherical, and cylindrical polar co-ordinates; Transformation of coordinate systems, line, surface, and volume integrals, Concept of scalar and vector fields; Gradient of a scalar field; Directional derivative, Equipotential surfaces, Conservative vector fields and their potential functions-gravitational and electrostatic examples. (9L)
• Flux, divergence of a vector, Gauss's theorem, Continuity equation; Curl– rotational and irrational vector fields, Stoke's theorem. Conservation principles for matter, energy, and electrical charge, physical applications in gravitation and electrostatics. Irrotational versus rotational vector fields. (8L)
• Electrostatics: Electrostatic potential and field due to discrete and continuous charge distributions, boundary condition, Energy for a charge distribution, Conductors and capacitors, Laplace's equation Image problem, Dielectric polarization, Electric displacement vector, Dielectric susceptibility, Energy in dielectric systems. (12L)
• Magneto statics: Lorentz force law, Bio-Savart's law and Ampere's law in magneto statics, Divergence and curl of B, Magnetic induction due to configurations of current-carrying conductors, Magnetization and bound currents, Energy density in a magnetic field, Magnetic permeability and susceptibility, Boundary conditions. (13 L)
Practice components will cover the experiments on electrostatics and magneto statics viz. Electrostatic field, dielectric polarization, Electric Permittivity, capacitance, electric conductivity, Biot Savart law, Magnetic field, Magnetic permeability, Helmholtz Coil, Magnetization, Hysteresis, Faraday's law etc. (28 P)</td></tr>
<tr><td>Text Book</td><td colspan="6">1. David J. Griffiths, Introduction to Electrodynamics, 4th Edition, Pearson, 2015, ISBN – 13: 978-9332550445
2. Bhag Singh Guru, Huseyin R. Hiziroglu, Electromagnetic field Theory, 2nd Edition, Cambridge University Press, 2009; ISBN-13 : 978-0521116022</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. W. H. Hayt, J. A. Buck and M. Jaleel Akhtar, Engineering Electromagnetics, McGraw Hill (India) Education Pvt. Ltd, Special Indian Edition 2020.
2. G. B. Arfken, H. J. Weber and F. E. Harris, Mathematical Methods for Physicists, Academic Press, 7th Edition, 2013, ISBN-13: 978-9381269558</td></tr>
</table>

<table>
<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Basic Electrical Engineering</td></tr>
<tr><td rowspan="2">Dept./Faculty proposing the course</td><td rowspan="2">ECE</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>1</td><td>0</td><td>4</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">B.Tech & DD (All Branches)</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 61</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">● To impart foundational knowledge on the construction, operation, and analysis of basic electrical and electronic circuits.
● To develop the ability to systematically analyze DC and AC circuits for practical engineering applications.
● To introduce students to fundamental electrical machines and their relevance in industrial and consumer contexts.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">At the end of the course, the students will be able to
• Represent and interpret basic electrical systems using standard technical conventions.
• Analyze and solve linear electric circuits (both DC and AC) with single or multiple power sources in the time domain.
• Understand the fundamentals of electronic components and circuits.
• Understand the construction, operation, and applications of electrical machines commonly used in industry.</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours for L/T/P)</td><td colspan="6">Basics of Electricity: Systems of units - charge and current, voltage, power and energy, electricity tariff, circuit elements - sources and passive elements (R,L,C), Overview of power system (4L+1T)

DC Circuits: Basic laws and circuit analysis - Ohm's law, Kirchhoff's laws, voltage and current division, Wye-Delta transformations, Nodal and Mesh analysis with independent sources (6L+3T).

Circuit theorems (with independent sources) - Linearity property, Superposition, source transformation, Thevenin's theorem, Norton's theorem, maximum power transfer theorem (5L+3T)

AC Circuits: Sinusoids and phasors – phasor relationships, Impedance and Admittance; sinusoidal steady-state analysis – Nodal and mess analysis, theorems; AC power analysis- Instantaneous and average power, RMS, apparent and PF, complex power (10L+4T)

Electrical Machines: Transformers – principle of operation, types, EMF equation, equivalent circuit, Losses and efficiency calculation, Dot convention (4L+1T)

DC Machines - principle of operation, emf and torque equation, types, characteristics and speed control of DC motors (4L+1T).

AC Induction Machines- operating principles, equivalent circuits, torque-speed characteristics, speed control, efficiency (4L+1T)

Electronic Circuits: Operational Amplifiers - Ideal op-amp, inverting and noninverting amplifier, Applications of Op-Amp (2L+1T)</td></tr>
</table>

	Diodes - V-I characteristics and their applications (2L)
Text Books	1. Alexander C. and Sadiku M. N. O., Fundamentals of Electric Circuits, 7th Edition, Tata McGraw-Hill, New Delhi, ISBN: 9781260226409, 2013. 2. A.E. Fitzgerald and Charles Kingsley, 'Electric Machinery', Tata McGraw-Hill Education Publications, 6th Edition, 2002.
Reference Books	1. Hughes, 'Electrical and Electronic Technology', Pearson Education India, 10th Edition, 2010. 2. W. H. Hayt and T. E. Kimmerley, Engineering Circuit Analysis, 9th Edition, TMH, ISBN: 9780073545516, 2019. 3. Joseph. A. Edminister, 'Electric Circuits - Schaum's Outline Series', McGraw-Hill Publications, 6th Edition, 2003.

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">Problem Solving and Programming</td></tr>
<tr><td rowspan="2">Dept./Faculty proposing the course</td><td rowspan="2">CSE</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">B.Tech, DD</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 61</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">The course focuses on problem solving skills / techniques. Students shall be exposed to data representations, base conversions, arithmetic in fixed and floating point representations. Sequence, selection, iterative statements and various other programming constructs in C,Python shall be discussed with case studies. The practice component of this course shall equip the students to test drive the theory concepts using appropriate case studies.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">• The teaching and assessment shall ensure that given a computational problem, students can use computers as a tool to solve the problem.
• Developing pseudo codes and programs using various programming constructs are expected out of the students.
• Students will be able to develop simple applications using the various programming constructs.</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours for L/T/P)</td><td colspan="6">Evolution of Computing Machines - Number Representation - Fixed & Floating Point - Base Conversions: Binary, Decimal, Octal, Hexa-decimal number systems and conversions. Introduction to algorithms and flow chart, Data types in C – Input and output statements – Formatted input/output – Phases of program development –Applications involving sequence statements (8L)
Operators - Arithmetic, logical, relational, shift, unary operators – Precedence and Associativity - Selection Statements: IF-ELSE, SWITCH-CASE - Programs involving sequence & selection - GOTO statements - break statement - Nested IF (6 L)
Repetition Statements - FOR, WHILE, DO WHILE - Programs involving sequence, selection & repetition - continue statement - Nested loops - Introduction to Arrays and Strings - Array manipulation - string manipulation -string operations - multi-dimensional arrays (10 L)
Functions in C – Function declaration, definition – scope -storage class-Built-in and user defined functions –Recursive functions (5 L)
Introduction to Pointers, Pointer Arithmetic, Dynamic Memory Allocation – Basic data structures using pointers, Structures and File processing, Command Line Arguments (6 L)
Introduction to Python programming: basic programming constructs, selection (IF), Looping Statements, Functions and Recursion - Examples. (7 L)
Practice Component: Introduction to text editors - basic text processing - case studies involving office software - doc and ppt creation, Introduction to Linux commands - file/directory creation - copy, move, pdf creation, zip commands -Applications using sequence statements - input/output statements - arithmetic with precedence and associativity. Case studies involving selection and repetition statements – arrays, functions, strings, recursion. Case studies involving pointers, dynamic memory allocation, structures, file processing (28P)
Note: 30% of the practice component to be done using Python</td></tr>
<tr><td>Text Books</td><td colspan="6">1. Deitel P J and Deitel H M, C How to Program, Prentice Hall, 9th Edition, 2022, 978-0137398355.
2. Deitel P J and Deitel H M, Python for Programmers, Pearson Education, 2019, 978-0135224335.</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. Kernighan, Ritchie D, The C Programming Language, Prentice Hall, 2nd Edition, 2015, 978-9332549449
2. Byron S. Gottfried, Programming with C, TMH Publishers, 4th Edition, 2018, 978-9353160272
3. Donald E. Knuth, The Art of Computer Programming, 3rd Edition,2022, 978-0137935109.
4. Yashavant Kanetkar, Understanding Pointers in C& C++, BPB Publications, 5th Edition, 2019, 978-9388176378.</td></tr>
</table>

<table>
<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Concepts in Engineering Design</td></tr>
<tr><td rowspan="2">Dept./Faculty proposing the course</td><td rowspan="2">SIDI</td><td rowspan="2">Structure (LTPC)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>2</td><td>0</td><td>2</td><td>3</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">B Tech/DD</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>None</td><td colspan="3">Submitted for approval</td><td colspan="2">Senate 61</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">• To understand the engineering design process, product development cycles, and market influences on design decisions.
• To transform customer needs into technical specifications using QFD and competitive benchmarking.
• To assess design alternatives using structured decision frameworks.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">• Students will formulate engineering problems by translating customer requirements into technical specifications, generate and evaluate innovative design concepts using creative thinking methodologies.</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours for L/T/P)</td><td colspan="6">• Introduction - Importance of engineering design- types of design- the design process- total life cycle- regulatory and social issues-product design- types of products- phases of product development process- product and process cycles-organization for product development-markets and marketing-technological innovation (5L+5P)
• Problem definition & need identification - Identifying customer needs- gathering information- classifying customer requirements- establishing engineering characteristics- competitive benchmarking- quality function deployment- product design specification (6L+6P)
• Conceptual design - Creativity in design- creativity and problem solving- creative thinking methods- conceptual decomposition- morphological methods-TRIZ (Theory of Inventive Problem Solving)- Decision making and concept selection-decision theories-concept screening and concept scoring (6L+6P)
• Embodiment design - Product architecture- steps in developing product architecture-configuration design-industrial design- human factors design- prototyping and testing (6L+6P)
• Product Economics and related issues - Risk, reliability and safety- failure mode & effects analysis- concept of total quality- robust design- economic decision making- time value of money-profitability of investment- cost estimation-design to cost (5L+5P)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. George E.Dieter & Linda C.Schmidt, Engineering Design, McGraw-Hill International Edition 5, 2013, ISBN-10 : 9355322259, ISBN-13 : 978-9355322258
2. Anita Goyal, Karl T Ulrich, Steven D Eppinger, Product Design and Development , Tata McGraw-Hill Education, 4th Edition, 2009, ISBN-10: 0070146799, ISBN-13: 978-0070146792</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. Kevin Otto, Kristin Wood, Product Design, Pearson Education, Indian Reprint, 2004, ISBN-10: 0130212717, ISBN-13: 978-0130212719
2. Yousef Haik, T.M.M. Shahin, Engineering Design Process, Cengage Learning, 2nd Edition Reprint, 2010, ISBN-10: 0495668141, ISBN-13: 978-0495668145
3. Clive L. Dym, Patrick Little, Engineering Design: A Project-based Introduction, John Wiley & Sons, 3rd Edition, 2009, ISBN-10: 0470225963, ISBN-13: 978-0470225967</td></tr>
</table>

