Curriculum for B.Tech

Mechanical Engineering

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	Engineering Mechanics	3	0	2	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	Engineering Thermodynamics	3	1	0	4
PCC	Mechanics of Materials	3	1	0	4
PCC	Fluid Mechanics and Machinery	3	1	0	4
PCC	Casting, Forming and Joining	3	0	0	3
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
PCC	Heat and Mass Transfer	3	1	0	4
PDC	Kinematics and Dynamics of Machinery	3	1	0	4
PCC	Machining Technology	3	0	0	3
PCC	Fluid Mechanics and Heat Transfer Practice	0	1	2	2
PCC	Machining Technology Practice	0	1	2	2
PDC	Kinematics and Dynamics Practice	0	1	2	2
HMC	Human Values and Stress Management	1	0	0	P / F
					24.0

Semester 5					
Category	**Course Name**	**L**	**T**	**P**	**C**
HMC	Entrepreneurship and Management Functions	1	0	2	2
PDC	Design of Machine Elements	3	1	0	4
PCC	Mechatronics	3	0	2	4
PDC	Thermal Engineering and Systems Design	3	0	0	3
PCC	Digital Manufacturing	3	0	2	4
PCC	Thermal Engineering Systems Practice	0	1	2	2
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
PDC	Robotics and Automation	3	0	2	4
PCC	Engineering Optimization	3	0	0	3
PCC	Production Drawing and Inspection	2	0	4	4
PEC	Program Elective 2	3	1	0	4
ELC	Open Elective 1	3	0	0	3
HMC	Professional Communication	1	0	2	2
HMC	Intellectual Property Rights	1	0	0	P/F
					21.0
	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	10	7	0	0	49	31.2
Program Design Course(PDC)				6	7	4			17.0	10.8
Program Elective Course (PEC)	0	0	0	0	3	4	3	0	10	6.4
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	24	22	21	15	9	157	100
	22	**43**	**66**	**90**	**112**	**133**	**148**	**157**	**157**	

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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.					

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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>
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<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>
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	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.

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<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>
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<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>
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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>
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Course Code		Course Name	Effective Language & Communication Skill			
Offered by Department	SH-English	Structure(LTPC)	1	0	2	2
To be offered for	B.Tech	Course Type	Core			
Prerequisite	NIL	Approved In	Senate 61			
Learning Objectives	• 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					
Learning Outcomes	• 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					
Course Contents(with approximatebreakup of hours forlecture/ tutorial/ be donepractice)	• 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)					
Essential & Supplementary Reading	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.					

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

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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					

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COURSE FORMAT

Course Code		Course Title	Science and Engineering of Materials			
Dept./ Specialization	SH - Physics	Structure (LTPC)	3	0	0	3
To be offered for	UG	Status	Core ☐		Elective ■	
Faculty Proposing the course	SH - Physics	Type	New ■		Modification ☐	
Pre-requisite		Submitted for approval			Senate 61	
Learning Objectives	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.					
Learning Outcomes	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.					
Contents of the course *(With approximate break-up of hours for L/T/P)*	• 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)					
Text Book	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**.					
Reference Books	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**.					

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<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>
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<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>
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COURSE FORMAT

<table>
<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Engineering Mechanics</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>0</td><td>2</td><td>4</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">B.Tech Mechanical; BTech Mechanical and MTech in AI and Robotics</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">• To analyze the components and systems of engineering structures under static and dynamic conditions in terms of forces and moments.
• To assess a few important geometric and material properties of given objects relevant for engineering applications</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">At the end of the course, a student will be able to:
• determine various forces acting on a component and structure, and calculate the resultant forces and moments
• apply governing equations of equilibrium, work-energy and impulse-momentum principles to solve engineering problems
• analyze the characteristics of single degree of freedom vibration systems</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours for L/T/P)</td><td colspan="6">Static equilibrium of rigid bodies: Forces in a plane and in space; Equivalent force systems; free-body diagrams; degrees of freedom; equilibrium of particles and rigid bodies (9L)

