LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING, (AUTONOMOUS)
Accredited by NAAC with 'A' Grade & NBA (Under Tier - I),
ISO 21001 : 2018, 50001 : 2018, 14001: 2015 Certified Institution
Approved by AICTE, New Delhi. and Affiliated to JNTUK, Kakinada
L.B. REDDY NAGAR, MYLAVARAM, NTR DIST., A.P.-521 230.
Phone: 08659-222933, Fax: 08659-222931

FRESHMAN ENGINEERING DEPARTMENT

COURSE HANDOUT

Part-A

PROGRAM : II B. Tech., I-Sem., MECH **ACADEMIC YEAR :** 2026-27
COURSE NAME & CODE : NM&TT & 23FE06 **L-T-P STRUCTURE:** 3-0-0
COURSE INSTRUCTOR : Dr. D. VIJAYA KUMAR **COURSE CREDITS :** 3
COURSE COORDINATOR : Mrs. SHAIK HASEENA BEGUM
PRE-REQUISITES : Basics of Differentiation, Integration.

COURSE EDUCATIONAL OBJECTIVES (CEOs):

- To elucidate the different numerical methods to solve non linear algebraic equations.
- To disseminate the use of different numerical techniques for carrying out numerical integration.
- To furnish the learners with basic concepts and techniques at plus two level to lead them into advanced level by handling various real world applications.

COURSE OUTCOMES (COs) After completion of the course, the student will be able to

CO1: Evaluate the approximate roots of polynomial and transcendental equations by different algorithms. Apply Newton's forward & backward interpolation and Lagrange's formulae for equal and unequal intervals (L3)

CO2: Apply numerical integral techniques to different Engineering problems. Apply different algorithms for approximating the solutions of ordinary differential equations with initial conditions to its analytical computations(L3)

CO3: Apply the Laplace transform for solving differential equations(L3)

CO4: Find or compute the Fourier series of periodic signals(L3)

CO5: Know and be able to apply integral expressions for the forwards and inverse Fourier Transform to a range of non-periodic waveforms (L3)

COURSE ARTICULATION MATRIX (Correlation between Cos &POs, PSOs):

COs/POs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12
CO1	3	2	-	2	-	-	-	-	-	-	-	1
CO2	3	2	-	2	-	-	-	-	-	-	-	1
CO3	3	2	-	2	-	-	-	-	-	-	-	1
CO4	3	2	-	2	-	-	-	-	-	-	-	1
CO5	3	2	-	2	-	-	-	-	-	-	-	1

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**
1- Slight (Low), **2 –** Moderate (Medium), **3 -** Substantial (High).

BOS APPROVED TEXT BOOKS:

T1 Dr. B.S. Grewal, "Higher Engineering Mathematics", 44nd Edition, Khanna Publishers, New Delhi, 2017.

T2 B. V. Ramana, "*Higher Engineering Mathematics*", 2007Edition , Tata McGraw Hill Education.

BOS APPROVED REFERENCE BOOKS:

R1 Erwin Kreyszig, *"Advanced Engineering Mathematics"*, 10th Edition, John Wiley – India.

R2 Steven c.chopra, "*Applied numerical methods with MAT lab for engineering and science*", Tata McGraw Hill Education.

R3 R.K. Jain and S.R.K. Iyengar, "*Numerical methods for Scientificand engineering computation",* New age international publications.

R4 Lawrence Turyn, "*Advanced engineering mathematics",* CRC press.

Part-B

COURSE DELIVERY PLAN (LESSON PLAN):

S. No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
1.	Introduction to the course	1	13- 07 - 2026		TLM1			
2.	Course Outcomes, Program Outcomes	1	14- 07 - 2026		TLM1			