☐

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

COURSE FORMAT

<table>
<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Engineering Skill Practice</td></tr>
<tr><td rowspan="2">Dept./Faculty proposing the course</td><td rowspan="2">Mechanical Engineering</td><td rowspan="2">Structure (LTPC)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>0</td><td>0</td><td>2</td><td>1</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">All UG & DD</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>NIL</td><td colspan="2">Submitted for approval</td><td colspan="2">Senate 61</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">The objective of this course is to give an exposure on the basic practices followed in the domain of mechanical, electrical, electronics and communication engineering. The exercises will train the students to acquire skills which are very essential for the engineers through hands-on sessions.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">At the end of the course, the students will be able to choose suitable process/method among the mechanical, electrical, electronics, and communication engineering concepts that can full fill the functional outcomes of the parts/prototypes/products.</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours for L/T/P)</td><td colspan="6">Experiments will be framed to train the students in following common engineering practices:

Basic manufacturing processes: Fitting, Drilling & tapping, Material joining processes, Carpentry, Sheet-metal work, Arc Welding, 3D Printing. (10P)

Familiarization of electronic components by Nomenclature, meters, power supplies, function generators and Oscilloscope – Bread board assembling of simple circuits: IR transmitter and receiver - LED emergency lamp – Communication study: amplitude modulation and demodulation. (6P)

Domestic wiring practice: Fluorescent lamp connection, Staircase wiring - Estimation and costing of domestic and industrial wiring - power consumption by Incandescent, CFL and LED lamps. (2P)

Dismantle and assembly of PC. Installing OS and disk management. (4P).</td></tr>
<tr><td>Text Books</td><td colspan="6">1. Uppal S. L., “Electrical Wiring & Estimating”, 5Edn, Khanna Publishers, 2003.
2. Chapman. W. A. J., Workshop Technology, Part 1 & 2, Taylor & Francis.</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. Clyde F. Coombs, “Printed circuits hand book”, 6Edn, McGraw Hill, 2007
2. John H. Watt, Terrell Croft, “American Electricians' Handbook: A Reference Book for the Practical Electrical Man”, Tata McGraw Hill, 2002.</td></tr>
</table>

<table>
<tr><td>Course Code</td><td></td><td>Course Name</td><td colspan="4">Effective Language & Communication Skills</td></tr>
<tr><td>Offered by Department</td><td>SH-English</td><td>Structure(LTPC)</td><td>1</td><td>0</td><td>2</td><td>2</td></tr>
<tr><td>To be offered for</td><td>B.Tech</td><td>Course Type</td><td colspan="4">Core</td></tr>
<tr><td>Prerequisite</td><td>NIL</td><td>Approved In</td><td colspan="4">Senate 61</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">• Hone LSRW and practice critical thinking
• Enable students to speak and write grammatically acceptable sentences
• Train students in technical communication
• Cultivate interest to learn language and to build the confidence to communicate in English
• Develop an interest in updating their language skills through continuous learning
• Connecting personal growth with improvement in their proficiency in English</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">• Able to communicate effectively with grammatically acceptable constructions and appropriate words in formal and informal situations
• Can extract information effectively and able to think critically
• Able to present technical content confidently</td></tr>
<tr><td>Course Contents(with approximatebreakup of hours forlecture/ tutorial/ be donepractice)</td><td colspan="6">• Introduction: Language, effective communication, ethics and aesthetics of communication (L1)
• Phonetics – sounds, pronunciation of words, stress, intonation, listening, Varieties of English (L3, P4)
• Sentence structure, concord, punctuation, stylistic errors, common errors (L3, P4)
• Reading and comprehension (L2, P5)
➢ Different types of reading, analyzing the organization of the text
➢ Critical thinking- thesis statement, argument, hypothesis, order, reason, evidence, consistency,tautology, conclusion
• Exercises for vocabulary enrichment (for daily practice)
• Speaking (L2, P5)
➢ Barriers to effective communication, technical presentation and presentation skills, self-introduction,
➢ Requests, enquiry, suggestion in formal and informal situations, reporting an event, grouppresentation – debate
• Writing (L3, P8)
➢ Writing formal letters, email, résumé,
➢ Data interpretation, reports, product description/requirements/ technical instructions, recordingobservations
➢ The language of content strategy - voice and tone strategy - the language of localization_ textanalysis tools
➢ Plagiarism – the importance of documentation, different methods of note-taking
➢ Essays/story/ book & movie reviews/writing for social media/blogging/ journaling
• Life lessons through stories and activities (P2)</td></tr>
<tr><td>Essential & Supplementary Reading</td><td colspan="6">1. Tebeaux, Elizabeth, and Sam Dragga. The Essentials of Technical Communication OUP, 2018.
2. Rizvi, M Ashraf. Effective Technical Communication. McGraw-Hill, 2017
3. Hancock, Mark. English Pronunciation in Use: Intermediate Self-study and Classroom Use.CUP,2012.
4. Cottrell, Stella. Critical Thinking Skills: Developing Effective Argument and Analysis. Palgrave,2005.
5. Gower, Roger. Grammar in Practice. CUP, 2005.
6. Paterson, Ken. Oxford Living Grammar. OUP, 2014.
7. Sabin, William A. The Gregg Reference Manual:A Manual of Style, Grammar, Usage, andFormatting. McGraw-Hill, 2011.
8. Fitikides, T. J. Common Mistakes in English. London: Orient Longman, 1984.</td></tr>
</table>

Leech, Geoffrey and Jan Svartvik. A Communicative Grammar of English. Routledge, 2013.
9. Astley, Peter and Lewis Lansford. *Oxford English for Careers: Engineering*. OUP, 2013.
10. Savage, Alice and Patricia Mayer. *Effective Academic Writing*. OUP, 2013
11. Harari, Yuval Noah. *Sapiens: A Brief History of Humankind*. Vintage, 2014.
12. https://www.ted.com/
13. https://www.bbc.co.uk/learningenglish/features/pronunciation/tims-pronunciation-workshop-ep-13
14. https://learnenglish.britishcouncil.org/skills/listening
15. https://www.nationalgeographic.com/podcasts/overheard
16. https://www.youtube.com/user/NatureVideoChannel
17. https://www.youtube.com/watch?v=Aj-EnsvU5Q0&list=PLcetZ6gSk969oGvAI0e4_PgVnlGbm64bp
18. https://www.merriam-webster.com/word-of-the-day
19. https://www.newyorker.com/tag/book-reviews

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

COURSE FORMAT

Course Code		Course Name	Differential Equations			
Offered by the Department	SH-Mathematics	Structure (LTPC)	3	1	0	4
To be offered for	B. Tech	Course Type	Core			
Pre-requisite	NIL	Approved In	Senate 61			
Learning Objectives	To provide an exposure to the theory of ODEs & PDEs and the solution techniques.					
Contents of the course	➢ Linear ordinary differential equations with constant coefficients, method of variation of parameters, Linear systems of ordinary differential equations (10L +3P) ➢ Power series solution of ordinary differential equations, Singular Points, Frobenius series solutions, Bessel and Legendre differential equations, Properties of Bessel functions and Legendre Polynomials (12L+4P) ➢ Fourier series (6L+2P) ➢ Laplace transforms: Elementary properties of Laplace transforms, inversion by partial fractions, convolution theorem, and its applications to ordinary differential equations (6L+2P) ➢ Introduction to partial differential equations, wave equation, heat equation, and diffusion equation (8L+3P)					
Essential Readings	1. Simmons G. F., Differential Equations, Tata McGraw-Hill, 2003. 2. Kreyszig E., Advanced Engineering Mathematics, Wiley, 2007.					
Supplementary Reading	1. William E. Boyce and R. C. Diprima, Elementary Differential Equations and Boundary Value Problems, John Wiley, 8th Edition, 2004. 2. Sneddon I., Elements of Partial Differential Equations, Tata McGraw-Hill, 1972. 3. Ross L. S., Differential Equations, Wiley, 2007. 4. Trench W., Elementary Differential Equations, http://digitalcommons.trinity.edu/mono					

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

COURSE FORMAT

<table>
<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Science and Engineering of Materials</td></tr>
<tr><td>Dept./ Specialization</td><td>SH - Physics</td><td>Structure (LTPC)</td><td>3</td><td>0</td><td>0</td><td>3</td></tr>
<tr><td>To be offered for</td><td>UG</td><td>Status</td><td colspan="2">Core ☐</td><td colspan="2">Elective ■</td></tr>
<tr><td>Faculty Proposing the course</td><td>SH - Physics</td><td>Type</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 61</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">The objective of the course is
• To provide overview of microstructure and properties of various engineering materials.
• To explore relations between performance of engineering products and properties of materials those are used to construct them.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">After the completion of the course, students will be able:
• To explain the microstructure and properties of materials like metal alloys, polymers, ceramics, and composites.
• To describe the correlation of microstructure-properties-performance of materials so as to select suitable materials for engineering products.</td></tr>
<tr><td>Contents of the course
(With approximate break-up of hours for L/T/P)</td><td colspan="6">• Classification and evolution of engineering materials, crystal structure, crystallographic planes, directions, defects, and deformation mechanisms (8 L)
• Mechanical properties –Tensile, hardness, impact, fatigue, creep, and fracture testing; Behavior and applications of metals, polymers, ceramics, and composites (10 L)
• Strengthening mechanisms –grain boundaries, solid solution and strain hardening; Binary phase diagrams –Iron-Iron carbide phase diagrams and phase transformations; Microstructure and properties of metal alloys (12 L)
• Electrical, electronic, thermal, and magnetic properties of materials (6 L)
• Material selection in mechanical design and case studies on automobile, aircraft, energy storage, and biomedical devices (6 L)</td></tr>
<tr><td>Text Book</td><td colspan="6">1. William D. Callister Jr., David G. Rethwisch, "Materials Science and Engineering: An Introduction", 10th Edition, Wiley, 2018, ISBN: 978-1-119-40549-8.
2. Michael Ashby, Hugh Shercliff, David Cebon, "Materials – Engineering, Science, Processing and Design", 4th Edition, Butterworth-Heinemann, 2018, ISBN 13: 978-0081023761.</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. V. Raghavan, "Materials Science and Engineering: A First Course", 5th Edition, PHI India, 2011, ISBN-978-81-203-2455-8.
2. Donald R. Askeland, K Balani, "The Science and Engineering of Materials," 7th Edition,Cengage Learning, 2016, ISBN: 789386858153.
3. Michael Ashby, "Materials Selection in Mechanical Design", 5th Edition, Butterwoth Heinemann, 2016, ISBN-13: 978-0081005996.</td></tr>
</table>

