Shri Vile Parle Kelavani Mandal's
DWARKADAS J.SANGHVI COLLEGE OF ENGINEERING
(Empowered Autonomous College Affiliated to the University of Mumbai)

Shri Vile Parle Kelavani Mandal's

Dwarkadas J. Sanghvi College of Engineering

(Empowered Autonomous College Affiliated to the University of Mumbai)

Scheme and detailed syllabus (D26)

First Year B. Tech

in

Mechanical Engineering

(Semester I)

With effect from the Academic Year: 2026-2027

Shri Vile Parle Kelavani Mandal's
DWARKADAS J.SANGHVI COLLEGE OF ENGINEERING
(Empowered Autonomous College Affiliated to the University of Mumbai)

Branch:- Mechanical Engineering, Sem I

			Teaching Scheme				Semester End Assessment (A)						Continuous Assessment (B)						Aggregate (A+B)	Credits Earned
Sr. No	Course Code	Subject	Theory	Practical	Tutorial	Credit	Duration (hrs.)	Theory	Oral	Pract.	Oral & Pract.	SEE Total (A)	Term Test 1 (TT1)	Term Test 2 (TT2)	Assignment/ course project/ group discussion/ presentation / quiz/ any other	Total (TT1, TT2 & Assignment)	Term Work Total	CA Total (B)		
1	D26MBS101	Engineering Mathematics	3			3	2	60				60	15	15	10	40		40	100	4
	D26MBS101T	Engineering Mathematics Tutorial			1	1											25	25	25	
2	D26MBS102	Engineering Physics	2			2	2	60				60	15	15	10	40		40	100	3
	D26MBS102L	Engineering Physics Laboratory		2		1											25	25	25	
3	D26MES101	Structured Programming using C	2			2	2	60				60	15	15	10	40		40	100	3
	D26MES101L	Structured Programming using C Laboratory		2		1	2				25	25					25	25	50	
4	D26MES102	Engineering Mechanics	2			2	2	60				60	15	15	10	40		40	100	3
	D26MES102L	Engineering Mechanics Laboratory		2		1											25	25	25	
5	D26MHS101	Engineering Communication and Lean Thinking	1			1							15	15	10	40		40	40	2
	D26MHS101L	Engineering Communication and Lean Thinking Laboratory		2		1											50	50	50	
6	D26MES103	Engineering Graphics I	1			1	2	60					15	15	10	40		40	100	2
	D26MES103L	Engineering Graphics I Laboratory		2		1											25	25	25	
7	D26MSC101L	Ideation and Innovation Laboratory		2		1											25	25	25	1
8	D26MHS102T	Indian Knowledge Systems			2	2											50	50	50	2
9	D26MSC149	Introduction to AI for Mechanical Engineers*	1			1							15	15	10			40	40	1

* Online Course to be completed on Coursera

Semester End Assessment (A):

Course	Assessment Tools	Marks	Time (hrs.)
Theory / * Computer based	Written paper based on the entire syllabus.	60	2
	* Computer based assessment in the college premises.		
Oral	Questions based on the entire syllabus.	25	As applicable
Practical	Performance of the practical assigned during the examination and the output / results obtained.	25	2
Oral & Practical	Project based courses - Performance of the practical assigned during the examination and the output / results obtained. Based on the practical performed during the examination and on the entire syllabus.	As per the scheme	2

Continuous Assessment (B):

Course	Assessment Tools	Marks	Time (mins)
Theory	a. Term Test 1 (based on 50% syllabus)	15	45
	b. Term Test 2 (on next 50% syllabus)	15	45
	c. Self-learning (Assignment / course project / group discussion / presentation / quiz/ any other.)	10	--
	Total marks (a + b + c)	40	--
Audit course	Performance in the assignments / quiz / power point presentation / poster presentation / group project / any other tool.	--	As applicable
Laboratory	Performance in the laboratory and documentation.	25	
Tutorial	Performance in each tutorial & / assignment.	25	
Laboratory &Tutorial	Performance in the laboratory and tutorial.	50	

The final certification and acceptance of term work will be subject to satisfactory performance upon fulfilling minimum passing criteria in the term work / completion of audit course.

Program: Mechanical Engineering	First Year B. Tech.	Semester: I
Course: Engineering Mathematics (D26MBS101)		
Course: Engineering Mathematics Tutorial (D26MBS101T)		

Pre-requisites: -- Knowledge of

1. Inverse of a matrix, addition, multiplication and transpose of a matrix.
2. Algebra of Complex Numbers. Geometric representation of complex numbers. Cartesian, polar and exponential form of complex numbers. Complex conjugate.
3. Basics of Differential Calculus.

Objectives:

1. To develop the fundamental mathematical skills required for understanding and solving engineering problems.
2. To strengthen analytical thinking and logical reasoning through the application of mathematical concepts.
3. To provide a foundation in mathematical methods that support advanced studies in various branches of engineering and technology.
4. To enable students to formulate and solve real-life engineering problems using appropriate mathematical techniques.
5. To enhance the ability to represent and interpret mathematical concepts through graphical and visual approaches.
6. To provide exposure to visualization tools such as R Programming, SciLab, Desmos, and GeoGebra for graphical representation and better understanding of mathematical ideas.

Outcomes: On completion of the course, the learner will be able to:

1. Apply matrix operations to determine rank and echelon forms of matrices and solve systems of simultaneous linear equations.
2. Apply the concepts of complex numbers to solve problems involving hyperbolic functions and logarithmic functions.
3. Expand functions using appropriate mathematical techniques and evaluate their applicability in engineering problems.
4. Apply the principles of partial differentiation to determine maxima, minima, and Jacobians of multivariable functions.
5. Use R Programming/SciLab/Desmos/GeoGebra for graphical visualization and interpretation of mathematical concepts and solutions.

Engineering Mathematics (D26MBS101)		
Unit	**Description**	**Duration**
1	**Matrices:** • Types of Matrices: Symmetric, Skew- Symmetric, Hermitian, Skew-Hermitian, Unitary, Orthogonal Matrices. Rank of a matrix using Echelon form. • System of homogeneous and non–homogeneous equations, their consistency and solutions. Linear dependent and independent vectors.	**8**

2	**Complex Numbers, Hyperbolic function and Logarithm of Complex Numbers:** • Review statement of D'Moivre's Theorem. • Application of D'Moivre's Theorem: Find expansion of $\sin^n\theta, \cos^n\theta$ in terms of sines and cosines of multiples of θ, expansion of sin nθ, cos nθ in powers of sin θ, cos θ and to find sum of the trigonometric series. • Roots of complex number. • Circular functions of complex number and Hyperbolic functions. Inverse Circular and Inverse Hyperbolic functions. Separation of real and imaginary parts of all types of functions. • Logarithmic functions, Separation of real and Imaginary parts of Logarithmic functions.	**12**
3	**Expansion of Function:** • Taylor's Theorem (Statement only), Taylor's series and Maclaurin's series (Statement only). Expansion of standard functions.	**4**
4	**Partial Differentiation:** • Partial Differentiation: Function of several variables, Partial derivatives of first and higher order, Differentiation of composite function, Total differentials and Implicit functions. • Euler's Theorem on Homogeneous functions with two and three independent variables (with proof). Deductions from Euler's theorem. **Applications of Partial Differentiation:** • Maxima and Minima of a function of two independent variables. • Jacobian's of two and three independent variables.	**14**
5	**Numerical Solutions of Transcendental Equations, System of Linear Algebraic Equations, Curve fitting:** • Solution of Algebraic and Transcendental Equations by: Newton Raphson Method. • Solution of system of linear algebraic equations by Gauss Seidal Iteration Method. • Curve fitting: Fitting a straight line, Quadratic curve.	**4**
	Total	**42**

Engineering Mathematics Tutorial (D26MBS101T)	
Sr. No.	**Tutorial Title**
	Tutorials for Theoretical and Conceptual Learning
1	Matrices.
2	Complex Numbers.
3	Hyperbolic and Logarithm of complex numbers.
4	Expansion of Function.
5	Partial Differentiation.
6	Application of Partial Differentiation.
	Hands-on Tutorials using R Programming/SciLab/Desmos/GeoGebra
7	Matrices.
8	Solution of Transcendental Equations by Newton Raphson Method.
9	Solution of system of linear algebraic equations by Gauss Seidal Iteration Method.
10	Curve Fitting.