Analysis of structures: beams, trusses, frames and machines (6L)

Distributed forces: concept of centroid, centers of gravity and moment of inertia (4L)

Friction and applications; Principle of virtual work. (7L)

Particle Dynamics: equations of motion; work-energy and impulse-momentum principles; System of particles. (9L)

Rigid body dynamics: Plane kinematics and kinetics of rigid bodies; Coriolis acceleration; Introduction to vibrations (7L)

Practice: Experiments to measure rigidity modulus and radius of gyration; Experiments to measure strength and elastic modulus of materials; Experiments to study the hardness of materials and their microstructure Experiments on small oscillations and friction (28P)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. F. Beer. R. Johnston, P.J. Cornwell, S. Sanghi, Vector mechanics for engineers: statics and dynamics, McGraw Hill Education; Eleventh edition, 2017.</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. J. L Meriam, L.G. Kraige, J.N. Bolton, Engineering Mechanics, Vol. I -Statics, Vol 2: Dynamics, SI version, Wiley, 2018.
2. Irving H Shames, Engineering mechanics: statics and dynamics, Pearson Education India, Fourth Edition, 2005.
3. R.C. Hibbeler, Engineering Mechanics: Statics & Dynamics, Pearson, Fourteenth Edition, 2016.</td></tr>
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<table>
<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Engineering Thermodynamics</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: ME
DD: ME (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">Understand and apply the fundamental laws of thermodynamics (Zeroth, First, Second, and Third) to analyze energy interactions in various systems and processes. Analyze and evaluate thermodynamic cycles (power, refrigeration, and air-conditioning) and calculate performance using property data and thermodynamic diagrams. Interpret thermodynamic relations and property data for pure substances and ideal gas mixtures, and apply them to practical engineering systems like IC engines, steam power plants, and HVAC systems..</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">Students will be able to:
● Use thermodynamic terminology correctly
● Assess thermodynamic applications using thermodynamic laws
● Solve problems using the properties and relationships of engineering fluids
● Analyse the performance of ideal and actual thermodynamic cycles such as vapour-power, refrigeration and air-standard cycles.</td></tr>
<tr><td>Contents of the course
(With approximate break-up of hours for L/T/P)</td><td colspan="6">Basic Concepts and First Law of Thermodynamics:Continuum and macroscopic approach; systems (closed and open); thermodynamic properties and equilibrium; paths, processes and cycles; zeroth law of thermodynamics; internal energy, enthalpy; specific heats. Applications: Thermometer, First law applied to elementary processes. (L3+T1)
Second Law of Thermodynamics and Entropy: Concepts of heat engines and reversed heat engines, Kelvin-Planck and Clausius statements; reversible and irreversible processes; Carnot cycle and Carnot principles/theorems; Clausius inequality and concept of entropy; T-s diagrams; availability and irreversibility; third law of thermodynamics. Applications: Heat pumps/refrigerators and its performance evaluation. (L6+T2)
Properties of Pure Substances: Thermodynamic properties diagrams of pure substances, steam property tables and charts, steam quality or dryness fraction. Applications: Calculation of thermodynamic properties of liquid water/steam. (L6+T2)
Thermodynamic Cycles: Carnot vapor cycle, ideal Rankine cycle, modified Rankine cycles. Application: Steam power plant. Otto cycle, air-standard Diesel cycle, air-standard dual cycle, air-standard Brayton cycle, Combined cycle Applications: IC Engines and Gas turbines. Simple vapor-compression refrigeration cycle, modified vapor-compression refrigeration cycle. Vapour absorption refrigeration Applications: Refrigerators. (L20+T7)
Thermodynamic Relations and Ideal Gas Mixtures: T-ds relations, Helmholtz and Gibbs functions, Gibbs relations, Maxwell relations, Clapeyron and Clapeyron-Clausius equations. Air-water vapor mixtures; atmospheric air properties, psychrometric chart. Applications: Air-conditioning Systems (L7+T2)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. P. K. Nag, Engineering thermodynamics. Tata McGraw-Hill Education, 6th Edition, 2017. (ISBN: 9789352606429)
2. Y A Cengel, and M A. Boles. Thermodynamics: An Engineering Approach (SI Units). The McGraw-Hill Companies, Inc., New York, 10th edition 2023. (ISBN 1266152113)</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. K A Kroos, C P Merle and S Tiwari. Thermodynamics for engineers. Cengage Learning India Private Limited, 1st Edition2015. (ISBN 8184958501)
2. M J Moran, H Shapiro, D D. Boettner, and M B. Bailey. Fundamentals of engineering thermodynamics. John Wiley & Sons, 8th edition, 2014, (ISBN 1118412931)</td></tr>
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<table>
<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Mechanics of Materials</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: ME
DD: ME (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 understand the principles of solid mechanics as applied to the simplified case of elastic solids.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">At the end of the course, a student will be able to
Analyses the material behavior under different static loading conditions
Solve problems related to deformation of elastic bodies
Design the geometry of elements like beams, shafts, columns, under equilibrium loads</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours for L/T/P)</td><td colspan="6">Equilibrium of a deformable body, stress, deformation, strain, Hooke‘s law for simple tension, compression and shear; axial loads; Torsion of circular shafts (L9+T3)