UNIT-I: Iterative Methods

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
3.	Introduction to Unit I	1	16- 07 - 2026		TLM1	CO1	T1, T2	
4.	Bisection method	1	17- 07 - 2026		TLM1	CO1	T1, T2	
5.	Secant method	1	20- 07 - 2026		TLM1	CO1	T1, T2	
6.	False – position method	1	21- 07 - 2026		TLM1	CO1	T1, T2	
7.	False – position method	1	23- 07 - 2026		TLM1	CO1	T1, T2	
8.	Iteration method	1	24- 07 - 2026		TLM1	CO1	T1, T2	
9.	Newton – Raphson method	1	27- 07 - 2026		TLM1	CO1	T1, T2	
10.	Simultaneous equations	1	28- 07 - 2026		TLM1	CO1	T1, T2	
11.	Simultaneous equations	1	30- 07 - 2026		TLM1	CO1	T1, T2	
12.	Newton's forward interpolation	1	31- 07 - 2026		TLM1	CO1	T1, T2	
13.	Newton's backward interpolation	1	03- 08 - 2026		TLM1	CO1	T1, T2	
14.	Lagrange's interpolation for unequal parts	1	04- 08 - 2026		TLM1	CO1	T1, T2	
15.	Lagrange's interpolation for unequal parts	1	06- 08 - 2026		TLM1	CO1	T1, T2	
16.	Tutorial – I	1	07- 08 - 2026		TLM3	CO1	T1, T2	
No. of classes required to complete UNIT-I		16			No. of classes taken:			

UNIT-II: Linear Differential equations of higher order (Constant Coefficients)

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
17.	Introduction to Unit - 2	1	10- 08 - 2026		TLM1	CO2	T1, T2	
18.	Trapezoidal rule	1	11- 08 - 2026		TLM1	CO2	T1, T2	
19.	Simpson's 1/3 rule	1	13- 08 - 2026		TLM1	CO2	T1, T2	
20.	Simpson's 3/8 rule	1	14- 08 - 2026		TLM1	CO2	T1, T2	
21.	Taylor's series method	1	17- 08 - 2026		TLM1	CO2	T1, T2	
22.	Taylor's series method	1	18- 08 - 2026		TLM1	CO2	T1, T2	
23.	Picard's method	1	20- 08 - 2026		TLM1	CO2	T1, T2	
24.	Euler's method	1	21- 08 - 2026		TLM1	CO2	T1, T2	
25.	Runge – Kutta method of 2^{nd} order	1	24- 08 - 2026		TLM1	CO2	T1, T2	

26.	Runge – Kutta method of 4th order	1	25- 08 - 2026		TLM1	CO2	T1, T2	
27.	Runge – Kutta method of 4th order	1	27- 08 - 2026		TLM1	CO2	T1, T2	
28.	Milne's predictor and corrector method	1	28- 08 - 2026		TLM1	CO2	T1, T2	
29.	Milne's predictor and corrector method	1	31- 08 - 2026		TLM1	CO2	T1, T2	
30.	Revision	1	01- 09 - 2026		TLM1	CO2	T1, T2	
31.	Tutorial – II	1	03- 09 - 2026		TLM3	CO2	T1, T2	
No. of classes required to complete UNIT-II		15			No. of classes taken:			

I MID EXAMINATIONS (07-09-2025 TO 09-09-202026)

UNIT-III: LAPLACE TRANSFORMS

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
32.	Introduction to Unit - III	1	10- 09 - 2026		TLM1	CO3	T1, T2	
33.	Laplace transform of standard functions	1	11- 09 - 2026		TLM1	CO3	T1, T2	
34.	Properties	1	15- 09 - 2026		TLM1	CO3	T1, T2	
35.	Shifting theorems	1	17- 09 - 2026		TLM1	CO3	T1, T2	
36.	Transforms of derivatives & integrals	1	18- 09 - 2026		TLM1	CO3	T1, T2	
37.	Unit step function& Dirac's delta function	1	21- 09 - 2026		TLM1	CO3	T1, T2	
38.	Inverse Laplace by partial fractions	1	22- 09 - 2026		TLM1	CO3	T1, T2	
39.	Inverse Laplace by Convolution theorem	1	24- 09 - 2026		TLM1	CO3	T1, T2	
40.	Applications to ODE	1	25- 09 - 2026		TLM1	CO3	T1, T2	
41.	Integral equations	1	28- 09 - 2026		TLM1	CO3	T1, T2	
42.	Tutorial - III	1	29- 09 - 2026		TLM1	CO3	T1, T2	
No. of classes required to complete UNIT-III		11			No. of classes taken:			