A minimum of eight tutorials (including R programming language/SciLab/Desmos/GeoGebra) from the above-suggested list or any other experiment based on the syllabus will be included, which would help the learner to apply the concept learnt.

Self -Learning Plan:

The subject teacher will identify the self-learning topics and ensure that students develop a deeper understanding of their relevance to industry and society. Further, the details of the self-learning activity, assessment methods, and rubrics will be provided in the self-learning plan of the course.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 4 questions (All compulsory, but with internal choice having sub questions as appropriate), total summing up to 60 marks.
2. Total duration allotted for writing the paper is 2 hrs.

Continuous Assessment (B):

Theory: (Term test: 40 Marks)

1. Assessment consists of two class tests of 15 marks each and self -learning assessment (SLA) of 10 marks. The first-class test (TT1) is to be conducted when approx. 50% syllabus is completed and second-class test (TT2) when rest 50% syllabus is completed.
2. Total duration allotted for writing each of the class tests is 45 mins.
3. The SLA of 10 marks is based on self- learning topics conducted as Assignments, Case study, Report writing, Quiz etc. and the distribution of marks will be as per Self-learning Rubrics designed by the subject teacher.

Tutorial (Term work: 25 Marks)

1. Term work shall consist of Tutorials with submission.
2. Batch wise Tutorials are to be conducted to develop a rational temperament for scientific observations which lead to constructive inferences essential for technology studies. Students must be encouraged to perform minimum eight experiments and submit the Term Work.
3. An additional laboratory/tutorial activity based on self-learning topics in the form of Lab demonstration experiment, Virtual Lab, Simulation Lab, extra tutorial, case study should be conducted and assessed.
4. The distribution of 25 marks for term work should be as per the Rubrics designed for the Laboratory work by the subject teacher.

Books Recommended:

Textbooks:

- Higher Engineering Mathematics, Dr. B. S. Grewal, Khanna Publication.
- Advanced Engineering Mathematics, Dennis G. Zill, Warren S. Wright.
- Andrie de Vries and Joris Meys, R Programming for Dummies, 2nd Edition, Wiley.

Reference Books:

- Foundations of Complex Analysis, S. Ponnusamy, Narosa Publications.

- Advanced Engineering Mathematics, Erwin Kreyszig, Wiley Eastern Limited, 9th Ed.
- Advanced Engineering Mathematics by H. K. Dass, 28th edition, S. Chand 2010.
- Introductory Methods of Numerical Analysis, S.S. Sastry, Eastern Economy Edition.
- Numerical Methods, M. K. Jain, R. K. Jain, S. R. K. Iyengar, New Age International Publishers.
- Matrices, Shanti Narayan, S. Chand publication.
- Applied Numerical Methods with MATLAB for Engineers and Scientists by Steven Chapra, McGraw Hill.
- Elementary Linear Algebra with Application by Howard Anton and Christ Rorres, 6th edition, John Wiley & Sons, INC.
- Jared P. Lander, R for Everyone: Advanced Analytics and Graphics, 2nd Edition, Addison-Wesley Data & Analytics Series.

Web References:

- Engineering Mathematics - I:(https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ma133)
- Advanced Calculus for Engineers : (https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ma130)
- Calculus of One Real Variable: (https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ma91)
- Calculus of Several Real Variables: (https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_ma92)

Program: Mechanical Engineering	First Year B. Tech.	Semester: I
Course: Engineering Physics (D26MBS102)		
Course: Engineering Physics Laboratory (D26MBS102L)		

Pre-requisites:

Foundations of physics and mathematics till H. Sc. or equivalent is necessary to comprehend engineering physics curriculum effectively.

Objectives:

1. Identify and understand the fundamental physical principles underlying engineering technologies—a prerequisite to become successful engineer.
2. To provide inclusive knowledge of fundamental physical principles encouraging engineering students to venture into the research field.
3. To introduce the fundamental principles of quantum mechanics and crystal structure, along with their applications in simple physical systems and material characterization.
4. To develop an understanding of engineering sensors, lasers and superconductors with emphasis on their principles, working and technological applications.

Outcomes: After successful completion of the course, students will be able to:

1. Relate to the scope and foundation of quantum mechanics in the development of modern technology.
2. Apply the concepts of crystallography and X-ray diffraction (XRD) techniques to analyze crystal structures and understand the properties of engineering materials used in mechanical systems.
3. Explore basic sensing and measurement techniques used for physical parameter monitoring and modern instrumentation in mechanical engineering applications.
4. Apply the principles of LASER and superconducting materials in modern mechanical engineering fields such as manufacturing and advanced industrial technologies.
5. Describe the fundamental properties, types, theories and applications of superconductors.

Engineering Physics (D26MBS102)		
Unit	**Description**	**Duration**
1	**QUANTUM MECHANICS** • Matter waves, De Broglie hypothesis. • Concept of Phase velocity, group velocity and relation with particle velocity, Concept of wave packet. • Heisenberg Uncertainty Principle. • Wave function; Physical interpretation of wave function. • Schrodinger's time dependent wave equation and time independent wave equation; • Application of Schrodinger equation: Particle trapped in a one-dimensional infinite potential well.	**7**
2	**ENGINEERING CRYSTALLOGRAPHY** • Miller indices crystallographic planes & directions. • Interplanar spacing and its relationship with Miller indices.	**6**

	• X-ray diffraction and Bragg's law. • Determination of Crystal structure using Bragg's diffractometer. • Crystal defects and applications.	
3	**ELECTROMAGNETIC FIELD THEORY** • Scalar and Vector fields, Physical significance of gradient, divergence, and curl in Cartesian coordinate system. • Divergence theorem, Stokes theorem. • Maxwell's equations integral and differential form & Significance.	**5**
4	**LASER** • Introduction and properties of Laser. • Absorption, Spontaneous emission and Stimulated emission of radiation; • Einstein's relations for absorption and emission coefficients. • Population inversion, pumping, types of pumping, metastable state, active medium, resonant cavity, three & four level laser system. • Helium Neon laser; Nd:YAG laser, 2 laser.	**5**
5	**SENSOR TECHNOLOGY AND SUPERCONDUCTIVITY** • Pressure Sensor: Concept of pressure sensing, Capacitive and piezoresistive pressure sensors. • Ultrasonic sensors: Concept of piezoelectricity and inverse piezoelectricity, use of piezoelectric transducer as ultrasonic generator and application of ultrasonic transducer for distance measurement. • Temperature Sensor: (Principle, working & Applications) • Velocity Sensor: (Principle, working & Applications) • IR sensor: (Principle, working & Applications) Superconductivity, Critical temperature, Critical magnetic field, Meissner's effect, • Type I and Type II and high Tc superconductors, • Concept of cooper pair, BCS theory. • Applications for superconducting materials.	**5**
	Total	**28**

Engineering Physics Laboratory (D26MBS102L)	
Sr. No.	**Experiment Title**
1.	Determination of Planck's constant using LED.
2.	Study of Miller Indices, Planes and direction.
3.	Study of pressure sensor characteristics
4.	Study of ultrasonic distance meter/ interferometer.
5.	Simulation experiments on sensors.
6.	Determination of width of a slit using single slit diffraction experiment (laser source).
7.	Study of divergence of laser beam.
8.	Determination of diameter of wire/hair or thickness of paper using Wedge shape film method.
9.	Study of temperature and IR Sensor Characteristics
10.	Study of PT100 calibration.
11.	Study of velocity of sound in liquid using Ultrasonic Interferometer

	Performance-Based Experiments (Hands-on and Simulation Tools)
12.	Simulation of de Broglie wavelength of an electron with varying accelerating voltage.
13.	Simulation of Miller indices for crystallographic planes and directions.
14.	Simulation of capacitive pressure sensor: variation of capacitance with pressure.
15.	Simulation of resistance versus temperature curve for a superconductor.
	Mini Lab Project
16.	Mini lab project (working model/ simulation/ research paper presentation

Minimum six experiments and mini lab project (working model/ simulation/ research paper presentation) as laboratory work from the above suggested list or any other experiment based on syllabus will be conducted batch wise to develop a rational temperament for scientific observations which lead to constructive inferences essential for technology studies.