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">Engineering Graphics</td></tr>
<tr><td rowspan="2">Dept./Faculty proposing the course</td><td rowspan="2">Mechanical Engineering Department</td><td rowspan="2">Structure (LTPC)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>1</td><td>1</td><td>2</td><td>3</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">B.Tech. programs of ME</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>Nil</td><td colspan="3">Submitted for approval</td><td colspan="2">Senate 61</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">• To introduce the basic concepts and techniques of technical drawing.
• To learn 2D and 3D representation of various shapes/objects and its engineering applications.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">Students will acquire visualization skills and will be able to prepare technical drawings and 3D models using computer aided tools.</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours for L/T/P)</td><td colspan="6">• Role of technical drawing in product development process, Basics of technical drawing, Standards, Dimensioning principles (L2+P2)
• Computer aided drafting (L2 + P2)
• Engineering curves and its applications (L6 + P6)
• Principles of orthographic projection. Orthographic projection of points, lines, planes and regular solids, Exercises related to engineering applications (L6+P6)
• Section of regular solids (L4+P4)
• Principles of isometric projections. Orthographic to isometric and isometric to orthographic transformation of objects (L4+P4)
• Introduction to 3D modelling of shapes and objects (L2+P2)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. Venugopal K and Prabhu Raja V, Engineering Drawing + AutoCAD, New Age International (P) Limited. 7th Edition, 2024 (ISBN: 9360749222)
2. Narayana. K.L, and Kannaiah. P, Engineering Drawing, Scitech Publications (India) Pvt. Ltd, 3rd Edition, 2021 (ISBN: 9789385983177)</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. Varghese P.I, Engineering Graphics, McGraw Hill Education, 2017 (ISBN: 1259081001)
2. Bhatt. N.D, Engineering Drawing – Plane and Solid Geometry, Charotar Publishing House Pvt. Ltd., 54th Edition, 2023 (ISBN: 9789385039706)</td></tr>
</table>

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 Structures and Algorithms</td></tr>
<tr><td rowspan="2">Dept./Faculty proposing the course</td><td rowspan="2">CSE</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">B.Tech, DD</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 61</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">Given a computational problem, the focus is on design and implementation of algorithms using suitable data structures. The notion of time and space complexity, design of efficient algorithms and data structures shall also be explored. The course also focuses on exploring role of data structure for solving problems efficiently.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">Students are expected to design efficient algorithms and data structures for computational problems</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours for L/T/P)</td><td colspan="6">ADT- Review of elementary data structures – List, Stack, Queue– time and space complexity – step count method based computation – asymptotic analysis and bounds – big oh, little oh,omega,theta notation (5L)
Analysis using recurrence relations – solving recurrence relations through guess method, recurrence tree method, Master theorem (5L)
Analysis of sorting/searching algorithms - Incremental Design - insertion sort, decremental Design - Celebrity problem - Divide and Conquer- quicksort ,merge sort- comparison/ non-comparison based sorting algorithms on restricted inputs –counting, radix sorting - discussion on inputs with best/worst case complexities (7L)
Binary Trees - Tree representation, traversal, Introduction to expression trees: traversal vs post/pre/infix notation. Recursive traversal and other tree parameters (depth, height, number of nodes etc.) (5L)
Dictionary ADT: Binary search trees, balanced binary search trees - AVL Trees. (5L)
Hashing - collisions, open and closed hashing, properties of good hash functions. Priority queue ADT: Binary heaps with application (5L)
Data Structures in Python – Strings, Lists, Tuples, Dictionary – Examples (5L)
Graphs: Representations (Matrix and Adjacency List),basic traversal such as BFS, DFS with complexity, spanning tree (5L)
Practice Component: Elementary Data Structures, Implementation of case studies involving algorithms and data structures using C, Binary Trees–Traversal –Computation of Structural parameters, Hashing–implementation of hash functions–computing collisions– Open vs closed hashing, Sorting and Searching Algorithms, Priority Queues and Heaps and its applications, Graph Traversals–BFS, DFS and its applications (28P)
Note: 30% of the practice component to be done using Python</td></tr>
<tr><td>Text Books</td><td colspan="6">1. M.A. Weiss,Data Structures and Algorithm Analysis in C,Pearson,2nd edition,2002, 978-8131714744.
2. Deitel P J and Deitel H M, Python for Programmers, Pearson Education, 2019, 978-0135224335.</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. Thomas H. Cormen, Charles E. Leiserson, Ronald L. Rivest, Introduction to Algorithms, Prentice Hall of India, 4th Edition, 2022, 978-0262046305.
2. Anany Levitin, Introduction to the Design and Analysis of Algorithms, Pearson, 3rd edition, 2017, 978-9332585485.
3. Horowitz, Sahni and Anderson-Freed, Fundamentals of Data Structures in C, Silicon Press, 2nd Edition, 2008, 978-8173716058
4. Michael T. Goodrich, Roberto Tamassia, Michael H. Goldwasser, Data Structures and Algorithms in Python, 1st edition, 2013, 978-1118290279.</td></tr>
</table>

<table>
<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Design Realisation</td></tr>
<tr><td rowspan="2">Dept./Faculty proposing the course</td><td rowspan="2">SIDI</td><td rowspan="2">Structure (LTPC)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>2</td><td>0</td><td>2</td><td>3</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">B.Tech/ DD</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>Concepts in Engineering Design</td><td colspan="3">Submitted for approval</td><td colspan="2">Senate 61</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">• To understand the user-centric design principles to identify and prioritize customer needs accurately.
• To generate creative design solutions using Morphological tools, SCAMPER, and TRIZ methodologies.
• To assess product concepts systematically through Pugh charts and concept scoring techniques.
• To learn visualization skills by producing freehand sketches and models for product development.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">• Analyze customer needs through structured methods like interviews and Quality Function Deployment (QFD).
• Create innovative design concepts using tools like Morphological tool, SCAMPER, and TRIZ.
• Evaluate design concepts using Pugh charts for effective concept screening and scoring
• Design product architecture by applying configuration and industrial design principles.</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours for L/T/P)</td><td colspan="6">Practical case studies using
• Customer need analysis, Indoor Customer interviews, Quality Function Deployment – House of quality (5L+5P)
• Tools for conceptual design - creative thinking methods - Morphological tool, SCAMPER, TRIZ (6L+6P)
• Embodiment design - Product architecture - steps in developing product architecture-configuration design-industrial design (6L+6P)
• Concept screening - concept scoring – Pugh chart (5L+5P)
• Realisation using free hand sketched and models (6L+6P)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. George E.Dieter & Linda C.Schmidt, Engineering Design, McGraw-Hill International Edition 5, 2013, ISBN-10 : 9355322259, ISBN-13 : 978-9355322258</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. Anita Goyal, Karl T Ulrich, Steven D Eppinger, Product Design and Development , Tata McGraw-Hill Education, 4th Edition, 2009, ISBN-10: 0070146799, ISBN-13 : 978-0070146792
2. Kevin Otto, Kristin Wood, Product Design, Pearson Education, Indian Reprint, 2004, ISBN-10: 0130212717, ISBN-13: 978-0130212719</td></tr>
</table>

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

COURSE FORMAT

<table>
<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Thermal and Fluids Engineering</td></tr>
<tr><td rowspan="2">Dept./Faculty proposing the course</td><td rowspan="2">Mechanical Engineering</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>1</td><td>0</td><td>4</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">B.Tech. 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>None</td><td colspan="3">Submitted for approval</td><td colspan="2">Senate 61</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">• To introduce different concepts and governing equations for thermodynamics and fluid mechanics.
• To apply the learned concepts to a few real-life cases.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">At the end of this course the students will be able to
• Understand and apply the concepts of thermodynamics, fluid mechanics and heat transfer.
• Analyse different thermodynamic cycles used in practical cases.
• Solve various basic fluid mechanics and heat transfer problems as a foundation for advance courses</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours for L/T/P)</td><td colspan="6">Thermodynamics:
Energy, work, heat, and the first and second laws, Thermodynamic Properties of pure substances, ideal gases, and real fluids. Thermodynamic Cycles - Carnot, Otto, Diesel, and Brayton cycles, Control Volume Analysis - Analyzing thermodynamic systems using control volumes. (L10+T3)
Heat Transfer:
Conduction, convection, and radiation, Heat conduction equation, thermal resistance, and transient heat transfer, Convection - Forced and natural convection, including internal and external flows. Radiation: Thermal radiation principles and applications. (L15+T6)
Fluid Mechanics:
Fluid Properties, Fluid Statics: Pressure, buoyancy, and hydrostatic thrusts.
Fluid Dynamics: Introduction to fluid dynamics, Navier-Stokes equations, and continuity equation.
Flow Analysis: Laminar and turbulent flow, Bernoulli's equation, and pipe flow. Introduction to fluid machinery– Pumps and Turbines (L15+T5)
Experimental Fluid Dynamics: Techniques for measuring fluid properties and flow characteristics. (L2)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. Yunus Cengel; Robert Turner, Fundamentals of Thermal-Fluid Sciences, McGraw-Hill Higher Education, 4th edition 2017.
2. P K Nag, Engineering Thermodynamics, McGraw-Hill Higher Education, 6th edition 2017.</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. Cengel, Y.A. and Boles, M.A., 2007. Thermodynamics: An Engineering Approach 6th Edition (SI Units). The McGraw-Hill Companies, Inc., New York.
2. Introduction to fluid mechanics and fluid machines, S Som, G Biswash, S Chakraborty, 3e. Tata McGraw-Hill Education, 2017.
3. Bergman, T.L., Incropera, F.P., Lavine, A.S. and Dewitt, D.P., 2011. Introduction to heat transfer. John Wiley & Sons.</td></tr>
</table>