UNIT-IV: FOURIER SERIES

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
43.	Introduction to Unit - IV	1	01- 10 - 2026		TLM1	CO4	T1, T2	
44.	Fourier series of periodic functions	1	05- 10 - 2026		TLM1	CO4	T1, T2	
45.	Dirichlet's conditions	1	06- 10 - 2026		TLM1	CO4	T1, T2	
46.	Problems on Fourier series	1	08- 10 - 2026		TLM1	CO4	T1, T2	
47.	Even and odd functions	1	09- 10 - 2026		TLM1	CO4	T1, T2	
48.	Even and odd functions	1	12- 10 - 2026		TLM1	CO4	T1, T2	
49.	Change of intervals	1	13- 10 - 2026		TLM1	CO4	T1, T2	

50.	Change of intervals	1	15- 10 - 2026		TLM1	CO4	T1, T2	
51.	Half range sine & cosine series	1	16- 10 - 2026		TLM1	CO4	T1, T2	
52.	Tutorial - IV	1	26- 10 - 2026		TLM1	CO4	T1, T2	
No. of classes required to complete UNIT-IV		10			No. of classes taken:			

UNIT-V: Fourier transforms

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
50	Introduction to Unit -V	1	27- 10 - 2026		TLM1	CO5	T1, T2	
51	Fourier integrals	1	29- 10 - 2026		TLM1	CO5	T1, T2	
52	Fourier sine & cosine integrals	1	30- 10 - 2026		TLM1	CO5	T1, T2	
53	Infinite Fourier transforms	1	02- 11 - 2026		TLM1	CO5	T1, T2	
54	Infinite Fourier cosine & sine transforms	1	03- 11 - 2026		TLM1	CO5	T1, T2	
55	Infinite Fourier cosine & sine transforms	1	05- 11 - 2026		TLM1	CO5	T1, T2	
56	Convolution theorem	1	06- 11 - 2026		TLM1	CO5	T1, T2	
57	Finite Fourier transforms	1	09- 11 - 2026		TLM1	CO5	T1, T2	
58	Tutorial - V	1	10- 11 - 2026		TLM3	CO5	T1, T2	
No. of classes required to complete UNIT-V		09			No. of classes taken:			

Content beyond the Syllabus

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
61	To find current using Laplace in simple electrical circuits	2	12-11-2026 13-11-2026		TLM2	CO3	T1, T2	
No. of classes		2			No. of classes taken:			

II MID EXAMINATIONS (03-11-2025 TO 08-11-2025)

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/SwayamPrabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

PART-CEVALUATION PROCESS (R23 Regulation):

Evaluation Task	**Marks**
Assignment-I (Units-I, II)	A1=5
I-Descriptive Examination (Units-I, II)	M1=15
I-Quiz Examination (Units-I, II)	Q1=10
Assignment-II (Unit-III, IV & V)	A2=5
II- Descriptive Examination (UNIT-III, IV & V)	M2=15
II-Quiz Examination (UNIT-III, IV & V)	Q2=10
Mid Marks =80% of Max ((M1+Q1+A1), (M2+Q2+A2)) + 20% of Min ((M1+Q1+A1), (M2+Q2+A2))	M=30
Cumulative Internal Examination (CIE):	30
Semester End Examination (SEE)	70
Total Marks = CIE + SEE	100

PART-D PROGRAMME OUTCOMES (POs):

PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis**: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety and the cultural, societal and environmental considerations.
PO 4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
PO 6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.
PO 8	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work**: Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings.
PO 10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.
PO 11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning**: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Dr. D.Vijaya Kumar	**Ms. SHAIK HASEENA BEGUM**	**Dr. A. RAMI REDDY**	**Dr. T. SATYANARAYANA**
Course Instructor	Course Coordinator	Module Coordinator	HOD

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DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor: Dr. V.Dhana Raju
Course Name & Code : Thermodynamics & 23ME03 Regulation: R23
L-T-P Structure : **2**-1-0 **Credits:** 2
Program/Sem/Sec : B.Tech III Sem **A.Y.:** 2026-27

PREREQUISITE: Engineering Physics

COURSE EDUCATIONAL OBJECTIVES (CEOs):

- Familiarize concepts of heat, work, energy and governing rules for conversion of one form to other.
- State and illustrate the basic laws of thermodynamics. Also, to learn the concept of entropy, enthalpy, reversibility and irreversibility.
- To get conversant with properties of steam and gas mixtures.
- Provide fundamental concepts of Thermodynamic cycles.