Self -Learning Plan:

The subject teacher will identify the self-learning topics and ensure that students develop a deeper understanding of their relevance to industry and society. Further, the details of the self-learning activity, assessment methods, and rubrics will be provided in the self-learning plan of the course.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 4 questions (All compulsory, but with internal choice having sub questions as appropriate), total summing up to 60 marks.
2. Total duration allotted for writing the paper is 2 hrs.

Continuous Assessment (B):

Theory: (Term test: 40 Marks)

1. Assessment consists of two class tests of 15 marks each with self -learning assessment (SLA) of 10 marks. The first-class test (TT1) is to be conducted when approx. 50% syllabus is completed and second-class test (TT2) when rest 50% syllabus is completed.
2. Total duration allotted for writing each of the class tests is 45 mins.
3. The SLA of 10 marks is based on self- learning topics conducted as Assignments, Case study, Report writing, Quiz etc. and the distribution of marks will be as per Self-learning Rubrics designed by the subject teacher.

Laboratory (Term work: 25 Marks)

1. Term work shall consist of Laboratory work with submission.
2. Batch wise laboratory work/Tutorial work is to be conducted to develop a rational temperament for scientific observations which lead to constructive inferences essential for technology studies. Students must be encouraged to perform minimum eight experiments and submit the laboratory Journal.
3. An additional laboratory/tutorial activity based on self-learning topics in the form of Lab demonstration experiment, Virtual Lab, Simulation Lab, case study should be conducted and assessed.
4. The distribution of 25 marks for term work should be as per the Rubrics designed for the Laboratory work by the subject teacher.

Books Recommended:

Textbooks:

- T. V. S. Arun Murthy, M. N. Avadhanulu and P. G. Kshirsagar, A Textbook of Engineering Physics, S. Chand Publishing, New Delhi, 2026.
- M. N. Avadhanulu and P. G. Kshirsagar, Problems in Engineering Physics, S. Chand Publishing, New Delhi, 2012.
- S. O. Pillai and Sivakami Pillai, A Textbook of Engineering Physics, New Age International Publishers, New Delhi, 2012.
- Ajoy Ghatak and S. Lokanathan, Quantum Mechanics: Theory and Applications, Springer, Dordrecht, 2004.
- A. S. Vasudeva, Modern Engineering Physics, S. Chand Publishing, New Delhi, 1999.
- Wiley Editorial, Engineering Physics: As per AICTE, Wiley India Pvt. Ltd., New Delhi, 2020.
- R. K. Gaur and S. L. Gupta, Engineering Physics, Dhanpat Rai Publications, New Delhi, 2012.
- Shatendra Sharma and Jyotsna Sharma, Engineering Physics, Pearson India Education Services Pvt. Ltd., Chennai, 2018.
- D. K. Bhattacharya and Poonam Tandon, Engineering Physics, Oxford University Press, New Delhi, 2015.
- V. Rajendran, Engineering Physics, Tata McGraw-Hill Education Pvt. Ltd., New Delhi, 2010.
- H. S. Kalsi, Electronic Instrumentation and Measurements, McGraw Hill Education, New Delhi, 2019.
- R. K. Puri and V. K. Babbar, Solid State Physics, S. Chand Publishing, New Delhi, 2010.

Reference Books:

- David J. Griffiths and Darrell F. Schroeter, Introduction to Quantum Mechanics, Cambridge University Press, Cambridge, 2018.
- Arthur Beiser, Concepts of Modern Physics, Tata McGraw-Hill Education, New Delhi, 2003.
- Albert D. Helfrick and William D. Cooper, Modern Electronic Instrumentation and Measurement Techniques, Prentice-Hall of India Pvt. Ltd., New Delhi, 1992.
- Jacob Fraden, Handbook of Modern Sensors: Physics, Designs, and Applications, Springer International Publishing, Cham, 2016.Albert D. Helfrick and William David Cooper, Modern Electronic Instrumentation and Measurement Techniques, PHI Learning Pvt. Ltd., New Delhi, 2014.

Web References:

- Quantum Mechanics I, https://onlinecourses.nptel.ac.in/noc26_ph08/preview
- Quantum Mechanics – An Introduction, https://nptel.ac.in/courses/115106066
- X-ray Crystallography and Diffraction, https://onlinecourses.nptel.ac.in/noc22_mm39/preview
- Design of Mechatronic Systems, https://nptel.ac.in/courses/112101304
- The Science of Light Amplification: An Extensive Laser Course, https://onlinecourses.nptel.ac.in/noc25_ph26/preview
- Laser: Fundamentals and Applications, https://nptel.ac.in/courses/104104085
- A Brief Course on Superconductivity, https://onlinecourses.nptel.ac.in/noc26_ph11/preview

Program: Mechanical Engineering	First Year B. Tech.	Semester: I
Course: Structured Programming using C (D26MES101)		
Course: Structured Programming using C Laboratory (D26MES101L)		

Pre-requisites: None

Objectives:

1. To familiarize with the logic of Computer Programming.
2. To provide exposure in developing algorithm, flowchart and thereby writing efficient codes for user defined problem.

Outcomes: After successful completion of the course, students will be able to:

1. Implement the programs in C.
2. Debug the C programs.

Structured Programming using C (D26MES101)		
Unit	**Description**	**Duration**
1	**Basics of Programming:** Introduction to programming paradigms, Structure of C program, Algorithm & Flowchart, Compilation process: Syntax and semantic errors, Character Set, Identifiers and keywords, Data types, Constants, Variables, Operators-Arithmetic, Relational and logical, Assignment, Unary, Conditional, Bitwise, Comma, and other operators, precedence and associativity, Library Functions, Preprocessor, Data Input and Output – getchar (), putchar (), scanf (), printf (), fgets (), puts (), Structure of C program.	**04**
2	**Control Structures:** Decision making with Branching - If statement, If-else Statement, Switch case statement, Looping – while, do-while, for, Nested control structure, Continue statement, Break statement, goto statement.	**05**
3	**Functions and Parameter:** Function -Introduction of Function, defining a Function, accessing a Function, Function Prototype, Passing Arguments to a Function, Designing Recursive function, Storage Classes –Auto, Extern, Static, Register	**04**
4	**Arrays and its applications:** Array-Concepts, Declaration, Definition, accessing array element, One- dimensional and Multidimensional array, Passing Arrays to Function, Sorting algorithms: Bubble sort, Insertion sort, Selection sort, radix sort Searching algorithms: Linear search, Binary search, String- Basics of String, Functions in string.h, user defined function for string handling	**07**
5	**Structures and Unions:** Declaration, Initialization, structure within structure, Operation on structures, Array of Structure, Structure padding, Union, comparison of Structures and Union	**04**
6	**Pointers and File handling:** Introduction to Pointers, Pointer Declaration, Call by Value, Call by Reference, Opening and closing files, reading and writing to files, operations on files.	**04**
	Total	**28**