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">Thermal and Fluids 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>1</td><td>0</td><td>4</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">B. Tech: 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 introduce different concepts and governing equations for thermodynamics and fluid mechanics.
• To apply the learned concepts to a few real-life cases.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">At the end of this course the students will be able to
• Understand and apply the concepts of thermodynamics, fluid mechanics and heat transfer.
• Analyse different thermodynamic cycles used in practical cases.
• Solve various basic fluid mechanics and heat transfer problems as a foundation for advance courses</td></tr>
<tr><td>Contents of the course
(With approximate break-up of hours for L/T/P)</td><td colspan="6">Thermodynamics: Energy, work, heat, and the first and second laws, Thermodynamic Properties of pure substances, ideal gases, and real fluids. Thermodynamic Cycles - Carnot, Otto, Diesel, and Brayton cycles, Control Volume Analysis - Analyzing thermodynamic systems using control volumes. (L10 + T3)
Heat Transfer: Conduction, convection, and radiation, Heat conduction equation, thermal resistance, and transient heat transfer, Convection - Forced and natural convection, including internal and external flows. Radiation: Thermal radiation principles and applications. (L15 + T6)
Fluid Mechanics: Fluid Properties, Fluid Statics: Pressure, buoyancy, and hydrostatic thrusts. Fluid Kinematics: Lagrangian and Eulerian descriptions: Types of flow: steady/unsteady, uniform/non-uniform, rotational/irrotational: Streamlines, pathlines, streaklines, Velocity and acceleration fields, Flow rate and continuity equation, Fluid Dynamics: Introduction to fluid dynamics, Navier-Stokes equations, Flow Analysis: Laminar and turbulent flow, Bernoulli's equation, and pipe flow. Introduction to fluid machinery – Pumps and Turbines (L15 + T5)
Experimental Fluid Dynamics: Techniques for measuring fluid properties and flow characteristics. (L2)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. Y Cengel, and J Cimbala and Afshin Ghajar, Fundamentals of Thermal-Fluid Sciences, 6th Edition, McGraw-Hill Higher Education, 2021, (ISBN 9781260716979)</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. Y A. Çengel, M A. Boles, and M Kanoğlu, Thermodynamics: An Engineering Approach, 9th Edition, McGraw-Hill Higher Education, 2019, (ISBN 9781259822674)
2. S Som, G Biswas, and S Chakraborty, Introduction to fluid mechanics and fluid machines, 3rd Edition, McGraw-Hill Higher Education, 2017, (ISBN 978-0071329194)
3. TL. Bergman, FP. Incropera, AS. Lavine, and DP. Dewitt, Introduction to heat transfer, 6th Edition, John Wiley & Sons, 2011, (ISBN 139780470501962)</td></tr>
</table>

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

<table>
<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="5">Database Management Systems</td></tr>
<tr><td rowspan="2">Dept./Faculty Proposing the course</td><td rowspan="2">CSE</td><td rowspan="2">Structure (LTPC)</td><td>L</td><td>T</td><td>P</td><td colspan="2">C</td></tr>
<tr><td>2</td><td>0</td><td>2</td><td colspan="2">3</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">B. Tech: SM</td><td>Type</td><td colspan="3">Core ▬</td><td colspan="2">Elective ☐</td></tr>
<tr><td>Status</td><td colspan="3">New ☐</td><td colspan="2">Modification ▬</td></tr>
<tr><td>Pre-requisite</td><td></td><td colspan="4">Submitted for approval</td><td colspan="2">Senate 62</td></tr>
<tr><td>Learning Objectives</td><td colspan="7">• The course focuses on skills required for the design and implementation of the databases. Students will be exposed to the concepts of ER Model, Schema Mapping, SQL and will be able to design applications that connect with databases.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="7">• Students will be able to design databases and apply SQL queries for database operations. They shall be able to design applications that connect with the backend for update / fetching data.</td></tr>
<tr><td>Contents of the course(With approximate break-up of hours for L/T/P)</td><td colspan="7">Introduction: Data models, Schema, Instances and Database Architecture. (L3)
ER Model: Entities, Attributes, Relationships, relationship types, E/R diagram notation, examples. (L4)
SQL: Introduction of SQL, DDL, DML, keys and foreign key, nested queries, correlated and uncorrelated queries, aggregation functions group by and having clauses. (L10)
Advanced SQL: Advanced SQL Functions, Join, Views, and embedded SQL. (L6)
NoSQL: Introduction to Mongo DB Architecture, Data Setup and Querying in Mongo DB. (L5)
Practice Component: E-R Diagram and Schema Design - Table Creation, Data Definition Language, Data Manipulation Language using SQL – Create Schema, Insert, Update, Joins, Group By, Having, Aggregate Operations - Mongo DB Database creation / manipulation (P28)</td></tr>
<tr><td>Text Books</td><td colspan="7">1. R. Elmasri and S. B. Navathe, ―Fundamentals of Database Systems,‖ Pearson, 7th Edition, 2016, ISBN 9789332582705</td></tr>
<tr><td>Reference Books</td><td colspan="7">1. A. Silberschatz, H. F. Korth, and S. Sudharsan, Database System Concepts, Tata McGraw Hill, 6th Edition, 2011, ISBN 9332901384.
2. Alan Beaulieu , Learning SQL:Master SQL Fundamentals, , 2nd Edition,O'Reilly, 3rd Edition, 2020, ISBN: 9781492057611.</td></tr>
</table>

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">Applied Mechanics</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">B. Tech: 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">The objectives are to provide students with an understanding of:
Force and moment systems on mechanical structures
Equations governing rigid body systems
Behavior of solid bodies subjected to various types of loads</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">After the completion of the course, the students will be able to:
Analyze the interactions of various structural elements
Apply the principles to practical structural analysis
Perform design and failure analyses of basic mechanical structures</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours for L/T/P)</td><td colspan="6">Engineering mechanics:
Equivalent force systems, free body concepts, equations of equilibrium, Trusses. (L9)
Strength of materials:
Stress, strain and their relation for simple tension, compression and shear; Axial load; Torsion. (L9)
Bending –Shear force and Bending moment, Stresses, Deflection; Euler’s theory of columns. (L9)
Analysis of stress and strain – Transformations, Principal stresses and strains, Plane stress, Mohr’s circle; Thin cylinders; Theories of failure. (L12)
Practice:
Experiments to measure the static coefficient of friction with various combinations of material surfaces; radius of gyration with bar pendulums, measurement of forces in jib crane. (P6)
Experiments to measure various material properties like microstructure, hardness, creep behaviour, rigidity modulus, flexural strain, flexural modulus, tensile stress and strain -comparison of stress-strain curves for different materials. (P14)
Experiments to measure torque in shaft, buckling in columns, bending moments and shear forces in beam, stress and strain analysis in thin-walled cylinder and construction of Mohr’s circle. (P8)</td></tr>
<tr><td>Text Books</td><td colspan="6">B.J.Goodno and J.M.Gere, Statics and Mechanics of Materials, CL Engineering, SI edition, 2018. ISBN-978-133364412.
F.P.Beer, E.R.Johnston, J.T.Dewolf, and D.F.Mazurek, Statics and Mechanics of Materials, McGrawHill,3rd edition, 2021, ISBN-978-0073398167.
Lab manual –Applied Mechanics Practice Course, IIITDM Kancheepuram</td></tr>
<tr><td>Reference Books</td><td colspan="6">R.C.Hibbeler, Statics and Mechanics of Materials, 6th edition, Pearson education, 2024, ISBN-978-0-13-796489-5,
W.F.Riley, L.D.Sturges and D.H.Morris, Statics and Mechanics of Materials: An integrated approach, Willey, 2nd edition, 2018, ISBN-978-0471013341.</td></tr>
</table>

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">Casting, Forming and Joining</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>0</td><td>3</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">B. Tech: ME/SM
DD: AIR</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="2">Senate 62</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">• To study the fundamentals of casting, forming and welding processes.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">Upon completion of the course, students will be able to:
• Design gating system and riser for casting processes.
• Select the appropriate forming and forging process and compute the required forming load and power.
• Select welding process and type of joint based on the materials characteristics and its thickness.
• Optimize the operating parameters for a given process to avoid defect and improve quality.</td></tr>
<tr><td>Contents of the course
(With approximate break-up of hours for L/T/P)</td><td colspan="6">Molding and Casting Practices: (L16)
Introduction to casting and foundry industry; basic principles; sequence in foundry operations; patterns; molding practice; ingredients of molding sand. Solidification of casting. Special casting techniques: investment casting, shell molding, die casting, centrifugal casting, plaster mould casting, full mould process, strip casting, CO_2 molding. Gating system design. Riser design. Casting defects.
Forming and Forging: (L14)
Basics of forming and forging, classification of rolling processes, rolling of bars and shapes, theories of hot and cold rolling, rolling forces, torque and power estimations, defects in rolling.
Extrusion, classification of extrusion processes, hydrostatic extrusion, tube extrusion, load and power estimations, defects in extrusion.
Drawing and sheet metal forming, rod and wire drawing, tube drawing, shearing, blanking and punching, spring back effect.
Basics of forging, classification of forging processes, forging equipment's, calculation of forging loads, forging defects.
Welding processes: (L12)
Classification of welding processes, V-I (Voltage-Current) relationship, types of weld joints.
Fusion welding processes, solid state welding processes, friction stir-welding, friction welding and cold metal transfer technology, thermo-chemical welding processes, brazing and soldering. Weld metallurgy; concept of heat affected zone (HAZ), inspection of weld joint, defects in welds, their causes and remedies.</td></tr>
<tr><td>Text Books</td><td colspan="6">1. S. Kalpakjian and S. R. Schmidt, Manufacturing Engineering and Technology, 7th edition, Pearson India, 2009. ISBN: 978 0133128741.
2. M. P. Groover. Principles of Modern Manufacturing, 5th edition, Wiley, 2014. ISBN: 978-8126547371.</td></tr>
</table>

Reference Books	1. B. Wulff, H. F. Taylor and M. C. Fleming, Foundry Engineering, Wiley Eastern, 2009. ISBN: 978-0471848431. 2. American Welding Society, Welding Handbook, AWS, 2009. ISBN: 978-0871712813. 3. A. Ghosh, and A. K. Mallik, A. K., Manufacturing Science, Chichester: Ellis Horwood. 1986. ISBN: 9788176710633. 4. W. Chapman, Workshop Technology Part 1. Routledge, 2019. ISBN: 9781315030449, 2019.