COURSE OUTCOMES (COs): At the end of the course, student will be able to

CO1	**Understand the basic concepts of thermodynamics and can distinguish the forms of heat and work. (Understanding - L2)**
CO2	**Apply first of law of thermodynamics to flow and non-flow processes of thermodynamic systems. (Applying – L3)**
CO3	**Apply the second law of thermodynamics to solve second law parameters of thermal systems .(Applying – L3)**
CO4	**Analyze the non-reactive mixture of gases, t-s and h-s diagrams, Mollier charts, and Phase Transformations using steam tables data hand book. (Analyzing – L4)**
CO5	**Compute the performance parameters of various thermodynamic cycles. (Applying – L3)**

COURSE ARTICULATION MATRIX (Correlation between COs, POs & PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2	2	-	-	-	-	-	-	-	-	2	2	-	-
CO2	3	1	-	-	-	-	-	-	-	-	2	3	-	1
CO3	3	1	2	-	-	-	-	-	-	-	2	3	-	2
CO4	3	3	-	-	-	-	3	-	-	-	2	1	-	3
CO5	3	2	1	-	-	-	-	-	-	-	2	2	-	3

TEXTBOOKS:

T1	P.K.Nag, "Engineering Thermodynamics"- McGraw-Hill. 5th Edition, 2013
T2	Claus Borgnakke Richard E. Sonntag, Fundamentals of Thermodynamics, 7th Edition, Wiley, 2009.

REFERENCE BOOKS:

R1	G.J.Van Wylen & Sonntag, "Fundamentals of Thermodynamics", John Wiley& sons, publications Inc. 5th Edition, 1998.
R2	E.Rathakrishnan, "Fundamentals of Engineering Thermodynamics", PHI, 2nd Edition, 2010.
R3	Y.A. Cengel, and M.A.Boles, "Thermodynamics: An Engineering Approach", McGraw-Hill, 7th Edition, 2011.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Basic Concepts and Zeroth Law of Thermodynamics

S.No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	Introduction, CEOs, COs, POs, PSOs	1	13/07/26		TLM1	
2	System, boundary, Surrounding, Universe, Types of Systems -examples	1	15/07/26		TLM1, TLM2	
3	Macroscopic and Microscopic viewpoints, Control mass, Control volume, Concept of Continuum.	1	18/07/26		TLM1, TLM2	
4	Properties of system, State, Change of state, Path, Process.	1	20/07/26		TLM1, TLM2	
5	Reversible and irreversible processes, Cycle, Quasi static Process.	1	22/07/26		TLM1, TLM2	
6	Thermodynamic equilibrium, Path and Point functions, Specific heat, Internal Energy, Enthalpy.	1	25/07/26		TLM1, TLM2	
7	Zeroth law of Thermodynamics Introduction, Zeroth law of thermodynamics, Measurement of temperature.	1	27/07/26		TLM1, TLM2	
8	Constant volume gas thermometer Numerical Problems on Temperature scales.	1	29/07/26		TLM1, TLM2	
9	Advantages of gas thermometers over liquid thermometers, Numerical Problems	1	01/08/26		TLM1, TLM2	
10	**Tutorial-I** on Numerical problems on Internal energy, enthalpy, specific heat and latent heat, Assignement-1.	1	03/08/26		TLM3	
	No. of classes taken: 10					

UNIT-II: First Law of Thermodynamics

S.No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
11	**First Law Analysis of Closed Systems** : Introduction, First law for a closed system undergoing change of state and cycle	1	05/08/26		TLM1, TLM2	
12	First Law Analysis of Closed System undergoing different process.	1	10/08/26		TLM1, TLM2	
13	Work done in different process - closed systems	1	12/08/26		TLM1, TLM2	
14	**Tutorial –II :** Different forms of stored energy, Forms of energy, Mechanical and Non mechanical forms of Work transfer	1	17/08/26		TLM1, TLM2	
15	pdV work and other types of work transfer. Applications of first law, PMM1 Numerical problems on work and energy.	1	19/08/26		TLM3	
16	**First Law Analysis of Open Systems**: Thermodynamic analysis of control volume-conservation of mass, energy principle.	1	22/08/26		TLM1, TLM2	
17	Steady Flow Energy Equation (SFEE), Steady Flow Engineering Devices-Nozzles, Diffusers.	1	24/08/26		TLM1, TLM2	
18	**Tutorial –III** on Work done in different	1	26/08/26		TLM1, TLM2	

	processes –Open systems					
19	SFEE - Turbine, Compressors, Throttling Valves Heat Exchangers, Limitations on first law of thermodynamics, PMM1.	1	29/08/26		TLM1, TLM2	
20	**Tutorial –IV,** Problems on SFEE-Compressors, Turbines	1	02/09/26		TLM3	
	No. of classes taken: 10					