A) **Course: Structured Programming using C Laboratory (D26MES101L)**	
Exp.	**Suggested experiments**
1	Write a program to swap two variables values with and without using third variables. Write algorithm and draw flowchart for the same.
2	Write a program to check odd or even number: (a) using modulus operator (b) using conditional operator.
3	Design and develop a C program to read a year as an input and find whether it is leap year or not. Also consider the end of the centuries. Write algorithm and draw flowchart for the same.
4	Write a C program to find the sum of individual digits of a 3-digit number.
5	Design and develop a flowchart or an algorithm that takes three coefficients (a, b, and c) of a Quadratic equation ($ax^2 + bx + c = 0$) as input and compute all possible roots. Implement a C program for the developed flowchart/algorithm and execute the same to output the possible roots for a given set of coefficients with appropriate messages.
6	Write a program to count the number of digits in a given integer.
7	Write a menu driven program to perform simple arithmetic operations based on the user's choice. The user will indicate the operation to be performed using the signs e.g. + for addition, etc. Write an algorithm and draw flowchart for same.
8	Write a program to read a number of more than one digit, reverse the number and display the sum of digits of numbers. Write algorithm and draw flowchart for the same.
9	Write programs to display each of the following patterns. B) 1 2 1 3 2 1 4 3 2 1 5 4 3 2 1 B) A ABA ABCBA ABCDCBA ABCDEDCBA
10	Write a C program to find maximum and minimum between two numbers using functions. Write algorithm and draw flowchart for the same.
11	Write C program to find GCD of two integers by using recursive function.
12	Write a C program to find both the largest and smallest number in a list of integers. Write algorithm and draw flowchart for the same.
13	Develop, implement and execute a C program that reads two matrices A (m x n) and B (p x q) and Compute product of matrices A and B. Read matrix A and matrix B in row major order and in column major order respectively. Print both the input matrices and resultant matrix with suitable headings and output should be in matrix format only.
14	Write a Program for deletion of an element from the specified location from Array.
15	Write a C program that implements the following sorting methods to sort a given list of integers in ascending order i) Bubble sort ii) Selection sort iii)Insertion sort
16	Write C programs that use both recursive and non-recursive functions to perform the following searching operations for a Key value in a given list of integers: i) Linear search ii) Binary search

17	Write a C program using user defined functions to determine whether the given string is palindrome or not.
18	Create a structure named "Employee" to store employee details such as employee ID, name, and salary. Write a program to input data for three employees, find the highest salary employee, and display their information.
19	Demonstrate Union for displaying student record.
20	Demonstrate the concept of Call by Value and Call by Reference in C programming by passing variables to functions and observing the effect of modifications on the original variables.
21	Read any text file (e.g. info.txt) and write its content to a new file (no_vowels.txt), excluding all lowercase and uppercase vowels (A, E, I, O, U, a, e, i, o, u).

Self -Learning Plan:

The subject teacher will identify the self-learning topics and ensure that students develop a deeper understanding of their relevance to industry and society. Further, the details of the self-learning activity, assessment methods, and rubrics will be provided in the self-learning plan of the course.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 4 questions (All compulsory, but with internal choice having sub questions as appropriate), total summing up to 60 marks.
2. Total duration allotted for writing the paper is 2 hrs.

Continuous Assessment (B):

Theory: (Term test: 40 Marks)

1. Assessment consists of two class tests of 15 marks each with self -learning assessment (SLA) of 10 marks. The first-class test (TT1) is to be conducted when approx. 50% syllabus is completed and second-class test (TT2) when rest 50% syllabus is completed.
2. Total duration allotted for writing each of the class tests is 45 mins.
3. The SLA of 10 marks is based on self- learning topics conducted as Assignments, Case study, Report writing, Quiz etc. and the distribution of marks will be as per Self-Learning Rubrics designed by the subject teacher.

Laboratory (Term work: 25 Marks)

1. Term work shall consist of Laboratory work with submission.
2. Batch wise laboratory work/Tutorial work is to be conducted to develop a rational temperament for scientific observations which lead to constructive inferences essential for technology studies. Students must be encouraged to perform all experiments and submit the laboratory Journal.
3. An additional laboratory/tutorial activity based on self-learning topics in the form of Lab demonstration experiment, Virtual Lab, Simulation Lab, case study should be conducted and assessed.
4. The distribution of 25 marks for term work should be as per the Rubrics designed for the Laboratory work by the subject teacher.

Books Recommended:

Textbooks:

- MASTERING C" by K.R.Venugopal and Sudeep R.Prasad , Tata McGraw-Hill Publications.
- "A Computer Science –Structure Programming Approaches using C", by Behrouz Forouzan, Cengage Learning.
- Schaum's outlines "Programming with C", by Byron S. Gottfried, Tata McGraw-Hill Publications.

Reference Books:

- "Basics of Computer Science", by BehrouzForouzan , Cengage Learning.
- "Programming Techniques through C", by M. G. Venkateshmurthy, Pearson Publication.
- "Programming in ANSI C", by E. Balaguruswamy, Tata McGraw-Hill Education.
- "Programming in C", by Pradeep Day and Manas Gosh, Oxford University Press.
- "Let Us C", by Yashwant Kanetkar, BPB Publication.

Web References:

- Problem Solving Through Programming In C - https://onlinecourses.nptel.ac.in/e-learning/preview/noc26_cs53

Program: Mechanical Engineering	Final Year B. Tech.	Semester: I
Course: Engineering Mechanics (D26MES102)		
Course: Engineering Mechanics Laboratory(D26MES102L)		

Pre-requisites:

1. Fundamentals of Engineering Mathematics, Physics, and basic mechanics concepts related to force, motion, and energy.

Objectives:

1. To understand the fundamental concepts of Engineering Mechanics, including centroid, moment of inertia, and their applications in engineering structures and components.
2. To analyze different systems of coplanar forces and apply equilibrium conditions for determining reactions and solving engineering mechanics problems related to beams and structures.
3. To comprehend the principles of friction, kinematics, and motion of particles and rigid bodies for solving practical engineering problems involving inclined planes, wedges, ladders, and mechanisms.
4. To apply the concepts of kinetics, work-energy principle, and dynamic equilibrium for analyzing the motion and behavior of particles and rigid bodies under various force systems.

Outcomes: On completion of the course, the learner will be able to:

1. Explain the concepts of force systems, moments, centroid, and center of gravity for engineering applications.
2. Apply the principles of static equilibrium and free body diagrams to determine support reactions and analyze beams and connected bodies.
3. Analyze problems involving dry friction, ladders, wedges, and inclined planes using laws of friction and equilibrium conditions.
4. Apply the principles of kinetics, work-energy, impulse-momentum, and motion analysis to study the behavior of particles in rectilinear and curvilinear motion.
5. Evaluate the kinetics of rigid bodies under translation and rotation using equations of motion, work-energy, and impulse-momentum principles.