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">Sensors and Controls</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>0</td><td>3</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">B. Tech: 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="2">Senate 62</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">(a) To learn the basic working principle and operation of various sensors and its characteristics
(b) To leverage the application of sensors in real world scenario
(c) To learn the concepts of feedback control systems.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">At the end of the course, a student will be able
(a) to leverage sensors for various engineering applications and choose sensors for required specification
(b) to analyze and design control systems and appreciate their relevance in different applications.
(c) 'to understand control systems and its relevance in different applications</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours for L/T/P)</td><td colspan="6">Measurement Systems and Sensor Fundamentals: Components of measurement systems, Types of sensors and transducers, Static and dynamic characteristics, Calibration and error analysis; Signal conditioning: amplifiers, filters, ADC/DAC (L6)
Sensors for Mechanical Systems: Displacement sensors; Velocity and acceleration; Force and torque; Pressure and flow measurement; Temperature sensing (L8)
Control System Fundamentals: Open-loop vs. closed-loop control; System modeling: transfer function, block diagrams; Modeling of mechanical/electromechanical systems; Time response and stability (L10)
Control System Design and Analysis: Steady-state error and performance evaluation; Root locus and Bode plots (L8)
Modern Sensors and Interfacing: Smart sensors and MEMS, Wireless and IoT-based sensors; Sensor interfacing with microcontrollers, Basics of DAQ systems (L5)
Applications and Case Studies: Industrial automation and robotics, Condition monitoring; Automotive sensor systems: ABS, airbags; HVAC, drone, and biomedical sensor applications (L5)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. John Vetelino and Aravind Reghu, Introduction to sensors, CRC Press,2017
2. Norman S Nise, Control System, John Wiley, 8th Edition, 2019</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. W. Bolton, Mechatronics, Pearson Education Ltd., 7th edition, 2018
2. T. Bartely, Industrial Automated Systems: Instrumentation and Motion Control, Cengage learning, 2011
3. Doebelin's Measurement systems, 7th edition, McGraw Hill Book, 2019, ISBN-13: 978-9353168711.</td></tr>
</table>

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">Production Drawing</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>0</td><td>0</td><td>4</td><td>2</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">B. Tech: 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 provide the knowledge of design practices for common machine elements,
• assembly drawings and blue print reading
• To understand the concept of various tolerances and fits used in component design</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">At the end of the course, a student will be able to:
• Represent and understand drawing symbols and geometric dimensioning and tolerance
• Prepare production drawings of machine components</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours for L/T/P)</td><td colspan="6">Representation: Layout of drawing sheet, title block, conventional representation of materials, machine components, welding symbols, hydraulic, pneumatic symbols, surface roughness symbols. (P9)

Limits, Fits and Tolerances: Introduction to Dimensioning and Tolerancing, Types of fits, exercises involving selection/interpretation of fits and estimation of limits from tables, Gauge design. (P5)

Form and Positional Tolerances: Introduction and indication of the tolerances of form and position on drawings, deformation of run out and total run out, and their indication. (P8)

3D Part Modelling and Assembly: Development of 3D models of machine components using CAD software with fits, assembly of machine components and drafting of assembly using CAD software with fits. Assembly drawings with sectioning and bill of materials. Detailed part drawings from assembly drawings. Machine Tool drawings including jigs and fixtures. (P16)

Production Drawings: Creation of production drawings of parts with indications of size, dimensional and geometric tolerances, welding and surface roughness symbols, form and position errors using CAD software. Surface quality symbols, terminology and representation on drawings, correlation of tolerances and surface quality with manufacturing techniques. (P14)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. G. Bertoline, E. Wiebe, N. Hartman and W. Ross, Technical Graphics Communication, 4th Edition, Tata McGraw Hill, 2008, ISBN: 9780077221300.
2. IIITD&M Laboratory manual for Production Drawing Lab.</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. P.S. Gill, Geometric Dimensioning and Tolerancing, 3rd Edition, Katson Books, 2024, ISBN 13: 978-9350143780
2. F.E. Giesecke, A. Mitchell, H.C. Spencer, I.L. Hill, J.T. Dygdon, J.E. Novak, and S.D. Lockhart, Technical Drawing with Engineering Graphics, 14th Edition, Prentice Hall, 2023, ISBN: 978-0134306414.
3. N.D. Bhatt, Machine Drawing, 51st Edition, Charotar Publishing House Pvt Ltd, 2022, ISBN 13: 978-9385039232.</td></tr>
</table>

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 Processes 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>
<tr><td>0</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">B. Tech: ME/SM
DD: AIR</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 perform experiments on casting, forming and welding to understand the process, equipment, tooling and set-up involved in these processes.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">At the end, students will be able to apply:
• A suitable casting process to shape the component and identify the defects involved and rectify them.
• The concepts of different forming processes and thus to get desired part shape.
• Select suitable welding processes based on the application.
• Can identify the effect of process parameters on the outputs and can select suitable process parameter values.</td></tr>
<tr><td>Contents of the course
(With approximate break-up of hours for L/T/P)</td><td colspan="6">List of experiments:
Determination of molding properties of sodium silicate bonded sand
Shrinkage behavior during phase change processes
Injection molding process
Sheet metal forming processes
Spring back in forming processes
Manual metal arc welding process
Gas metal arc welding (GMAW) process
Gas tungsten arc welding (GTAW) processes
Welding metallurgy
Process control and optimization in welding</td></tr>
<tr><td>Text Books</td><td colspan="6">1. IIITDM Kancheepuram manual for Manufacturing Processes Lab. IIITDM Kancheepuram.</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. M. P. Groover, Principles of Modern Manufacturing, 5th edition, Wiley, 2014. ISBN: 978-8126547371.
2. S. Kalpakjian, S. R. Schmidt, Manufacturing Engineering and Technology, 7th edition, Pearson India, 2009. ISBN: 978-0133128741.
3. E. P. DeGarmo, J. T. Black and R. A. Kohser, DeGarmo's materials and Processes in Manufacturing, 11th Edition, John Wiley & Sons, 2013. ISBN: 978-8126540464.</td></tr>
</table>

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 for Mechanical Engineers</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>2</td><td>0</td><td>2</td><td>3</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">B. Tech: ME/SM
DD: AIR</td><td>Type</td><td colspan="2">Core ■</td><td colspan="3">Elective □</td></tr>
<tr><td>Status</td><td colspan="2">New □</td><td colspan="3">Modification ■</td></tr>
<tr><td>Pre-requisite</td><td></td><td colspan="3">Submitted for approval</td><td colspan="3">Senate 62</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">● This course aims to provide a formal exposure to data science and its real world applications in Mechanical Engineering.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">● Become familiar with Descriptive and Inferential Statistics
● Learn how to perform exploratory data analysis and data management
● Implementing basic Machine Learning algorithms using Python tools
● hands-on exercises with case studies of data science projects</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours for L/T/P)</td><td colspan="6">Overview of Data Science: Data Science Process, Problem Definition, Data Collection, Data Preparation (cleaning and transformation), Exploratory data Analysis, Model Building, Model Evaluation and Model Deployment. (L4+ P4)
Descriptive Statistics: Measures of Central Tendency (Mean, Median and Mode)and spread and position (range, Variance, Standard Deviation and quartile), Data Visualization. (L4+ P4)
Inferential Statistics: Probability theory, Data Distributions (Binomial, Poisson, Geometric, Exponential, Sampling and Normal), Hypothesis Testing. (L4+ P4)
Data management: Data preprocessing (Data cleaning and aggregation), Data retrieval and transformation, Binary Encoding One-Hot Encoding, Standardization and Normalization. (L4+ P4)
Predictive Analytics: Concept of machine learning algorithms, Supervised and unsupervised algorithms, Introduction to reinforcement algorithms.(L10+ P10)
Lab Component: Mechanical engineering applications may be considered along with the regular lab practice</td></tr>
<tr><td>Text Books</td><td colspan="6">1. J. Grus, Data Science from Scratch, O'Reilly Media, Inc. 2nd Edition, 2019 (ISBN: 9781492041139)
2. L. Igual and S. Seguí, Introduction to Data Science: A Python Approach to Concepts, Techniques and Applications, 1/e, Springer, 2017 (ISBN978-3-319-50016-4).</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. P Bruce, Practical Statistics for Data Scientists, O'Reilly, 2017 (ISBN: 9781491952962)
2. A Geron, Hands-On Machine Learning with Scikit-Learn, Keras, and TensorFlow: Concepts, Tools, and Techniques to Build Intelligent Systems, O'Reilly Media, 2022 (ISBN: 1098125975)</td></tr>
</table>

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">Theory of Machines and Design</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>1</td><td>0</td><td>4</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">B. Tech: 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 understand the kinematics and kinetics of various planar mechanisms
● To understand design concepts and procedures necessary to design and/or select a machine component in terms of geometry and materials</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">At the end of the course, a student will be able to:
● Investigate the motion of planar mechanisms using graphical and analytical methods
● Apply multidimensional failure criteria in the analysis and design of machine components.
● Design of power transmission systems involving shafts, gears, belts and bearings.</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours for L/T/P)</td><td colspan="6">Introduction to mechanisms joints, pairs and couplings; Constraints, mobility and degree of freedom, mobility criterion, Grashof’s law. (L6 + T2)
Analysis of Planar Mechanism (Position, Velocity and Acceleration); Cams and Followers. (L8 + T3)
Design based on Failure theories; Design of Shafts, Keys and Couplings. (L8 + T3)
Design of Joints-Bolted, Riveted and Welded Joints (L8 + T2)
Design of Spur Gears and Belt Drives (L6 + T2)
Design of Clutches and Bearings (L6 + T2)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. J.J. Uicker, G.R. Pennock and J.E. Shigley, Theory of Machines and Mechanisms, Oxford University Press, 4th Edition, 2014, ISBN: 978-0199454167.
2. R.G. Budynas and J.K. Nisbett, Shigley's Mechanical Engineering Design, McGraw-Hill Education,10th Edition, 2017, ISBN: 978-0073398204.</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. A. Ghosh and A. K. Mallik, Theory of Mechanism and Machines, Affiliated East-West Press Private Ltd.,3rd Edition, 2009, ISBN: 9788185938936.
2. R.L. Norton, Design of Machinery, 6th Edition, Tata McGraw Hill, 2005, ISBN: 9781260113310.
3. V. Bhandari, Design of Machine Elements, McGraw-Hill Education, 5th Edition, 2020, ISBN: 978-9390177479.
4. R.L. Norton, Machine Design: An Integrated Approach, Pearson Education, 6th Edition, 2020, ISBN: 978-0135184233.</td></tr>
</table>

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">Machining Technology</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>0</td><td>3</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">B. Tech: ME/SM
DD: AIR</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 study the fundamentals of machining processes and machine tools. Students should be able to design/choose a cutting tool based on the job required.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">At the end of this course students will be able to:
• Select and apply a suitable machining process and cutting tool upon the work piece material and geometry.
• Identify the machining defects and solution to overcome the same.</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours for L/T/P)</td><td colspan="6">Machining and Cutting Tool: Material removal. Elements, fundamentals, and mechanism of deformation in metal cutting. Geometry & design of single and multi-point tool. (L8)
Mechanics of Chip Formation: Orthogonal & oblique cutting, mechanism of chip formation, chip types, mechanics of machining. Forces and stresses on tool and its distribution, cutting force measuring technique. (L10)
Heat flow in metal cutting and tool life: Heat flow in primary, secondary and tertiary zones, tool temperature measurement, temperature distribution in tool. Machinability, tool wear, tool life, Taylor's equation, tool failure, economics in metal machining. (L8)
Cutting Tool material and Cutting fluids: Tool materials, Alloying elements in tool steel. Carbon steel, high speed steels, co-cast alloys, carbide tools, ceramic tools, diamond tools. Coated cutting tool and coating of tool material. Function & requirement of cutting fluid. Type of cutting fluid. Method of application of cutting fluids. (L10)
Abrasive Machining Processes and Broaching: Abrasive processes, grinding wheel-specifications and selection, types of grinding process, concepts of surface integrity, broaching machines, broach construction. (L6)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. G. K. Lal, Introduction to Machining Science, 3rd edition, New Age International (P) Ltd., Publishers, 2007 (ISBN: 9788122421040).
2. N. K. Mehta, Metal Cutting and Design of Cutting Tools, Jigs & Fixtures, Mc Graw Hill India, 2014 (ISBN: 9789339213190).</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. W. A. Knight and G. Boothroyd, Fundamentals of Metal Machining and Machine Tools, 3rd Edition, CRC Press, 2005 (ISBN: 9781574446593).
2. S. Kalpakjian and S. R. Schmidt, Manufacturing Engineering and technology, 7th edition, Pearson India, 2009 (ISBN:978-0133128741).
3. M. P. Groover, Principles of Modern Manufacturing, 5th edition, Wiley, 2014 (ISBN: 978-8126547371).
4. E. P. De Garmo, J. T. Black and R. A. Kohser, De Garmo's materials and processes in manufacturing,11th edition, John Wiley & Sons, 2013.(ISBN-13 978-8126572632)
5. D. A. Stephenson and J. S. Agapiou, Metal cutting theory and practice, CRC Press, 2005. (ISBN 9781315373119)</td></tr>
</table>