UNIT-III: Second Law of Thermodynamics

S.No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
21	**Second Law Analysis of Thermodynamics:** Introduction, Energy Reservoirs, Heat Engines, Refrigerators, Heat Pumps.	1	05/09/26		TLM1, TLM2	
22	Kelvin-Planks, Clausius statement of second law of thermodynamics.	1	12/09/26		TLM1, TLM2	
23	Numerical Problems on Second law of TD.	1	14/09/26		TLM1, TLM2	
24	Equivalence of Kelvin -Planck and Clausius statements.	1	16/09/26		TLM1, TLM2	
25	Perpetual Motion Machine-II, Carnot cycle, Carnot Theorem	1	19/09/26		TLM1, TLM2	
26	**Entropy:** Introduction, Clausius inequality, t-s property diagrams. Entropy change for ideal gases – Derivations.	1	21/09/26		TLM3	
27	Isentropic relations for ideal gases, Principle of increase of entropy, Applications of Entropy - Third law of Thermodynamics	1	23/09/26		TLM1, TLM2	
28	**Tutorial V -** Numerical Problems on Entropy.	1	26/09/26		TLM1, TLM2	
	No. of classes taken:08					

UNIT-IV: Properties of Pure Substances and Ideal Gas Mixtures

S.No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
29	**Properties of Pure Substance:** Introduction, Phases of pure substance.	1	28/09/26		TLM1, TLM2	
30	*p-v, p-T, T-s* and *h-s* diagrams for pure substance, *p-v-T* Surface.	1	30/09/26		TLM1, TLM3	
31	Properties of steam, quality or dryness fraction, Phase change processes,	1	03/10/26		TLM1, TLM2	
32	Mollier diagram for a pure substance, Numerical problems.	1	05/10/26		TLM1, TLM4	
33	**Tutorial VI-** Numerical Problems.	1	07/10/26		TLM3	
34	**Properties of Ideal Gases:** Equation of state of a gas, Avogadro's law, Ideal gas, perfect gas, real gas.	1	12/10/26		TLM1, TLM2	
35	Properties of mixture of gases – Dalton's law and Amagat's law of partial pressures.	1	14/10/26		TLM1, TLM2	
36	Internal energy, enthalpy and specific heats of gas mixtures, Entropy of gas mixtures.	1	17/10/26		TLM1, TLM2	
	No. of classes taken: 08					

UNIT-V: Thermodynamic Cycles

S.No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
37	Introduction, working of Carnot vapour cycle, working of simple Rankine cycle	1	26/10/26		TLM1, TLM2	
38	Problems on Carnot vapour cycle and simple Rankine cycle	1	28/10/26		TLM1, TLM2	
39	Gas power cycles - Otto, Numerical Problems	1	31/10/26		TLM1, TLM2	
40	Diesel cycle, Dual cycle - Numerical Problems – **Tutorial VII**	1	02/11/26		TLM3	
41	Brayton Cycles and its problems	1	04/11/26		TLM1, TLM2	
42	Refrigeration Cycles - Reversed Carnot cycle, Numerical Problems	1	07/11/26		TLM1, TLM2	
43	Bell-Coleman cycle and simple vapour compression refrigeration Cycle (Theory)	1	09/11/26		TLM1, TLM2	
44	Content beyond the syllabus Stirling cycle, Ericsson cycle	1	11/11/26		TLM1, TLM2	
	No. of classes taken: 08					

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

PART-C

EVALUATION PROCESS (R23 Regulation):

Evaluation Task	Marks
Assignment-I (Units-I, II)	A1=5
I-Descriptive Examination (Units-I, II)	M1=15
I-Quiz, short answer questions (Units-I, II)	Q1=10
Assignment-II (Units-III IV & V)	A2=5
II- Descriptive Examination (UNIT-III, IV & V)	M2=15
II-Quiz short answer questions (UNIT-III ,IV & V)	Q2=10
Mid Marks =80% of Max ((M1+Q1+A1), (M2+Q2+A2)) + 20% of Min ((M1+Q1+A1), (M2+Q2+A2))	M=30
Cumulative Internal Examination (CIE):	30
Semester End Examination (SEE)	70
Total Marks = CIE + SEE	100