Beam Bending: Shear force and bending moment diagrams, Euler-Bernoulli beam, bending stresses, shearing stress, deflection of beams (L12+T4)

Buckling of Columns: eccentric loading under various end constraints (L3+T1)

Biaxial and Triaxial states of stress and strain, Transformations, Principal stresses and strains, Mohr‘s circle (L9+T3)

Theories of failure, Design of thin cylinders, shafts and beams; Energy methods (L9+T3)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. F. P. Beer, E. R. Johnston, J. T. Dewolf, D. F. Mazurek and S. Sanghi, Mechanics of Materials, McGraw Hill, 8th Edition, 2020 (ISBN: 9390219426)
2. B. J. Goodno and J. M. Gere, Mechanics of Materials, Cengage Learning India Pvt. Ltd., 9th Edition, 2022 (ISBN: 935573784X)</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. R. C. Hibbeler, Mechanics of Materials, Pearson education, 10th Edition, 2022 (ISBN: 9354492258)
2. A. C. Ugural, Mechanics of Materials, John Wiley India Pvt. Ltd., 2013 (ISBN: 9332519412)
3. E. P. Popov, Mechanics of Materials, Pearson education, 2nd Edition, 2015 (ISBN: 9789332559547)</td></tr>
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<table>
<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Fluid Mechanics and Machinery</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: ME
DD: ME (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 introduce different concepts and governing equations for fluid mechanics.
● To demonstrate application of the learned concepts.
● To discuss the concepts of various fluid machines (both prime mover and non-prime mover) with design concepts</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">At the end of this course the students will be able to
● Understand the concepts of fluid mechanics and can relate them with practical scenarios and can apply them suitably.
● Solve fundamental problems of fluid mechanics which help them to understand the fluid mechanics consideration of mechanical design
● Analyse the performance of various turbo machineries which a foundation for the design of turbomachines.</td></tr>
<tr><td>Contents of the course
(With approximate break-up of hours for L/T/P)</td><td colspan="6">Introduction to fundamental concepts and Fluid Statics: Introduction to fluid, stress, fluid properties - Density, viscosity, surface tension, different types of flows, Forces on fluid elements, concept of pressure, concept of pressure measurement, stability of submerged and floating object (L9+T3)
Fluid Kinematics: The principles governing fluids in motion, the momentum equation, Physical similarity and dimensional analysis (L3+T1)
Fluid Dynamics: Laminar flow between solid boundaries, Flow and losses in pipes and fittings, Boundary layers, wakes and other shear layers, The flow of an inviscid fluid, Flow with a free surface, Application of flow through a pipe, Application of Unsteady flow, Lift and Drag, Compressible flow of gases, Turbulent flow (L18+T7)
Fluid Machinery – Concepts and Design: Hydraulic turbine – Impulse, Reaction turbine, Pump – Centrifugal pump, reciprocating pump- Wind turbine - Drag and lift turbine - Performance parameters (L12+T3)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. S Som, G Biswas, and S Chakraborty, Introduction to fluid mechanics and fluid machines, Tata McGraw-Hill Education, 3rd edition, 2017. (ISBN: 0071329196)
2. F M White, Fluid Mechanics, McGraw-Hill Education, 9th edition 2022. (ISBN 9355322046)</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. J. Pritchard, Fox and McDonald's Introduction to Fluid Mechanics, John Wiley and sons, 8th edition, 2010, (ISBN: 9780470547557)
2. Y A. Cengel, J A Cimbala, Fluid Mechanics: Fundamentals and Applications, Tata McGraw-Hill Education, 4th edition, 2017. ISBN: 1259696537</td></tr>
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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 and SM
DD: ME (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 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</td></tr>
</table>