Engineering Mechanics (D26MES102)		
Unit	**Description**	**Duration**
1	**Force Systems and Center of Gravity** Concept of force, composition, resolution and resultant of coplanar forces. Moment of force about a point and Varignon's theorem. Force-couple systems. Center of gravity and centroid of simple geometrical bodies. Center of gravity and centroid of simple geometrical bodies.	**5**
2	**Equilibrium of Rigid Bodies** Conditions of static equilibrium and free body diagrams. Equilibrium of connected bodies. Types of supports and support reactions. Analysis of statically determinate beams under different loading conditions. Determination of support reactions.	**6**

3	**Friction** Static and kinetic friction. Laws of dry friction. Angle of friction, cone of friction, and angle of repose. Equilibrium analysis of block friction, ladder friction, and wedge.	**4**
4	**Kinetics of Particles** Newton's laws of motion. D'Alembert's principle. Work-energy principle and applications. Impulse-momentum principle and applications to particle systems. Motion in rectilinear and curvilinear coordinates.	**6**
5	**Kinetics of Rigid Bodies** Moment of inertia. Kinetics of rigid bodies under translation and rotation. Equations of motion for rigid bodies. Work-energy principle for rigid bodies (basic applications). Impulse-momentum principle (basic linear form). Rolling motion without slipping (introductory concept only).	**7**
	Total	**28**

Engineering Mechanics Lab (D26MES102L)	
Sr. No.	**Experiment Title**
1	Verification of Polygon law of coplanar forces.
2	Verification of law of Moment using Bell crank lever.
3	Determination of Support reaction for beam.
4	Determination of coefficient of friction using Inclined plane
5	Verification of Lami's theorem using Jib crane.
6	Resultant of non-concurrent non-parallel coplanar force system.
7	Determination of coefficient of restitution for Collision of elastic bodies (Law of conservation of momentum).
8	Measurement of linear acceleration using MPU-6050 (3-axis accelerometer/gyroscope) with ESP32.
9	Measurement of rotational speed (RPM) of a shaft using an IR tachometer / Hall-effect sensor with ESP32.
10	Measurement of force and weight using HX711 load cell amplifier with ESP32; calibration and static equilibrium verification.

A minimum of six experiments from the above-suggested list or any other experiment based on the syllabus will be included, which would help the learner to apply the concept.

Self -Learning Plan:

The subject teacher will identify the self-learning topics and ensure that students develop a deeper understanding of their relevance to industry and society. Further, the details of the self-learning activity, assessment methods, and rubrics will be provided in the self-learning plan of the course.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 4 questions (All compulsory, but with internal choice having sub questions as appropriate), total summing up to 60 marks.
2. Total duration allotted for writing the paper is 2 hrs.

Continuous Assessment (B):

Theory: (Term test: 40 Marks)

1. Assessment consists of two class tests of 15 marks each with self -learning assessment (SLA) of 10 marks. The first-class test (TT1) is to be conducted when approx. 50% syllabus is completed and second-class test (TT2) when rest 50% syllabus is completed.
2. Total duration allotted for writing each of the class tests is 45 mins.
3. The SLA of 10 marks is based on self- learning topics conducted as Assignments, Case study, Report writing, Quiz etc. and the distribution of marks will be as per Self-learning Rubrics designed by the subject teacher.

Laboratory/Tutorial (Term work: 25 Marks)

1. Term work shall consist of Laboratory work & Tutorial work with submission.
2. Batch wise laboratory work/Tutorial work is to be conducted to develop a rational temperament for scientific observations which lead to constructive inferences essential for technology studies. Students must be encouraged to perform minimum eight experiments and submit the laboratory Journal.
3. An additional laboratory/tutorial activity based on self-learning topics in the form of Lab demonstration experiment, Virtual Lab, Simulation Lab, extra tutorial, case study should be conducted and assessed.
4. The distribution of 25 marks for term work should be as per the Rubrics designed for the Laboratory work by the subject teacher.

Books Recommended:

Text books:

- Engineering Mechanics by A K Tayal, Umesh Publication.
- Engineering Mechanics by S Ramamrutham Dhanpat Rai Publishing company.

Reference Books:

- Engineering Mechanics by R. C. Hibbeler. Pearson education.
- Engineering Mechanics by Beer & Johnston, Tata McGraw Hill
- Engineering Mechanics by Bhattacharya B, Oxford University press
- Engineering Mechanics by Nelson and Mc Lean, Tata McGraw Hill

Program: Mechanical Engineering	First Year B. Tech.	Semester: I
Course: Engineering Communication and Lean Thinking (D26MHS101)		
Course: Engineering Communication and Lean Thinking Laboratory (D26MHS101L)		

Pre-requisites:

1. Basic understanding of communication and language skills.

Objectives:

1. Understand the fundamentals and process of effective communication in academic and professional environments.
2. Develop active listening and verbatim note-taking skills for factual understanding and communication.
3. Build observation and awareness abilities using Lean Thinking and Gemba-based approaches.
4. Differentiate between facts, assumptions, and opinions while analyzing observations.
5. Apply structured thinking tools such as 4W1H and Ladder of Abstraction for professional reporting and communication.

Outcomes: On completion of the course, the learner will be able to:

1. Explain the fundamentals and barriers of communication in professional environments.
2. Demonstrate active listening, verbatim note-taking, and observation skills in academic and workplace situations.
3. Apply observation principles and appreciative enquiry for factual analysis and interpretation.
4. Use structured communication and reporting tools for reflection, discussion, and professional interaction.
5. Illustrate basic systems thinking concepts and communicate system relationships using simple system dynamic models.

Engineering Communication and Lean Thinking (D26MHS101)		
Unit	**Description**	**Duration**
1	**Basics of Communication Skills:** Fundamentals of communication; Process of communication; Verbal and non-verbal communication; Active listening skills; Verbatim note-taking; Barriers to communication; Professional interaction basics; Introduction to workplace communication; AI assisted communication practices; Communication for value creation and waste elimination.	**3**
2	**Observation and Awareness Skills:** Importance of observation in engineering and daily life; seeing vs observing; Attention, approach and analysis; Visible, invisible and unknown observations; Fishbowl concept and Gemba observation; Observation without assumptions; Qualitative vs quantitative observations; Appreciative enquiry; Observation in human behaviour and surroundings.	**3**
3	**Analytical Thinking and Principles of Observation:** Six Principles of Observation: Observe the Periphery, See the Unusual, look for Shadows, look for Missing, Identify Symbols, Make Comparisons. Facts vs Opinions, Observation-based analysis and interpretation.	**2**

4	**Communication, Reflection and Professional Skills:** Language of affection vs Language of report; 4W1H methodology; Ladder of Abstraction; Structured thinking and reporting; Reflection writing; Writing symbol words; Communication through factual observations. Introduction to visual communication.	**4**
5	**Systems Thinking and System Dynamics:** Concept of systems; Components and interactions; Cause-and-effect relationships; Feedback loops; Introduction to Systems Thinking; Basics of System Dynamics Model Diagram; Simple engineering and daily-life system examples; Presentation skills through system model presentations and team discussions.	**2**
	Total	**14**

Engineering Communication and Lean Thinking (D26MHS101L)	
Sr. No.	**Experiment Title**
1	Active listening and verbatim note-taking exercise
2	Observation activity inside campus/workplace environment
3	Gemba observation and reporting activity
4	Facts vs opinions identification exercise
5	Reflection writing activity
6	4W1H analysis activity
7	Visual communication activity using symbols/images
8	Team-based system dynamics model presentation
9	Role play using non-verbal communication
10	Email writing
11	Case studies in workplace communication
12	Comprehension and summarization writing
13	Public Speaking

A minimum of eight experiments from the above-suggested list or any other experiment based on the syllabus will be included, which would help the learner to apply the concept.

Self -Learning Plan:

The subject teacher will identify the self-learning topics and ensure that students develop a deeper understanding of their relevance to industry and society. Further, the details of the self-learning activity, assessment methods, and rubrics will be provided in the self-learning plan of the course.

Evaluation Scheme:

Continuous Assessment (B):

Theory: (Term test: 40 Marks)

1. Assessment consists of two class tests of 15 marks each with self -learning assessment (SLA) of 10 marks. The first-class test (TT1) is to be conducted when approx. 50% syllabus is completed and second-class test (TT2) when rest 50% syllabus is completed.
2. Total duration allotted for writing each of the class tests is 45 mins.
3. The SLA of 10 marks is based on self- learning topics conducted as Assignments, Case study, Report writing, Quiz etc. and the distribution of marks will be as per Self-learning Rubrics designed by the subject teacher.