ACADEMIC CALENDER:

Commencement of Class work		13-07-2026	
I Phase of Instructions	13-07-2026	05-09-2026	8 Weeks
I Mid Examinations	07-09-2026	09-09-2026	3 Days
II Phase of Instructions	10-09-2026	17-10-2026	5 ½ Weeks
Dussehra Holidays	19-10-2026	24-10-2026	1 Week
II Phase of Instructions Contd..	26-10-2026	1111-2026	2 ½ Weeks
II Mid Examinations	12-11-2026	14-11-2026	3 Days
Preparation and Practical's	16-11-2026	21-11-2026	1 Week
Semester End Examinations	23-11-2026	05-12-2026	2 Weeks

Knowledge and Attitude Profile (WK)

WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

WK2: Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.

WK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

WK6: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

WK7: Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

WK8: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

WK9: Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

PART-D

PROGRAMME OUTCOMES (POs):

PO 1	**Engineering Knowledge:** Apply knowledge of mathematics, natural science, Computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
PO 2	**Problem Analysis:** Identify, formulate, review research literature and analyze Complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
PO 3	**Design/Development of Solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
PO 4	**Conduct Investigations of Complex Problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
PO 5	**Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
PO 6	**The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
PO 7	**Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
PO 8	**Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
PO 9	**Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
PO 10	**Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments
PO 11	**Life-Long Learning:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	To apply the principles of thermal sciences to design and develop various thermal systems.
PSO 2	To apply the principles of manufacturing technology, scientific management towards improvement of quality and optimization of engineering systems in the design, analysis and manufacturability of products.
PSO 3	To apply the basic principles of mechanical engineering design for evaluation of performance of various systems relating to transmission of motion and power, conservation of energy and other process equipment.

Title	**Course Instructor/ Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**Dr. V.Dhana Raju**	**Dr. K.Dilip Kumar**	**Dr. M.B.S.S Reddy**
Signature			

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

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Approved by AICTE, New Delhi. and Affiliated to JNTUK, Kakinada
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DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor: Dr M B S Sreekara Reddy

Course Name & Code	**:** Mechanics of Solids & 23ME04	**Regulation**: R23
L-T-P Structure	**: 3-0-0**	**Credits:** 3
Program/Sem	: B.Tech III Sem	**A.Y.:** 2026-2027

PREREQUISITE: Engineering Mechanics

COURSE EDUCATIONAL OBJECTIVES (CEOs): The objectives of the course are to

- Understand the behavior of basic structural members subjected to uni- axial and bi-axial loads.
- Apply the concept of stress and strain to analyze and design structural members and machine parts under axial, shear and bending loads, moment and torsional moment.
- Learn all the methods to analyze beams, columns, frames for normal, shear, and torsion stresses and to solve deflection problems in preparation for the design of such structural components. Students are able to analyze beams and draw correct and complete shear and bending moment diagrams for beams.
- Attain a deeper understanding of the loads, stresses, and strains acting on a structure and their relations in the elastic behavior
- Design and analysis of Industrial components like pressure vessels.

COURSE OUTCOMES (COs): At the end of the course, student will be able to

CO1	Understand the concepts of basic structural members subjected to uni-axial and bi-axial loads. **(Understanding-L2)**
CO2	Construct the shear force and bending moment diagrams along the length of beam. **(Applying-L3)**
CO3	Compute the stresses of a member subjected to flexural and torsional loads. **(Applying-L3)**
CO4	Determine the transverse shear stresses and deflections of beams due to bending loads**. (Applying– L3)**
CO5	Estimate the stresses in pressure vessels and analyze the columns for buckling **(Analyzing-L4)**

COURSE ARTICULATION MATRIX (Correlation between COs, POs & PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	2	1	--	--	--	--	--	--	--	--	2	--	--	3
CO2	2	3	1	--	--	--	--	--	--	--	--	2	--	--	3
CO3	3	2	1	--	--	--	--	--	--	--	--	2	--	--	3
CO4	3	2	1	--	--	--	--	--	--	--	--	2	--	--	3

CO5	3	1	2	--	--	--	--	--	--	--	--	2	--	--	3
1 - Low				2 –Medium							3 - High				

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'1-** Slight (Low), **2 –** Moderate (Medium), **3 -** Substantial (High).