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">Introduction to DevOps</td></tr>
<tr><td rowspan="2">Dept./Faculty proposing the course</td><td rowspan="2">CSE</td><td rowspan="2">Structure (LTPC)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>2</td><td>0</td><td>2</td><td>3</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">B. Tech: 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="2">Senate 62</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">• To introduce students to the foundational principles of DevOps, focusing on collaboration, automation, continuous integration/delivery, and the use of modern tools and practices in software engineering.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">• Understand the key principles and practices of DevOps.
• Use version control and CI/CD tools to automate workflows.
• Set up and manage containerized applications using Docker.
• Deploy and monitor services using orchestration and monitoring tools.
• Apply infrastructure as code and configuration management techniques.</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours for L/T/P)</td><td colspan="6">Introduction to DevOps: History, evolution of methodologies (Waterfall, Agile), DevOps culture, principles, lifecycle, and key practices (L3)
Version Control with Git: Git fundamentals, workflows, branching, conflict resolution, collaboration tools (L4)
Continuous Integration and Delivery (CI/CD): Concepts, tools (Jenkins/GitHub Actions), pipelines, deployment strategies (L5)
Containerization with Docker: Containers vs. VMs, Dockerfiles, images, volumes, Compose (L5)
Configuration Management and Infrastructure as Code: Ansible basics, Terraform scripting, automation workflows (L5)
Container Orchestration with Kubernetes: Pods, Deployments, Services, ConfigMaps, Helm basics (L4)
Monitoring and Logging: Metrics, Prometheus, Grafana dashboards, ELK stack logging and observability (L4)

Practice Sessions: Git Basics and Repository Setup, Branching and Merging; Conflict Resolution and Git Workflows, CI/CD: Setting up CI with GitHub Actions, Automating Build and Test Workflows; Full CI/CD Pipeline Deployment, Containerization and Orchestration: Writing Dockerfiles and Managing Containers; Docker Compose for Multi-Container Apps, Kubernetes Basics - Deployments, Pods, Services; Using ConfigMaps and Secrets,Monitoring, Logging, and Troubleshooting: Setting up Prometheus for Metrics and Alerts; Grafana for Dashboard Visualization, ELK Stack for Log Aggregation; Troubleshooting CI/CD and Kubernetes Failures. (P28)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. Gene Kim, Patrick Debois, John Willis, and Jez Humble, The DevOps Handbook, IT Revolution Press, 2016, ISBN: 9781942788003.
2. Nicole Forsgren, Jez Humble, and Gene Kim, Accelerate: The Science of Lean Software and DevOps, IT Revolution Press, 2018, ISBN: 9781942788331.</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. Sanjeev Sharma, The DevOps Adoption Playbook: A Guide to Adopting DevOps in a Multi-Speed IT Enterprise, 2017, ISBN: 9781119308744.
2. Ryn Daniels and Jennifer Davis, Effective Devops: Building a Culture of Collaboration, Affinity, and Tooling at Scale, 2016, ISBN: 9781491926307</td></tr>
</table>

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</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>0</td><td>3</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">B. Tech: 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 analyze 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 analyze 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 (L 6)

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. (L 21)

Factory Layouts: Types of layouts, systematic layout planning and Design (L 4)

Production Scheduling: Scheduling process, priority dispatch rules, Flow shop and Job Shop Scheduling (L 3)

Simulation of Manufacturing systems: Monte Carlo simulation, System and Environment, Discrete event Simulation (L5)

Intelligent Manufacturing Systems: Introduction to Industry 4.0, Digital twins and The role of Artificial Intelligence in the factory of the future (L 5)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. M. P. Groover, Automation, Production systems and Computer Integrated Manufacturing. third edition, Pearson Education, 2015. ISBN: 978-9332549814.

2. Manufacturing Systems Engineering. Katsundo Hitomi, Taylor and Francis, Second Edition</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. W. J. Hopp, M. L. Spearman, Factory Physics, 3rd edition, Waveland Press, 2011

2. R. Askin and C. Standridge, Modelling and Analysis of Manufacturing Systems, 1st edition, John Wiley, 1992. ISBN: 978-0-471-51418-33. S. B. Gershwin, Manufacturing Systems Engineering, 1st edition, Prentice Hall PTR, 1993, ISBN: 9780135606087</td></tr>
</table>

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">Machining Technology 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>
<tr><td>0</td><td>1</td><td>2</td><td>2</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">B. Tech: ME/SM
DD: AIR</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 study and practice the various operations that can be performed in lathe, milling machines etc. and to equip with the practical knowledge required in the industry.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">At the end of this course the student will be able to select and apply:
• Methods to solve problems on cutting forces, tool life and analytical methods of estimating cutting temperature.
• Suitable machining operations to subtractive remove the materials and thus to get the component/work piece with desired geometry.</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours for L/T/P)</td><td colspan="6">• Taper turning process in lathe
• External Thread cutting process in lathe
• Internal thread cutting process in lathe
• Knurling process
• Simple prismatic parts
• Contour milling using vertical milling machine
• Spur gear cutting in milling machine
• Helical gear cutting in milling machine
• Effect of Primary Cutting Edges in drilling machine
• Effect of Secondary Cutting Edges in drilling machine
• Plain surface grinding
• Cylindrical grinding
• Fabrication of wax cutting tool

Determination of machining time and material removal rate in various processes. Measurement of cutting forces in the above exercises.</td></tr>
<tr><td>Text Books</td><td colspan="6">1. IIITD&M Laboratory manual for Machining Technology Lab.</td></tr>
<tr><td>Reference Books</td><td colspan="6">2. M. P. Groover, Principles of Modern Manufacturing, 5th edition, Wiley, 2014 (ISBN: 978-8126547371).
3. S. Kalpakjian and S. R. Schmidt, Manufacturing Engineering and technology, 7th edition, Pearson India, 2009 (ISBN:978-0133128741).
4. E. P. DeGarmo, J. T. Black and R. A. Kohser, DeGarmo's materials and processes in manufacturing, 11th edition, John Wiley & Sons, 2013 (ISBN: 978- 8126540464).</td></tr>
</table>

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">Quality 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>2</td><td>0</td><td>2</td><td>3</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">B. Tech: 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 impart knowledge on inspection, measurement, quality control, validation and certification of products.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">At the end of the course, a student will be able to:
• Understand various metrology principles and techniques
• Identify and select suitable techniques and equipments to inspect and to ensure product quality
• Know about various quality control methodologies, standards and certifications</td></tr>
<tr><td>Contents of the course
(With approximate break-up of hours for L/T/P)</td><td colspan="6">Basic concepts: Measurement and inspection; Role of metrology in quality assurance; Errors; Length standards; Gauges and comparators; Linear and angular measurements; Limits, Fits and tolerances. (L7+P8)

Measurement Practices: Optical metrology and laser interferometers; Measurement of flatness, straightness and form errors; Surface finish measurements; Profile measurement with Profile projector; Coordinate measuring machine; Vision-applications in Metrology; Nano-measurements. (L8+P8)

Statistical Methodologies: Graphical methods, Statistical control charts, Regressionanalysis, Analysis of variance, Sampling and acceptance. (L10+P8)

Case studies: Inspection and Validation practices adopted in various industries. (L3+P4)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. T G Beckwith, R D Marangoni and J H Lienhard, Mechanical Measurements, 6th Edition, Pearson Higher Education, 2007 (ISBN: 0132296071)
2. R K Jain, Engineering Metrology, Khanna Publishers, 20th Reprint, 2014 (ISBN: 817409153X)</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. D J Whitehouse, Hand book of surface and nanometrology, 2nd Edition, CRCPress, 2010 (ISBN: 9781420082012)
2. G T Smith, Industrial Metrology, 1st Edition, Springer, 2002 (ISBN: 9781852335076)
3. M Mahajan, A Text book of Metrology, 2nd Edition (Reprint), Dhanpat Rai & Co Pvt. Ltd., 2005 (ISBN-13 : 978-8177000511)
4. R C Gupta, Statistical Qualtiy Control, 8th E dition, Khanna Publishers, 2008 (ISBN: 8174091114)</td></tr>
</table>

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">Embedded Systems Design</td></tr>
<tr><td rowspan="2">Dept./Faculty proposing the course</td><td rowspan="2">ECE</td><td rowspan="2">Structure (LTPC)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>2</td><td>0</td><td>2</td><td>3</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">B. Tech: 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="2">Senate 62</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">To provide a hands-on introduction to design of embedded systems hardware and software, and interfacing in real-time to networked cyber-physical systems.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">The course would equip the students to
• Understand the basic elements of embedded systems such as I/O and interfaces
• Understand embedded system design using the ARM Cortex-M microcontroller with the Launchpad IDE in C
• Hands-on laboratory experiments and team projects involving the above concepts.</td></tr>
<tr><td>Contents of the course

(With approximate break-up of hours for L/T/P)</td><td colspan="6">Introduction to embedded processors- Design Process- Requirements- Specifications Hardware architecture- Software Architecture- Introduction to Harvard & Von Neuman architectures CISC & RISC Architectures (L8)

ARM Microcontroller: Architecture, Hardware description, Register and Memory organization, Structure and interrupt priorities, Interfacing with external devices (L10).