	Technology, 7th edition, Pearson India, 2009. ISBN: 978-0133128741. 2. M. P. Groover. Principles of Modern Manufacturing, 5th edition, Wiley, 2014. ISBN: 978-8126547371.
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.

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<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 and SM
DD: ME (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 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">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>
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<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>
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DD: ME (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">• 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>
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<table>
<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Heat and Mass Transfer</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: ME
DD: ME (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">The course will make the students learn various fundamental concepts in Heat transfer and helps students to develop the problem-solving skills essential to good engineering practice of heat transfer in real-world applications.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">At end of the course the students will be able to understand the heat transfer concepts and apply them to solve the real-world heat transfer problems.</td></tr>
<tr><td>Contents of the course
(With approximate break-up of hours for L/T/P)</td><td colspan="6">Introduction: Modes of heat transfer, Fourier law, Material properties of importance in heat transfer, Thermal conductivity and Specific heat capacity of various materials. (L2+T1)
Conduction: General Differential equation of Heat Conduction, One Dimensional Steady State Heat Conduction in Cartesian and Polar Coordinates, plane and Composite Systems, Critical insulation thickness, Conduction with Internal Heat Generation, Fins or Extended Surfaces, Unsteady Heat Conduction, Lumped-system Analysis, Slab, Semi-infinite Solids. (L12+T4)
Convection: Energy Equation, Forced and Free Convection, Hydrodynamic and Thermal Boundary Layer. Concept of heat transfer coefficient, Heat transfer in Turbulent and Laminar flows, Free and Forced Convection - external flow over Plates, Cylinders and Spheres. Internal flow through tubes and ducts. Empirical correlations. (L12+T4)
Applications: Heat Exchanger Types, Overall Heat Transfer Coefficient, Fouling Factors, LMTD method, NTU method. (L5+T1)
Boiling and Condensation: Regimes of Pool boiling and Flow boiling. Correlations in boiling and condensation. (L3+T1)
Radiation: Basic definitions of radiation. Black Body Radiation, Planck’s law, Wien’s law, Stefan-Boltzmann law, Kirchhoff’s law, and Grey body radiation. Radiative heat transfer between surfaces, View factor. Electrical Analogy, Radiation Shields. (L5+T2)
Mass Transfer: Mass Transfer - Diffusion ,Fick’s Law of Diffusion, Steady state Molecular Diffusion, Heat and Mass Transfer Analogy, Mass Transfer Correlations. (L3+T1)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. J P Holman, Heat and Mass Transfer, Tata McGraw Hill, 10th edition, 2010. (ISBN: 0071267697)
2. YA. Cengel, Heat Transfer A Practical Approach, Tata McGraw Hill, 5th edition, 2015, (ISBN: 0073398128)</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. A. Bejan, Heat Transfer, John Wiley, 1st edition, 1993, (ISBN: 0471502901)
2. F P Incropera, and D P Dewitt, Fundamentals of Heat and Mass Transfer, John Wiley, 8th edition, 2018, (ISBN: 9781119353881)
3. Massoud Kaviany, Principles of Heat Transfer, John Wiley, 2002, (ISBN: 0471434639)
4. A Bejan, Convection Heat Transfer, John Wiley, 4th edition, 2013, (ISBN:9780470900376)</td></tr>
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<table>
<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Kinematics and Dynamics of Machinery</td></tr>
<tr><td rowspan="2">Dept./Faculty proposing the course</td><td rowspan="2">ME</td><td rowspan="2">Structure (LTPC)</td><td>L</td><td>T</td><td>P</td><td>C</td></tr>
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DD: ME (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 understand the kinematics and kinetics of various planar mechanisms in different machineries</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
● Synthesize cams, followers, gears and gear-trains
● Analyze the imbalance in rotating and reciprocating masses</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, Grashof's law, Kinematic inversions. (L7 + T2)
Kinematics (Position, Velocity and Acceleration) of rigid bodies analytical and graphical methods. (L12 + T4)
Kinematic synthesis of mechanisms, gears, gear trains and cams. (L12 + T4)
Dynamics of planar mechanisms slider crank forces, engine balancing. (L9 + T3)
Introduction to vibrations; Harmonically excited vibration; Vibration isolation, resonance, critical speeds of shafts (L2 + T1)</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, 5th Edition, 2017.</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.,2009.
2. S. S.Rattan,Theory of Machines, TataMcGraw-Hill,4thEdition, 2017.
3. Norton, R. L., Design of Machinery, Third Edition, Tata-McGraw Hill, New Delhi, 2005.</td></tr>
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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 and SM
DD: ME (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.
5. D. A. Stephenson and J. S. Agapiou, Metal cutting theory and practice, CRC Press, 2005.</td></tr>
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DESIGN AND MANUFACTURING (IIITDM) KANCHEEPURAM