Laboratory (Term work: 25 Marks)

1. Term work shall consist of Laboratory work with submission.
2. Batch wise laboratory work is to be conducted to develop a rational temperament for scientific observations which lead to constructive inferences essential for technology studies. Students must be encouraged to perform minimum eight experiments and submit the laboratory Journal.
3. An additional laboratory activity based on self-learning topics in the form of Lab demonstration experiment, Virtual Lab, Simulation Lab, extra tutorial, case study should be conducted and assessed.
4. The distribution of 25 marks for term work should be as per the Rubrics designed for the Laboratory work by the subject teacher.

Mini-Project (25 Marks)

Students will undertake a mini-project based on the concepts and skills acquired through the various modules of the syllabus and present their project findings in groups.

Books Recommended:

Reference Books:

- James P. Womack and Daniel T.Jones, Lean Thinking: Banish Waste and Create Wealth in Your Corporation, Revised and Updated. Free Press, New York, 2003
- Peter M. Senge, The Fifth Discipline: The Art and Practice of The Learning Organization, Crown Currency, United States, 2006
- Shoji Shiba & David Walden, Breakthrough Management: Principles, Skills, and Patterns for Transformational Leadership, Confederation of Indian Industry, New Delhi, 2008
- Samuel I. Hayakawa, Language in Thought and Action, Harcourt Brace International, India, 1991
- P. D. Hemphill, D. W. McCormick & R. D Hemphill, Business Communication with Writing Improvement Exercises, Pearson, Upper Saddle River, NJ: Prentice Hall, 2001
- Kitty O. Locker & Stephen Kyo Kacmarek, Business Communication: Building Critical Skills, McGraw-Hill, 2019
- Meenakshi Raman & Sangeeta Sharma, Technical Communication: Principles and Practice, New Delhi, Oxford University Press, 2016
- Asha Kaul, Effective Business Communication, Prentice-Hall of India, 2015
- M. Ashraf Rizvi & Priyadarshi Patnaik, Effective Technical Communication: A guide for scientists and engineers, New Delhi, Tata McGraw Hill, 2010
- Norman Lewis, Word Power Made Easy, Random House USA, 2014
- Sanjay Kumar & Pushp Lata Communication skills. New Delhi, Oxford University Press, 2018
- Shirley Mathew, Effective Communication Skills, Nirali Prakashan, 2025
- Smita Rane & Chumki Biswas, Professional Communications and Ethics, Himalaya Publishing House, 2025
- Jacqueline Farrington, The Non-Obvious Guide to Better Presentations: How to Present Like a Pro (Virtually or in Person), Ideapress Publishing, 2023
- Aruna Koneru, Professional Communication, McGraw Hill, 2018

Program: Mechanical Engineering	F.Y B. Tech.	Semester: I
Course: Engineering Graphics I (D26MES103)		
Course: Engineering Graphics I Laboratory (D26MES103L)		

Pre-requisite: --

1. Basics of geometrical constructions

Objectives:

1. To introduce the fundamentals of engineering drawing, drawing standards, dimensioning practices, and projection systems used in engineering communication.
2. To develop the ability to visualize and represent three-dimensional objects through orthographic projections and multi-view drawings.
3. To impart knowledge of isometric drawing techniques for effective pictorial representation of engineering components and objects.
4. To enhance spatial visualization skills required for interpreting and constructing missing views from given engineering drawings.

Outcomes: On completion of the course, the learner will be able to:

1. Apply engineering drawing conventions, dimensioning standards, and projection principles in technical drawings.
2. Construct orthographic projections and multi-view drawings of simple solids and machine components using the First Angle Projection method as per BIS standards.
3. Develop isometric views and convert orthographic drawings into isometric representations of engineering objects and components.
4. Interpret engineering drawings and generate missing views of objects using visualization and projection principles.

Engineering Graphics I (D26MES103)		
Unit	**Description**	**Duration**
1	**Introduction to Engineering Drawing**. Types of Lines, Dimensioning Systems as per IS conventions, Types of Projections.	**01**
2	**Orthographic projections:-** Principles of Orthographic Projection; Projection planes and reference line (XY); Methods of Projection: First Angle Projection and Third Angle Projection; Selection and arrangement of Front View, Top View, and Side View.; Orthographic Views of Simple Solids: Cube, Prism, Cylinder, and Cone.; Generation of multi view drawings from pictorial representations; Drawing different views of simple machine parts as per the First Angle Projection Method recommended by Bureau of Indian Standards (BIS/IS).	**05**
3	**Isometric Views: -** Introduction to Isometric Drawing and Isometric Projection; Difference between Isometric View and Isometric Projection; Isometric Axes and Isometric Scale; Principles and conventions used in isometric representation; Construction of Isometric Views of simple geometrical shapes; Isometric Views of simple solids: Cube, Prism,	**04**

	Pyramid, Cylinder, and Cone; Conversion of Orthographic Views into Isometric Views; Drawing Isometric Views of simple machine components and engineering objects (plain and cylindrical, excluding spheres); Visualization and interpretation of three-dimensional objects using isometric drawings.	
4	**Missing Views: -** Interpretation of orthographic drawings and construction of the missing front, top, or side view from the given views of simple engineering objects and machine components using principles of visualization and projection.	**04**
	Total	**14**

Engineering Graphics I Laboratory (D26MES103L)	
Exe.	**Suggested exercise**
1	Familiarization with drawing instruments, line types, lettering, and dimensioning practices as per BIS standards.
2	Drawing examples demonstrating first-angle and third-angle projection methods. Drawing front, top, and side views of simple geometrical objects.
3	Generation of orthographic views of prism, cylinder, cube and cone in different orientations.
4	Generation of orthographic views from given pictorial or isometric sketches.
5	Generation of orthographic views from given pictorial or isometric sketches.
6	Generation of orthographic views from given pictorial or isometric sketches.
7	Drawing isometric views of cube, prism, cylinder, cone, and combinations of solids.
8	Development of isometric drawings from given orthographic projections.
9	Development of isometric drawings from given orthographic projections.
10	Preparation of isometric views of engineering objects and machine parts
11	Determination and construction of missing front, top, or side views from given orthographic
12	Determination and construction of missing front, top, or side views from given orthographic

Minimum eight exercises from the above suggested list covering all the topics or any other exercise based on syllabus will be included, which would help the learner to apply the concept learnt.

Self -Learning Plan:

The subject teacher will identify the self-learning topics and ensure that students develop a deeper understanding of their relevance to industry and society. Further, the details of the self-learning activity, assessment methods, and rubrics will be provided in the self-learning plan of the course.

Evaluation Scheme:

Semester End Examination (A):

Theory:

1. Question paper based on the entire syllabus will comprise of 5 questions (All compulsory, but with internal choice having sub questions as appropriate), total summing up to 60 marks.
2. Total duration allotted for writing the paper is 2 hrs.

Continuous Assessment (B):

Theory: (Term test: 40 Marks)

1. Assessment consists of two class tests of 15 marks each with self -learning assessment (SLA) of 10 marks. The first-class test (TT1) is to be conducted when approx. 50% syllabus is completed and second-class test (TT2) when rest 50% syllabus is completed.
2. Total duration allotted for writing each of the class tests is 45 mins.
3. The SLA of 10 marks is based on self- learning topics conducted as Assignments, Case study, Report writing, Quiz etc. and the distribution of marks will be as per Self-learning Rubrics designed by the subject teacher.