Elements of embedded systems such as GPIO, communication, interrupts, ADC, DAC, Registers, Systick Timer, Parallel Ports etc (L10).,
• TM4C microcontroller setup and Parallel I/O:
• Interfacing GPIO ports with an LED and a switch
• LED and switch interface with Systick Timer
• Servo Motor Control with Systick Timer
• Stepper Motor Control with Systick Timer
• DC Motor Control with Systick Timer
• Periodic interrupt with Systick Timer
• ADC control with Tiva Microcontroller
• DAC with Tiva Microcontroller
• SSI with Tiva Microcontroller
• UART with Tiva Microcontroller (P28)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. J W Valavno, Embedded Systems: Introduction to Arm® Cortex(TM)-M Microcontrollers, 5th Edition, Create Space, ISBN: 978-1477508992, 2012,
2. JW Valavano, Embedded Micro computer Systems: Real Time Interfacing, 2nd edition, Create Space, 2006. ISBN0534551629.</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. JW Valavano, Embedded Systems: Real-Time Interfacing to Arm® Cortex(TM)-Micro controllers, 2nd edition, Create Space, 2011.ISBN-10:1463590156,ISBN-13:978- 1463590154</td></tr>
</table>

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">Electrical Drives</td></tr>
<tr><td rowspan="2">Dept./Faculty proposing the course</td><td rowspan="2">ECE</td><td rowspan="2">Structure (LTPC)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>2</td><td>1</td><td>2</td><td>4</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">B. Tech: 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">• In this course fundamental applications of electromechanical and power electronic systems will be studied as applied to mechanical systems.
• The capabilities and limitations of different types of electric machines (e.g., permanent magnet, induction) in various drive applications will be covered
• To introduce the students to conventional and static methods to control various AC and DC drives used in Industry.
• Also to deliver a thorough understanding on feedback control via interfacing various sensors for an automated system.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">At the end of the course, a student will be able to,
• Understand how power electronic rectifiers, converters and inverters operate.
• Possess an understanding of control of electrical drives.
• Analyze and compare the performance of DC and AC machines.
• Select and design a suitable drive system for the given application.
• Select proper sensors, electrical drive, signal conditioning circuit and controller for the required automation.
• Design control algorithms for electric drives which achieve the regulation of torque, speed, or position in the above machines.
• Develop Simulink® models which dynamically simulate electric machine and drive systems and their controllers.</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours for L/T/P)</td><td colspan="6">Energy conversion principles, Introduction to Electrical Drives, controlled Rectifiers, DC/DC converters, inverters (L6+T2)
Characteristics and control (starting, braking and speed control-static methods only) of Basic machine types: DC motor(L8+T3)
Three phase Induction motor(L8+T3)
BLDC motor(L3+T3)
Servo motor, torque motor, stepper motor(L3+T3)
Experiments conducted in this course:
• Essential sensors incorporated with an understanding and hands on study towards Signal conditioning, Calibration of sensors, and Measurement of various physical quantities.
• Brings out the basic concepts of different types of electrical machines and their performance.</td></tr>
</table>

	• Introduce the concept of control of conventional electric motors such as DC motor, AC Induction motor and also special machines such as Stepper motor, Permanent magnet brushless motors, Servo motor. • Familiarize various power electronic converters and static control of drives. Introduces Speed-Torque characteristics of various types of load and drive motors. (P28)
Text Books	1. Gopal K. Dubey, Fundamentals of Electrical Drives, 2nd edition, Narosa, January 2010, ISBN-13: 978-8173194283 2. Ned Mohan, Electric Machines and Drives: A First Course, 1st edition, Wiley, 2012.
Reference Books	1. VedamSubramanyam, Electric Drives, McGraw Hill, 2017, ISBN-13: 9780070701991 2. D.P. Kothari, Rakesh Singh Lodhi, Electric Drives, TMH, June 2020 3. I. Boldea, S. A. Nasar, Electric drives, 3rd edition, CRC Press, 2017. 4. R. Krishnan, "Electric Motor Drives: Modeling, Analysis, and Control," Prentice Hall, 2001.

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">Fundamentals of IIoT and Cloud Computing</td></tr>
<tr><td rowspan="2">Dept./Faculty Proposing the course</td><td rowspan="2">CSE</td><td rowspan="2">Structure (LTPC)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>2</td><td>0</td><td>2</td><td>3</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">B. Tech: 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 introduce students to the fundamental concepts of Industrial Internet of Things and Cloud Computing.
• To introduce the hands-on implementation of smart connected systems design using Internet of Things, Cloud storage for industrial automation.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">• Understand the existing IIoT and Cloud architectures.
• Design an IoT system with cloud infrastructure.
• Implement a prototype of the IoT/cloud system design.</td></tr>
<tr><td>Contents of the course(With approximate break-up of hours for L/T/P)</td><td colspan="6">Introduction to IIoT and Architecture: Evolution from IoT and IIoT, Industrial verticals and use cases, IIoT architecture and Ecosystem, Ecosystem players (L4)
Sensors, Actuators, and Edge Devices: Types of industrial sensors, Role of actuators and controllers, Microcontrollers and associated computing devices (L2)
Network Models, Topologies, and Communication Protocols in IIoT: Star, mesh, hybrid, wired vs. wireless networks in industries, MQTT, CoAP, OPC-UA, Modbus, LoRaWAN, CAN Bus, HART, Wireless HART, BLE, WiFi, ZigBee (L10)
Cloud Computing Basics: Service models, Deployment models, Virtualization and Containers, SLA, Introduction to AWS, GCP (L6)
IIoT and Cloud Integration: End-to-end design, Data flow: sensor→ edge/fog→cloud, Publish sensor data to cloud dashboard, AWS IoT (L6)
Practice Sessions:Getting Started with Arduino/Raspberry Pi and Sensors - Reading and Sending Sensor Data via WiFi, Zigbee, Bluetooth, LoRaWAN- Using MQTT, CoAP for Lightweight IIoT Communication - Streaming Sensor Data to AWS IoT and Visualizing with AWS IoT Analytics - Simulating IIoT Systems with Node-RED and MQTT - End-to-end design (P28)</td></tr>
<tr><td>Text Book</td><td colspan="6">1. Giacomo Veneri and Antonio Capasso , Hands-On Industrial Internet of Things: Create a powerful Industrial IoT infrastructure using Industry, 1st Edition, Packet Publishing, 2018, ISBN: 978-1789537222.
2. Christian Vecchiola, S.ThamaraiSelvi, RajkumarBuyya,, Mastering Cloud Computing 1st Edition, McGraw Hill Publisher, 2023, ISBN: 978-9353590130.</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. David Hanes, Gonzalo Salgueiro, Patrick Grossetete, Robert Barton, Jerome Henry , IoT Fundamentals: Networking Technologies, Protocols, and Use Cases for the Internet of Things, 1st Edition, Cisco Press, 2017, ISBN: 978-0134307060.
2. Kai Hwang, Geoffrey C Fox, Jack J Dongarra,Distributed and cloud computing from parallel processing to internet of things, 1st Edition, Morgan Kaufmann Publisher, 2013, ISBN: 978-0128002049.
3. A. Bagha and V. Madisetti , Cloud Computing: A Hands-on Approach, 1st Edition, Universities press, 2015, ISBN: 978-0996025508.</td></tr>
</table>

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">Digital Manufacturing</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">B. Tech: ME/ SM
DD: AIR</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 make the students utilize the computer aided design, computer aided manufacturing, computer aided engineering and computer aided inspection tools in the virtual environment before implementing it in the shop floor.
• To make the students understand how a CAD, CAM, CAE, and CAI systems are linked through data associativity and utilize them effectively.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">At the end of the course, the students will be able to
• apply digital tools such as CAD, CAM, and CAE to design, simulate, and optimize manufacturing processes.
• design and implement end-to-end digital manufacturing workflows that incorporate process planning, automation, and quality control.</td></tr>
<tr><td>Contents of the course
(With approximate break-up of hours for L/T/P)</td><td colspan="6">Introduction: Digital manufacturing overview, Fundamentals of Computer-Aided Design, Computer-Aided Manufacturing, Computer-Aided Engineering, and Computer-Aided Inspection, Digital product development workflow. (L4)

Computer-Aided Design: 2D and 3D transformations, projections, Bezier curves - control polygons and Bernstein basis, rational Beziers, Bezier surface, rational Bezier surface, Bezier solid, rational Bezier solid, B-spline curves - periodic, open and non-uniform knot vectors and corresponding curves, rational B-spline curves, B-Spline surfaces - periodic, open and non-uniform knot vectors and corresponding surfaces, rational B-spline surfaces, B-Spline solids - periodic, open uniform and non-uniform knot vectors, rational B-spline solids, Solid modelling for CAM/CAE Digital model. Practice: Generation of point cloud data, Modelling of parametric curve, surface and solid from point cloud data. (L16 + P10)
Computer-Aided Engineering: Role of Computer-Aided Engineering in product development, Finite element analysis fundamentals, Case studies- structural analysis, thermal analysis, computational fluid dynamics, Digital shadow.
Practice: Convergence study, Loading and Boundary conditions, Finite element analysis of solid, computational fluid dynamics analysis. (L12 + P10)

Computer-Aided Manufacturing and Computer Aided Inspection: Industry 4.0, Industry 5.0, Product development methodology - reverse engineering, CAD and CAM interfacing, CNC programming - CNC turning, CNC milling, Additive manufacturing basics, File formats, Files processing, Computer-Aided Inspection and case study, Digital twin.
Practice: CNC programming, Additive manufacturing of simple objects, Computer-Aided Inspection. (L10 + P8)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. DF Rogers, and JA Adams, J.A, Mathematical Elements for Computer Graphics, McGraw Hill, 2nd Edition, 2009 (ISBN: 9780070486775).
2. P Smid, CNC programming handbook, Industrial Press Inc., 3rd Edition, 2007.(ISBN: 978-0831133474)</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. Z Bi. Practical Guide to Digital Manufacturing: First-Time-Right for Design of Products, Machines, Processes and System Integration, Springer Nature,1st Edition, 2021 (ISBN: 978-3030703035)
2. I Gibson, D Rosen, and B Stucker, Additive Manufacturing Technologies (3D printing, Rapid prototyping and Direct digital manufacturing), Springer Nature, 2nd Edition, 2014 (ISBN: 9781493921126).</td></tr>
</table>

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 Manufacturing</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>0</td><td>3</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">B. Tech: 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">• The objective of the course is to impart fundamentals of additive manufacturing processes along with the various file formats, software tools, processes, techniques and applications.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">• Students will be able to decide between the various trade-offs when selecting Additive Manufacturing processes, devices and materials to suit engineering requirements.
• Students will have in-depth knowledge in latest trends and opportunities in Additive Manufacturing, including design for additive manufacturing, mass customization, and how to commercialize their ideas.</td></tr>
<tr><td>Contents of the course</td><td colspan="6">Historical context and evolution of Additive Manufacturing (AM) - product development and prototyping applications, Basic Principles: layer-by-layer fabrication, advantages/limitations, ASTM nomenclature, AM process chain- from to design to postprocessing, industry enablers for AM. (L6)

Digital thread: CAD model data sources, file formats (STL, AMF, 3MF), model repair and validation, part orientation and placement, support structures, slicing and tool path generation, data preparation tools. (L9)