<table>
<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Fluid Mechanics and Heat Transfer 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
DD: ME (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">The objective of this course is to provide an experimental exposure for fluid mechanics and heat transfer concepts such as viscosity, pressure, flow, hydrostatic forces, conduction, convection, radiation, etc.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">To acquire practical knowledge in various fluid mechanic, fluid machinery, and Heat transfer concepts</td></tr>
<tr><td>Contents of the course
(With approximate break-up of hours for L/T/P)</td><td colspan="6">The following fluid mechanics and heat transfer experiments will be performed
1. Buoyancy and stability of bodies through metacentric height.
2. Flow Visualization
3. Study of Losses in Flow through Valves
4. Flow Measuring devices
5. Performance analysis of impulse turbine
6. Performance Analysis of Francis Turbine
7. Heat Transfer from Fins
8. Heat Transfer Coefficient in Forced Convection
9. Heat Transfer Coefficient in Natural Convection.
10. Emissivity Measurement.</td></tr>
<tr><td>Text Books/Essential Reading</td><td colspan="6">1. IIITD&M Laboratory manual for Fluid Mechanics and Heat Transfer Practice.</td></tr>
<tr><td>Reference Books/Supplementary Reading</td><td colspan="6">1. Van Dyke, Milton. An Album of Fluid Motion. Stanford, Calif: Parabolic Press, 1982.
2. Ascher Shapiro. National Committee for Fluid Mechanics Films (NCFMF) in cooperation with the Education Development Center. (A series of 39 videos and accompanying texts which revolutionized the teaching of fluid mechanics)</td></tr>
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<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 and SM
DD: ME (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">1. M. P. Groover, Principles of Modern Manufacturing, 5th edition, Wiley, 2014 (ISBN: 978-8126547371).
2. S. Kalpakjian and 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>