TEXTBOOKS:

1. GH Ryder, Strength of materials, Palgrave Macmillan publishers India Ltd, 1961.
2. B.C. Punmia, Strength of materials,10/e, Lakshmi publications Pvt. Ltd, New Delhi, 2018.
3. Sadhu Singh, Strength of Materials, Khanna Publishers, 2013.
4. S.Ramamrutham, Strength of Materials, Dhanpat Rai& Sons, 2011.

REFERENCE BOOKS:

1. Gere & Timoshenko, Mechanics of materials, 2/e, CBS publications, 2004.
2. U.C.Jindal, Strength of Materials, 2/e, Pearson Education, 2017.
3. Timoshenko, Strength of Materials Part – I& II, 3/e, CBS Publishers, 2004.
4. Andrew Pytel and Ferdinand L. Singer, Strength of Materials,4/e, Longman Publications, 1990.
5. Popov, Mechanics of Solids, 2/e, New Pearson Education, 2015.

Online Learning Resources:

- https://onlinecourses.nptel.ac.in/noc19_ce18/preview
- https://youtube/iY_ypychVNY?si=310htc4ksTQJ8Fv6
- https://www.youtube.com/watch?v=WEy939Rkd_M&t=2s
- https://www.classcentral.com/course/swayam-strength-of-materials-iitm-184204
- https://www.coursera.org/learn/mechanics-1
- https://www.edx.org/learn/engineering/massachusetts-institute-of-technology-mechanical-behavior-of-materials-part-1-linear-elastic-behavior
- https://archive.nptel.ac.in/courses/112/107/112107146/

PART-B

COURSE DELIVERY PLAN (LESSON PLAN): Section - A

UNIT-I: SIMPLE STRESSES & STRAINS

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	Introduction, Types of stresses & strains, Hooke's law	1	13-07-2026		TLM 1	
2	Stress – strain diagram for mild Steel, Working stress – Factor of safety	1	14-07-2026		TLM 4	
3	Lateral strain, Poisson's ratio & volumetric strain, Relation between elastic constants	1	16-07-2026		TLM 1	
4	Bars of varying section, Problems	1	20-07-2026		TLM 1	
5	composite bars, Problems	1	21-07-2026		TLM 1	

6	Problems on simples stresses & strains, Thermal stresses, Problems	1	23-07-2026		TLM 1	
7	Complex Stresses - Stresses on an inclined plane under different uniaxial and biaxial stress conditions	1	27-07-2026		TLM 1	
8	Principal planes and principal Stresses, Mohr's circle	1	28-07-2026		TLM 1	
9	Strain energy – Resilience – Gradual, sudden, impact and shock loadings, Problems on strain energy	1	30-07-2026		TLM 1	
No. of classes required to complete UNIT-I: 09				**No. of classes taken:**		

UNIT-II: SHEAR FORCE AND BENDING MOMENT

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
10	Definition of beam – Types of beams – Concept of shear force and bending moment	1	03-08-2026		TLM 1	
11	S.F and B.M diagrams for Cantilever	1	04-08-2026		TLM 1	
12	Problems on combination of loads: S.F and B.M diagrams for cantilever	1	06-08-2026		TLM 1	
13	S.F and B.M diagrams for simply supported beams	1	10-08-2026		TLM 1	
14	Problems on S.F and B.M diagrams for simply supported	1	11-08-2026		TLM 1	
15	Problems on combination of loads: S.F and B.M diagrams for simply supported	1	13-08-2026		TLM 1	
16	S.F and B.M diagrams for over hanging	1	17-08-2026		TLM 1	
17	Problems on S.F and B.M diagrams for over hanging	1	18-08-2026		TLM 1	
18	Problems on combination of loads: S.F and B.M diagrams for overhanging	1	20-08-2026		TLM 1	
19	Point of contra flexure, Relation between S.F., B.M and rate of loading at a section of a beam.	1	24-08-2026		TLM 1	
No. of classes required to complete UNIT-II: 10				**No. of classes taken:**		