AM processes: Powder Bed Fusion (PBF)- laser/electron beam, materials, process parameters, modelling, defects and post-processing, Material Extrusion (FDM/FFF)- Thermoplastics, composites, process parameters, modelling, process control and post-processing technologies. (L9)

Direct Energy Deposition, Binder Jetting, Vat Photopolymerization, Material Jetting, Sheet Lamination, Direct Writing and other emerging hybrid processes, process and material selection, Measurement and Improvement of quality and surface finish. (L6)

Design for AM (DfAM): topology optimization, generative design, multiple materials, hybrids, composite materials, current and future directions. (L5)

Sustainability of additive manufacturing processes, Standards for qualification of parts and processes trends and future directions in AI-driven AM. (L4)

Applications of AM: Aerospace, automotive, biomedical, electronics, construction and other emerging applications of AM .(L5)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. Gibson, Ian, David Rosen, Brent Stucker, Mahyar Khorasani. Additive manufacturing technologies (3rd Edition). Switzerland: Springer, 2021.</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. Chua, Chee Kai, and Kah Fai Leong. 3D printing and additive manufacturing: principles and applications-of rapid prototyping (5th Edition). World Scientific Publishing Company, 2022.
2. 2. Chua, Chee Kai, Chee How Wong, and Wai Yee Yeong. Standards, quality control, and measurement sciences in 3D printing and additive manufacturing. Academic Press, 2023.</td></tr>
</table>

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">Operations and Supply Chain Management</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>0</td><td>3</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">B. Tech: 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">● The course aims to provide an in-depth coverage of operations management and supply chain management.
● Students will be exposed to various aspects such as production planning, forecasting, regression analysis, queuing models, transportation models, topics in supply chain etc.
● The course would equip students with skills required for effective decision making and management.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">● Students will recognize production planning and control activities including forecasting, scheduling, MRP, Queuing etc
● Students will have a basic understanding of performance measurement and management in modern day logistics and supply chain system</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours for L/T/P)</td><td colspan="6">INTRODUCTION
Scope of operations management, strategy and productivity, productivity tools. Forecasting - Measures of forecast. Accuracy, time series, smoothing -Regression models. (L7)
PRODUCTION PLANNING AND CONTROL
Types of Production Systems – Scheduling -Scheduling with resource constraints – allocation of units for a single resource - allocation of multiple resources - Materials Requirement Planning – Waiting line models - Queuing characteristics and terminology, single server and parallel server models, Introduction to discrete event simulation. (L8)
NETWORK DESIGN IN SUPPLY CHAIN
Introduction to Supply chain, Role of distribution in supply chain –network design in the supply chain –models for facility location and capacity allocation – Impact of uncertainty on network design. (L8)
INVENTORY MANAGEMENT IN SUPPLY CHAIN
Cycle inventory – multi-echelon inventory –safety stock in supply chain – safety level estimation, supply uncertainty, data aggregation, replenishment policies, managing safety inventory in practice– product availability –optimal level, affecting factors, supply chain contracts. (L8)
TRANSPORTATION IN SUPPLY CHAIN
Design options for Transportation network, trade-offs, Risk management in Transportation. (L5)
INFORMATION SHARING IN SUPPLY CHAIN
DSS for supply chain management- Value of information – Bullwhip effect, information and supply chain technology. (L6)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. Simchi – Levi Davi, Kaminsky Philip and Simchi-Levi Edith, “Designing and Managing the Supply Chain”, Tata McGraw –Hill Publishing Company Ltd, New Delhi, 2003. ISBN 978-0070666986</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. Kenneth Karel Boyerand Rohit Verma. Operations & Supply Chain Management for the 21st Century, Cengage Learning, 2009 ISBN 978-0618749331
2. Chopra S and Meindl P, Supply Chain Management: Strategy, Planning, and Operation,2nd Edition, Prentice Hall India Pvt. Ltd, New Delhi, 2005.</td></tr>
</table>

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">Robotics and Automation</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">B. Tech: ME/SM
DD: AIR</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 introduce the students to various state of art automation technologies in manufacturing and the role of robots in automation.
• To familiarize students with robotic systems, sensors, actuators, and controllers being used in industry automation.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">At the end of the course, a student will be able to
• Design robots with application in manufacturing automation.
• Apply pneumatic and hydraulic circuits & systems in automation.
• Integrate PLCs, microcontrollers and implement IoT-based automation.</td></tr>
<tr><td>Contents of the course
(With approximate break-up of hours for L/T/P)</td><td colspan="6">Automation Systems-Overview: Overview of mechatronic and automation systems and devices, automated feeding, transfer, retrieval mechanisms and devices, AGVs, FMS workstations, material handling and storage systems, overview of sensors, transducers, control systems and microfluidic devices in automation. (L7)

Robots in Automation: Robot classification and anatomy, forward and inverse kinematics, DH matrix transformation, Jacobian and differential motion, Trajectory planning, Static and dynamic analysis, Grippers and other hardware, Vision systems, Mobile and parallel robots. (L14)

Pneumatic Systems: Production, distribution and conditioning of compressed air, system components and graphic representations, design of pneumatic circuits. (L7)

Hydraulic Systems: Hydraulic systems: flow, pressure and direction control valves, actuators, supporting and control elements, pumps, servo valves and actuators, proportional valves and their applications, design of hydraulic and performance analysis. (L7)

Controllers: Types, Force feedback, Visitation-assisted robot control, Programming and PLC interfacing, IoT enabling. (L7)

<u>Lab/Practice :</u> Integration of various sensors, actuators, vision systems, and other mechatronic devices in automation; computer-based design, simulation, and analysis of robotic systems; design, development, and implementation of pneumatic and hydraulic circuits; programming and integration of PLCs, controllers, and IoT devices for intelligent automation.(P28)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. J. J. Craig, Introduction to Robotics: Mechanics and Control, Prentice Hall, 4th Edition, 2017, ISBN: 978-0201543612.
2. A. Esposito, Fluid power with applications, 7th Edition, Prentice Hall, 2014, ISBN: 9789332518544.</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. M. P. Groover, Industrial Robotics: Technology, Programming and Applications, McGraw-Hill, 2nd Edition, 2012, ISBN: 9780070265097.
2. W. Bolton, Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, 7th Edition, Pearson, 2021. ISBN: 9781292250977.
3. S. R. Deb, Robotics technology and flexible automation, Tata McGraw-Hill, 2nd Edition, 2017, ISBN: 9780070077911.
4. T. O. Boucher, Computer Automation in Manufacturing: An Introduction, Chapman and Hall, 2013, ISBN: 9780412602306.
5. M. A. Cohen and U. M. Apte, Manufacturing Automation, McGraw Hill, New York, 1997, ISBN: 9780256146066.</td></tr>
</table>

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">Generative AI for Manufacturing</td></tr>
<tr><td rowspan="2">Dept./Faculty proposing the course</td><td rowspan="2">CSE</td><td rowspan="2">Structure (LTPC)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
<tr><td>2</td><td>0</td><td>2</td><td>3</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">B. Tech: 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="2">Senate 62</td></tr>
<tr><td>Learning Objectives</td><td colspan="6">• Introduce generative AI fundamentals and their applications in Industry 5.0 manufacturing systems.
• Provide hands-on training in data preprocessing, model development, and ethical AI practices.
• Address regulatory frameworks (EU AI Act, ISO standards) and ethical challenges in industrial AI deployment.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">• Implement Python scripts with TensorFlow/PyTorch to process manufacturing datasets and optimize production workflows.
• Design basic AI models for predictive maintenance and quality control
• Analyze ethical dilemmas (bias, transparency) and compliance requirements in real-world AI-driven manufacturing cases.</td></tr>
<tr><td>Contents of the course
(With approximate break-up of hours for L/T/P)</td><td colspan="6">Overview of Generative AI and Industry 5.0 Perspectives. Generative AI capabilities for Industry 5.0: data-driven modeling, adaptive learning, human-in-the-loop systems. Key use cases: predictive maintenance, quality control, supply chain optimization and decision support systems. (L4)
Predictive Maintenance with Generative AI: Introduction to predictive maintenance principles and evolution from traditional methods. The P-F Curve analysis. Generative AI for predictive maintenance: CNNs, RNNs, LSTMs. Generative models for anomaly detection (autoencoders, GANs). Transformer models for maintenance forecasting. (L5)
Quality Control with Generative AI: Quality control in manufacturing: traditional vs. data-driven approaches. Generative AI for visual inspection and defect identification using CNNs, Vision Transformers (ViTs), and Generative Adversarial Networks (GANs). Challenges of sparse and limited labeled data. Data augmentation techniques and transfer learning. (L5)
Supply Chain Optimization with Generative AI: Introduction to supply chain processes: procurement, production, distribution, logistics. Challenges: complexity, uncertainty, disruptions. Case studies of Generative AI for demand forecasting, inventory optimization, logistics planning.(L5)
Decision support system (DSS):Generative AI for DSS - Data-Driven, Simulation-Based, Reinforcement Learning-Based, Multi-Agent and Collaborative, Neurosymbolic and Knowledge-Driven (L5)
Ethical Challenges and Regulatory Compliance: Transparency, bias, accountability, and human-in-the-loop. Explainable AI (XAI) techniques in manufacturing. Regulatory landscape: AI Act (EU), ISO/IEC standards, IEEE 7000 series. (L4)
Practice: Setting up Python environment with TensorFlow/PyTorch for generative AI and manufacturing simulation environments. Data preprocessing, CNN-based vibration analysis, and LSTM network development for equipment</td></tr>
</table>

	degradation prediction. GAN-based synthetic data generation, maintenance scheduling with transformer models, and defect detection using CNN and Vision Transformer. Transfer learning, demand forecasting with generative time-series, multi agent supply chain simulation, and hybrid decision support systems. (P28)
Text Books	1. John Soldatos, Artificial Intelligence in Manufacturing: Enabling Intelligent, Flexible and Cost-Effective Production Through AI, First Edition, Springer Nature Switzerland, 2024, 9783031464522. 2. Susu Nousala, Gary Metcalf, David Ing, Industry 4.0 to Industry 5.0: Explorations in the Transition from a Techno-economic to a Socio-technical Future, First Edition, Springer Nature Singapore, 2024, 9789819997305.
Reference Books	1. Sastry Mahanta Kumar, Nagamani, Artificial Intelligence and Industry 5.0, First Edition, PHI Learning, 2025, 9789354437427. 2. Ritesh Kumar Dewangan, Vinita Dewangan, Pallavi P. Khobragade (Editors); Data Analytics and Artificial Intelligence for Predictive Maintenance in Smart Manufacturing, First Edition, Routledge,2025, 9781032769523. 3. Binay Kumar Pandey, Uday Kumar Kanike, A. Shaji George; AI and Machine Learning Impacts in Intelligent Supply Chain, First Edition, IGI Global, 2024, 9781668491067.