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<table>
<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Kinematics and Dynamics 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
DD: ME (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 understand the kinematics and kinetics of various mechanisms</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">At the end of the course, a student will be able:
• To analyze the effects of force, motion and their interactions on simple machineries.
• To investigate the resonance conditions in slender shafts and simple vibrating systems</td></tr>
<tr><td>Contents of the course
(With approximate break-up of hours for L/T/P)</td><td colspan="6">Experiments on kinematic simulations for few mechanisms and inversions.
Experiments based on the concepts of kinematics and dynamics of machine elements and machineries like cams, Balancing of masses, gyroscope, gear-trains.
Experiments related to resonance in shafts, and different damping conditions of longitudinal vibrations.</td></tr>
<tr><td>Text Books/Essential Reading</td><td colspan="6">1. S. Molian, Mechanism Design: Practical Kinematics and Dynamics of Machinery Hardcover –Import, 3 December 1997
2. IIITDM Kancheepuram Laboratory manual for Kinematics and Dynamics Lab, 2024</td></tr>
<tr><td>Reference Books/Supplementary Reading</td><td colspan="6">1. J.J. Uicker, G.R. Pennock and J.E. Shigley, Theory of Machines and Mechanisms, Oxford University Press, 5th Edition, 2017.
2. S. S. Rattan, Theory of Machines, TataMcGraw-Hill,4th Edition, 2017.
3. R. L. Norton, Design of Machinery, Third Edition, Tata-McGraw Hill, New Delhi, 2005.</td></tr>
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<table>
<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Design of Machine Elements</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: ME
DD: ME (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 understand engineering design concepts and procedures necessary to design or select a machine component in terms of geometry and materials based on the applications.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">At the end of the course, a student will be able to:
• analyze the stresses in machine elements and structural members under various loads
• apply multidimensional failure criteria in the analysis and design of machine components
• design and select power transmission systems involving belts, clutches, and gears</td></tr>
<tr><td>Contents of the course
(With approximate break-up of hours for L/T/P)</td><td colspan="6">Review of failure theories; Design for variable loading- fatigue strength and design; design of shafts and springs. (L11+T4)
Design of rivets, bolts and Power Screws. (L6+T2)
Theory of friction drives. Design and selection of belt drives; Design of clutches. (L7+T2)
Design of Gears -spur, helical and worm gears -Contact and bending fatigue strength-Gear accuracy. (L10+T4)
Tribology -Lubricant theories; Design of Journal bearings; Selection of ball and roller bearings. (L8+T2)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. Richard G Budynas and J Keith Nisbett, Shigley's Mechanical Engineering Design, McGraw-Hill Education, 11th Edition, 2020</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. V Bhandari, Design of Machine Elements, McGraw-Hill Education, 5th Edition, 2020.
2. Robert L. Norton, Machine Design: An Integrated Approach, Pearson Education, 6th Edition, 2020</td></tr>
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<table>
<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Mechatronics</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
DD: ME (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 understand the fundamentals of mechatronics systems and their components.
• To apply sensors, actuators, microcontrollers, and control strategies in system design.
• To develop the ability to model, simulate, and prototype mechatronic products.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">After completing the course, students will be able to:
• Model and analyze mechatronic systems.
• Select appropriate sensors, actuators, and microcontrollers for real-world applications.
• Work in interdisciplinary teams and develop integrated hardware-software solutions.</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours for L/T/P)</td><td colspan="6">Introduction to mechatronics: scope, components, and applications; modeling of lumped parameter systems; governing equations using Newton's and Kirchhoff's laws. (L8+P2)

Dynamic response of systems: First-order and second-order systems; time-domain specifications; steady-state error. (L5+P4)

Sensors and signal conditioning: Sensors' characteristics, Types of sensors (position, velocity, force, temperature, proximity, capacitive, inductive, LiDAR, Accelerometer, Gyroscopes, IMUs); Signal conditioning circuits. (L8+P4)

Microcontrollers and Embedded programming: microcontroller architecture; digital I/O; ADC; PWM generation; sensor and actuator interfacing. (L8+P10)

Feedback control: Open-loop and closed-loop systems; PID controller design and tuning; microcontroller-based implementation. (L6+P4)