Laboratory/Tutorial (Term work: 25 Marks)

1. Term work shall consist of Laboratory work & Tutorial work with submission.
2. Batch wise laboratory work/Tutorial work is to be conducted to develop a rational temperament for scientific observations which lead to constructive inferences essential for technology studies. Students must be encouraged to perform minimum eight experiments and submit the laboratory Journal.
3. An additional laboratory/tutorial activity based on self-learning topics in the form of Lab demonstration experiment, Virtual Lab, Simulation Lab, extra tutorial, case study should be conducted and assessed.
4. The distribution of 25 marks for term work should be as per the Rubrics designed for the Laboratory work by the subject teacher.

Books Recommended:

Text books:

- N. D. Bhatt, 'Engineering Drawing', Charotar Publishing House.
- M. B. Shah & B. C. Rana 'Engineering Drawing', Pearson Education.
- Basant Agrawal, C M Agrawal, 'Engineering Drawing', Third Edition, Tata McGraw Hill Education Private Limited.

Reference Books:

- K. Venugopal (2007), 'Engineering Drawing and Graphics + AutoCAD', New Age International Publishers.
- M. L. Dabhade (2008), 'Engineering Drawing', Vision Publications.
- Dhananjay A. Jolhe, 'Engineering Drawing with an Introduction to AutoCAD', Tata McGraw Hill Education Private Limited.

Web References:

- Swayam Course: https://onlinecourses.swayam2.ac.in/e-learning/preview/aic22_ts42

Program: Mechanical Engineering	First Year B. Tech.	Semester: I
Course: Ideation and Innovation Laboratory (D26MSC101L)		GROUP B

Pre-requisites: Nil

Objectives:

1. Provide first-year engineering students with experiential, hands-on learning in electronics, mechanical fabrication, and prototyping.
2. Encourage innovation and problem-solving by integrating ideation, design, and fabrication in practical activities.
3. Develop critical thinking, teamwork, and collaborative learning through hands-on engineering activities

Outcomes: Learners are expected to:

1. Demonstrate the ability to identify and use basic electronic instruments and mechanical tools safely and effectively for measurement and testing purposes.
2. Construct, solder, and house electronic circuits by interpreting schematics and applying fabrication skills for functional prototyping.
3. Design and assemble a wired two-wheeled robotic system with motor controls, demonstrating integration of mechanical and electronic components.

Ideation and Innovations Laboratory (D26MSC101L)		
Unit	**Description**	**Duration**
1	**Project-Based Learning Activity 1: Introduction to Tools, Equipment, and Component Identification** • **Objective:** To familiarize the learners with laboratory experimentation, design, debugging, and micro-manufacturing tools & equipment through a structured sequence of short instructional videos. • **Outcome:** Learners engage in a series of guided activities using concise instructional videos to understand the functionality of various instruments. They demonstrate their learning by performing tasks such as recording observations, tabulating readings, and drawing conclusions. The activity covers key instruments including: · Cathode Ray Oscilloscope · Function Generator · Multimeter · Power Supply · Laser Cutter 3D Printer	**10**
	Project-Based Learning Activity 2: Breadboarding, Soldering, and Circuit Housing • **Objective:** To develop hands-on skills in component identification, circuit schematic interpretation, breadboarding, soldering, and circuit housing through a structured learning approach. • **Outcome:**	

	Learners identify and differentiate resistor and capacitor values and types, as well as recognize and utilize an LSI IC (e.g., IC 555). They assemble a 555 timer-based astable multivibrator circuit on a breadboard with a known oscillation frequency. · Learners apply soldering techniques by mounting and soldering the evaluated circuit onto a general-purpose PCB and verifying its functionality. · A CAD file (.stl format) for the circuit housing is processed into a .gcode file using slicer software, followed by 3D printing of the housing. • The circuit is securely mounted within the housing using basic workshop techniques, including cutting, smoothing with a flat file, and fixing components with self-threading screws.	
3	**Project-Based Learning Activity 3: Wired Two-Wheeled Robot** • **Objective:** To introduce learners to the design and operation of a two-wheeled robotic vehicle with a caster wheel pivot, enabling motion control using DC motors and a reversible mechanical switch. • **Outcome:** · Learners assemble a two-wheeled robot using a metal chassis, rubber-cushioned wheels, and a single caster wheel for stability. · Motion is initiated using geared DC motors, with directional control implemented via a reversible mechanical joystick switch. · Learners understand and apply the principles of reversing a DC motor for bidirectional movement. · Learners analyze the function of a DC motor speed-reduction gearbox, evaluating its advantages and limitations.	**08**
	Total	**28**

Self -Learning Plan:

The subject teacher will identify the self-learning topics and ensure that students develop a deeper understanding of their relevance to industry and society. Further, the details of the self-learning activity, assessment methods, and rubrics will be provided in the self-learning plan of the course.

Evaluation Scheme:

Continuous Assessment (B):

Laboratory (Term work: 25 Marks)

1. Term work shall consist of Laboratory work with submission.
2. Batch wise laboratory work/Tutorial work is to be conducted to develop a rational temperament for scientific observations which lead to constructive inferences essential for technology studies. Students must be encouraged to perform minimum six experiments (project based learning activities) and submit the laboratory journal.
3. An additional laboratory/tutorial activity based on self-learning topics in the form of Lab demonstration experiment, Virtual Lab, Simulation Lab, case study should be conducted and assessed.
4. The distribution of 25 marks for term work should be as per the Rubrics designed for the Laboratory work by the subject teacher.

Reference Books:

- Paul Horowitz and Winfield Hill, "The Art of Electronics" Cambridge University Press, 3rd Edition, 2015.
- Paul Scherz and Simon Monk, "Practical Electronics for Inventors" McGraw Hill Education, 4th Edition, 2016.
- Charles K. Alexander and Matthew N. O. Sadiku, "Fundamentals of Electric Circuits" McGraw Hill Education, 4th Edition, 2016.

Online Resources:

- Online repository and community for sharing and exploring 3D-printable designs and open-hardware projects. - https://www.thingiverse.com/
- Step-by-step learning resource for developing Android applications using MIT App Inventor. - http://www.appinventor.org/book2
- Official resource for ESP32 development boards, hardware, software frameworks, documentation and IoT development resources. - https://www.espressif.com/
- Visual, beginner-friendly platform for learning mobile app development through hands-on application building, tutorials and educational resources. - https://appinventor.mit.edu/
- Practical tutorials and project resources for ESP32, ESP8266, Arduino, Raspberry Pi, IoT, web servers and related embedded applications. - https://randomnerdtutorials.com/

Program: Mechanical Engineering	First Year B. Tech.	Semester: I
Course: Indian Knowledge System (D26MHS102T)		

Pre-requisites: NIL

Objectives:

1. To impart knowledge about basic principles of thought process, reasoning, and inferencing.
2. To make students aware of Indian Traditional knowledge Systems connecting society and nature.
3. To acquaint students with holistic lifestyle of yogic science and wisdom in modern society with rapid technological advancements and societal disruptions.
4. Develop ethical values, critical thinking, and holistic perspectives through Indian traditions.
5. Explore Indian Knowledge Systems and their contributions to society and civilization.

Outcomes: On completion of the course, the learner will be able to:

1. Understand the history of Indian education system.
2. Learn about Indian Scientists and their inventions.
3. Understand and appreciate the various art forms and architecture in India.
4. Illustrate the classic literature written in Indian languages.
5. Know the various religions followed in India and their philosophies.