Actuators and control techniques: Types of actuators; Brushed permanent magnet DC Motors; gear drives and motor sizing; motor characteristics and selection; PWM-based speed and position control; sensor feedback for closed-loop control, Case studies (L7+P4)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. W. Bolton, Mechatronics: Electronic Control Systems in Mechanical and Electrical Engineering, 7th Edition, Pearson, 2021. ISBN: 9781292250977
2. R. H. Bishop, The Mechatronics Handbook, 2nd Edition (Two Volumes), CRC Press, Taylor & Francis Group, 2018. ISBN: 9781315217710</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. K. Ogata, Modern Control Engineering, 5th Edition, Pearson, 2010. ISBN: 978-0136156734
2. M. Ali Mazidi, R. D. McKinlay, and J. G. Mazidi, The 8051 Microcontroller and Embedded Systems: Using Assembly and C, 2nd Edition, Pearson, 2012. ISBN: 9789862801963
3. M. Margolis, Arduino Cookbook, 3rd Edition, O'Reilly Media, 2012/2020.</td></tr>
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<table>
<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Thermal Engineering and Systems 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: ME
DD: ME (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 develop a fundamental understanding of the thermal system design process and integrate principles of thermodynamics, fluid mechanics, and heat transfer in the design of practical thermal systems.
• To provide analytical and computational tools for evaluating and optimizing thermal systems and impart experience in modelling, simulation, and decision-making under constraints.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">• Apply thermal science principles to the design and analysis of thermal systems and Conduct system-level design including component selection and integration.
• Perform thermal and economic optimization of systems and Use simulation tools and analytical methods to solve open-ended design problems.
• Address trade-offs between performance, cost, reliability, and sustainability in thermal 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: Role and types of thermal systems, Design steps: concept, analysis, evaluation, and implementation, Review of key thermodynamics and heat transfer concepts needed for design, (L4 + T1)
System Modelling: Fundamentals of system modeling, Lumped parameter models and energy balances, Heat exchangers, pipe flows, and pumps: simplified models, Example: modeling a basic heat exchanger network. (L8 + T3)
Simulation of Thermal Systems: Concept of system simulation. Iterative solution methods: simple examples (sequential and simultaneous). Use of MATLAB for simulation. Example: simulation of a simple refrigeration cycle (L6 + T2)
Economic Considerations and Optimization: Cost concepts: capital, operating, and maintenance costs. Life-cycle costing and payback period. Basic principles of optimization. Example: economic pipe diameter selection. (L6 + T2)
Thermal System Components, Heat exchangers: types, sizing, and selection. Pumps and compressors: selection and performance curves. Insulation and piping. Example: pump selection for a cooling water system. (L8 + T3)
Practical Design Applications. Case study: design of a simple HVAC system, Case study: design of a solar water heater. Case study: Electronic cooling system design. Mini-group project: practical system design report. (L10 + T3)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. W F Stoecker, Design of Thermal Systems, McGraw-Hill Education, 3rd edition, 1989 (ISBN: 0070616205)</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. Y A. Cengel and A J Ghajar, Heat and Mass Transfer: Fundamentals and Applications, McGraw-Hill, 5th edition, 2017. (ISBN: 9789339223199)
2. B.K. Hodge and Robert P. Taylor, Analysis and Design of Energy Systems, Pearson, 3rd edition, 1998. (ISBN: 0135259738)</td></tr>
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<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 and SM
DD: ME (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 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>
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<table>
<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Thermal Engineering Systems 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
DD: ME (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">In this practice course, undergraduate engineering students will conduct experiments to understand the various concepts taught in thermal engineering courses.</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">To acquire practical knowledge in various modern thermal systems</td></tr>
<tr><td>Contents of the course
(With approximate break-up of hours for L/T/P)</td><td colspan="6">1. Performance Study of Solar Water Heater
2. Performance Study of Single-Cylinder Diesel Engine
3. Performance study of a multistage reciprocating air compressor
4. Performance Study of Single-Cylinder Petrol Engine
5. Viscosity Measurement
6. Fuel Properties
7. Wet Type Cooling Tower
8. Experimental Study on Air-Conditioning System
9. Vapour Compression Refrigeration System
10. Performance Study of Heat Exchanger</td></tr>
<tr><td>Text Books/Essential Reading</td><td colspan="6">1. IIITD&M Laboratory manual for Thermal Engineering Systems Lab</td></tr>
<tr><td>Reference Books/Supplementary Reading</td><td colspan="6">1. Eastop, T. D., and A. McConkey. Applied Thermodynamics for Engineering Technologists, Pearson Education India, 5th edition, 2002. (ISBN 0582091934)</td></tr>
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<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 and SM
DD: ME (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 (P28):</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.</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>
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<table>
<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Engineering Optimization</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
DD: ME (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">The objectives of this course are to train the students
● To formulate an engineering design problem as an optimization problem
● To apply or adopt a suitable method for arriving at optimal solution</td></tr>
<tr><td>Learning Outcomes</td><td colspan="6">At the end of the course, the students are expected to be capable of
● Developing mathematical models to solve real life engineering problems.
● Formulate optimization problems to arrive at a desired solution
● Participate in advanced research on optimization methods and its applications.
● Provide solution to the optimization problem using appropriate technique</td></tr>
<tr><td>Contents of the course (With approximate break-up of hours for L/T/P)</td><td colspan="6">Introduction to Optimization-Definitions of objective functions, constraints, feasibility conditions, examples on formulation of optimization problems -(L3)
Analytical methods in Single and Multivariable Optimization with and without constraints (L6)
Linear Programming - Simplex method and two-phase simplex method (L3)
Non-linear programming: 1D minimization methods - Direct & Indirect search methods (L10)
Non-linear programming: Multivariable unconstrained and constrained minimization problems - Direct & Indirect search methods (L12)
Modern methods of Optimization: Genetic Algorithms - Simulated Annealing - Ant colony optimization - Tabu search - Neural-Network based Optimization- Applications (subject to change based on the evolution of new methods). Use of python to solve optimization problems (L8)</td></tr>
<tr><td>Text Books</td><td colspan="6">1. S. S. Rao, Engineering Optimization: Theory and Practice, 5th edition, John Wiley & Sons, 2019 (ISBN: 978-1-119-45471-7).
2. K. Deb, Optimization for Engineering Design, 2nd edition, PHI Learning Pvt. Ltd., 2012(ISBN-13: 978-8120346789).</td></tr>
<tr><td>Reference Books</td><td colspan="6">1. P. Y. Papalambros and D. J. Wilde, Principles of Optimal Design: Modeling and Computation, 2nd edition, Cambridge University Press, 2000 (ISBN-13 : 978-0521627276).
2. G. V. Reklaitis, A. Ravindran and K. M. Ragsdell, Engineering Optimization-Methods and Applications, Wiley, 2nd edition, 2006 (ISBN-13:978-0471558149)
3. D. G.Luenberger, Linear and Nonlinear Programming, 4th edition, Springer, 2015 (ISBN: 978-0-387-74502-2).</td></tr>
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<table>
<tr><td>Course Code</td><td></td><td>Course Title</td><td colspan="4">Production Drawing and Inspection</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>4</td><td>4</td></tr>
<tr><td rowspan="2">To be offered for</td><td rowspan="2">B.Tech: ME
DD: ME (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>Engineering Graphics</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 with geometric dimensioning and tolerances.
• To familiarize with precision measurement methods and inspection practices followed in industrial metrology.</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
• Apply inspection practices to industry scale products and systems.</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. (L3 + P6)

Limits, Fits and Tolerances: Introduction to Geometric dimensioning and tolerancing, Types of fits, exercises involving selection/interpretation of fits and estimation of limits from tables, Gauge design. (L2+P4)

Form and Positional Tolerances: Introduction and indication of the tolerances of from and position on drawings, deformation of run out and total run out and their indication. (L4+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. (L6+P12)

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, Bill of materials and process charts. (L6+P12)

Inspection: Calibration experiments using precision measurement methods and devices; gear and screw- thread metrology; flatness measurement; quality control and statistical inferencing- Hypothesis testing. (L7+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 & Inspection 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.
4. M.F. Ashby, Materials and the Environment: ECO-Informed Material Choice, 3rd Edition, Elsevier, 2021, ISBN: 978-0128215210.</td></tr>
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