Unit	Description	Duration
1	**Indian Education System** • Gurukul system • Ancient Universities (Nalanda, Takshashila,Vikramshila,Vallabhi, Nagarjuna,etc	4
2	**Indian Scientists and Their inventions** • Patanjali, Aryabhatta, Bhaskaracharya, Charaka, Brahmagupta, Varahmitra, Sushruta, Kanada, Baudhyana, etc.	6
3	**Indian art and architecture** • Mughal Paintings, Tanjore Paintings, Madhubani Paintings, Warli Paintings, etc. • Harrappa and Mohenjo-Daro Civilization • Temples and other religious places • Buddhist stupas • Forts and monuments	8
4	**Indian Classic Literature** • Puranas • Epics (Ramayana, Mahabharata, Shakuntala, Meghdoota, Arthashastra,Sangam Literature, Malavikagnimitram etc.)	6
5	**Religion and Philosophy** • Vedas • Buddhism Jainism and other religions	4
	Total	28

Sr. No.	Tutorial Title
	Interactive/Participative Learning Assignments
1	**Indian Education System** • Group discussions/debates on various education systems.
2	**Indian Scientists and Their inventions** • Group presentations on various Indian scientists • An assignment on different inventions by Indians and their impact on world.
3	**Indian art and architecture** • Group Poster project on different painting forms and Harappa and Mohenjo-Daro civilization. • Group presentation on different archaeological structures in India
4	**Indian Classic Literature** • An assignment on review of any one of the Indian classic literatures. • Group discussion/Debate on the importance of the Indian classic literature in spreading the awareness about the importance of Indian culture and traditions. OR **Dramatic Adaptations**: • Ask students to adapt a scene or act from Indian classical literature into a dramatic performance. • They can write scripts, create props and costumes, and rehearse their adaptations. • Encourage creativity while staying true to the essence of the original work. • Students can perform their adaptations for the class or in a larger setting.
5	**Religion and Philosophy** • A group discussion/debate on the various religions and their philosophies

A minimum of eight experiments from the above-suggested list or any other experiment based on the syllabus will be included, which would help the learner to apply the concept.

Self -Learning Plan:

The subject teacher will identify the self-learning topics and ensure that students develop a deeper understanding of their relevance to industry and society. Further, the details of the self-learning activity, assessment methods, and rubrics will be provided in the self-learning plan of the course.

Evaluation Scheme:

Tutorial (Term work: 25 Marks)

1. Term work shall consist of Tutorial work with submission.
2. Batch wise Tutorial work is to be conducted to develop a rational temperament for scientific observations, which lead to constructive inferences essential for technology studies. Students must be encouraged to perform minimum eight experiments and submit the tutorial.
3. An additional tutorial activity based on self-learning topics in the form of extra tutorial/case study should be conducted and assessed.
4. The distribution of 25 marks for term work should be as per the Rubrics designed for the tutorial work by the subject teacher.

Mini project Report Presentation (25 Marks)

Students in team will select a topic related to Indian Knowledge System and prepare a 30-page report. Each group will present the problem identified, objectives, methodology, key findings, proposed solution, and conclusion in a clear and structured manner. Students must use PPT slides to present.

Books Recommended:

- B. Mahadevan, V. R. Bhat, Nagendra Pavana, '*Introduction to Indian Knowledge Systems: Concepts and Applications',* PHI Learning Publications, Delhi, 2022.
- Satishchandra Chaterjee, Dheerendramohan Datta, *An Introduction to Indian Philosophy,* Motilal Banarsidass Publishing House, New Delhi, 2016
- V.Sivaramakrishnan (Ed.), *'Cultural Heritage of India-course materia'l*, Bharatiya Vidya Bhavan, Mumbai. 5th Edition,2014

Program: First Year - Mechanical Engineering	First Year B. Tech	Semester: I
Course: Introduction to AI for Mechanical Engineers (D26MSC149)		

Pre-requisites:

1. Basic understanding of mathematics and computer fundamentals, along with an elementary knowledge of engineering concepts and digital technologies.

Objectives:

1. To understand the fundamentals of digital engineering and modern industrial technologies.
2. To explain basic concepts related to Artificial Intelligence (AI), Machine Learning (ML), and Industry 4.0.
3. To identify the role of digital technologies in mechanical engineering industries.
4. To develop awareness about smart manufacturing, robotics, automation, and intelligent systems.
5. To understand future engineering trends associated with AI-enabled industrial transformation.

Outcomes: On completion of the course, the learner will be able to:

1. Describe the concepts of digital engineering and intelligent industrial systems.
2. Explain the fundamentals of AI, ML, IoT, and Industry 4.0 technologies.
3. Identify applications of AI and automation in mechanical engineering industries.
4. Interpret the role of smart technologies in manufacturing and maintenance systems.
5. Discuss future engineering technologies and their industrial relevance.

Introduction to AI for Mechanical Engineers (D26MSC149)		
Unit	**Description**	**Video Lecture Duration**
1	**Introduction to Digital Engineering and Industrial Evolution** Introduction to engineering in the digital era; Evolution of industrial revolutions (Industry 1.0, 2.0, 3.0, 4.0, and 5.0); Digital transformation in engineering industries; Traditional industries versus smart industries; Emerging trends in modern industries.	**1h 17m**
2	**Artificial Intelligence Fundamentals** Introduction to Artificial Intelligence (AI); Types of AI; Introduction to intelligent systems; What is Machine Learning (ML)?; What is Deep Learning (DL); Difference between AI, ML, and DL.	**2h 26m**
3	**Generative AI and Responsible Engineering** Introduction to Generative AI; AI applications in industries; Benefits and limitations of AI systems; AI ethics and responsible engineering practices; Role of AI in engineering innovation.	**1h 30m**
4	**Engineering Data and Smart Sensing Systems** Introduction to engineering data; Types of data; Importance of data in engineering decision-making; Introduction to sensors and transducers; Industrial data generation systems.	**1h 20m**
5	**Internet of Things and Cyber-Physical Systems** Basics of Internet of Things (IoT); Introduction to cyber-physical systems; Smart monitoring systems; Introduction to cloud computing in industries; Connected industrial ecosystems.	**1h 14m**

6	**Automation, Robotics, and Smart Manufacturing** Introduction to automation; Types of industrial automation; Smart manufacturing systems; Introduction to industrial robots; Components of robotic systems; Collaborative robots (Cobots); Human-machine interaction systems.	**2h 8m**
7	**Connected Manufacturing and Industrial Intelligence** Automated material handling systems; Introduction to Computer Integrated Manufacturing (CIM); Smart factories and connected manufacturing; Introduction to predictive maintenance; Industrial intelligence and decision support systems.	**1h 47m**
8	**Future Technologies and Sustainable Engineering Systems** Introduction to digital twins; Introduction to autonomous systems; Basics of smart mobility systems; AI-enabled electric and hydrogen vehicles; Sustainable manufacturing concepts; Green and intelligent industries; Introduction to smart cities; Human-centric engineering systems; Future trends in mechanical engineering; Industry 5.0 and sustainable industrial transformation.	**2h 43m**
	Total	**15 h**

Evaluation Scheme:

Continuous Assessment

1. The identified courses shall focus on developing AI-related competencies and skills among students. Each selected course shall carry one (1) credit.
2. Faculty members shall act as mentors for the Coursera courses identified for various semesters of the program.
3. One faculty mentor shall be assigned to each division of the program for effective coordination and monitoring of this activity.
4. The assigned faculty mentor shall complete and review the course content before assigning the course to students.
5. The term work for these one-credit courses shall form a part of the Internal Continuous Assessment (ICA)component.
6. The Term work (ICA) component shall carry **40 marks**

The distribution of marks for term work shall be as follows:

- **15 Marks**: Coursera Course Completion and Certification
- **15 Marks**: Faculty-curated quiz conducted through the Coursera/Any other platform
- **10 Marks**: Internal faculty evaluation through quizzes, assignments, presentations, or Project

Suggested Coursera Mapping

Module	Suggested Coursera Content Provider
Introduction to Digital Engineering	IBM, Google
Fundamentals of AI and ML	DeepLearning.AI, Andrew Ng
Data and Smart Systems	Microsoft, IBM
Smart Manufacturing and Robotics	University of Colorado Boulder
Future Technologies and Sustainability	NVIDIA, AWS