UNIT-III: FLEXURAL STRESSES, TORSION

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
20	**FLEXURAL STRESSES**: Theory of simple bending, Derivation of bending equation	1	25-08-2026		TLM 1	
21	Determination of bending stresses	1	27-08-2026		TLM 1	
22	section modulus of rectangular, circular, I and T sections, Design	1	31-08-2026		TLM 1	

	of simple beam sections					
23	Problems on Design of simple beam sections.	1	01-09-2026		TLM 1	
24	**TORSION:** Introduction-Derivation	1	03-09-2026		TLM 1	
25	Torsion of Circular shafts- Pure Shear	1	10-09-2026		TLM 1	
26	Transmission of power by circular shafts	1	15-09-2026		TLM 1	
27	Shafts in series, Shafts in parallel.	1	17-09-2026		TLM 1	
No. of classes required to complete UNIT-III: 08				**No. of classes taken:**		

UNIT-IV: SHEAR STRESSES IN BEAMS & DEFLECTION OF BEAMS

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
28	**SHEAR STRESSES IN BEAMS:** Derivation of formula	1	21-09-2026		TLM 1	
29	Shear stress distribution across rectangular and triangular Sections	1	22-09-2026		TLM 1	
30	Shear stress distribution across I and T section	1	24-09-2026		TLM 1	
31	**DEFLECTION OF BEAMS:** Bending into a circular arc – slope, deflection and radius of Curvature	1	28-09-2026		TLM 1	
32	Differential equation for the elastic line of a beam, Double integration method	1	29-09-2026		TLM 1	
33	Macaulay's method, Determination of slope and deflection for cantilever	1	01-10-2026		TLM 1	
34	Determination of slope and deflection for simply supported	1	05-10-2026		TLM 1	
35	Mohr's theorem and Moment area method	1	06-10-2026		TLM 1	
36	Application to simple cases.	1	08-10-2026		TLM 1	
No. of classes required to complete UNIT-IV: 9				**No. of classes taken:**		

UNIT-V: THIN AND THICK CYLINDERS, COLUMNS

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
37	Thin seamless cylindrical shells, Derivation of formula for longitudinal and circumferential stresses	1	12-10-2026		TLM 1	
38	Hoop, longitudinal and volumetric strains, Changes in dia, and volume of thin cylinders	1	13-10-2026		TLM 1	
39	Problems on thick Cylinders	1	15-10-2026		TLM 1	
40	Problems on thin Cylinders	1	26-10-2026		TLM 1	
41	Thin spherical shells, Wire wound thin cylinders, Lame's Equation	1	27-10-2026		TLM 1	
42	cylinders subjected to inside &	1	29-10-2026		TLM 1	

	outside pressures –compound cylinders.					
43	Columns: Buckling and Stability, Columns with Pinned ends	1	02-11-2026		TLM 1	
44	Columns with other support Conditions	1	03-11-2026		TLM 1	
45	Limitations of Euler's Formula, Rankine's Formula.	1	05-11-2026		TLM 1	
No. of classes required to complete UNIT-V: 9				**No. of classes taken:**		

CONTENT BEYOND SYLLABUS

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Shell Theory-Introduction	1	09-11-2026		TLM2	
2	Shell Theory-Concept, Application	1	10-11-2026		TLM2	

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

Academic Calander: 2026-27

Description	From	To	Weeks
B. Tech III semester			
Commencement of class work	13-07-2026		
I phase of Instructions	13-07-2026	05-09-2026	8 weeks
I Mid examinations	07-09-2026	09-09-2026	3 days
II phase of Instructions	10-09-2026	17-10-2026	5 ½ weeks
Dussehra Holidays	19-10-2026	24-10-2026	1 week
II phase of Instructions	26-10-2026	11-11-2026	2 ½ weeks
II Mid examinations	12-11-2026	14-11-2026	3 days
Preparation and practical's	16-11-2026	21-11-2026	1 week
Semester end examinations	23-11-2026	05-12-2026	2 weeks

PART-C

EVALUATION PROCESS (R23 Regulation):

Evaluation Task	Marks
Assignment-I (Units-I, II)	A1=5
I-Descriptive Examination (Units-I, II)	M1=15
I-Quiz Examination (Units-I, II)	Q1=10
Assignment-II (Unit-III, IV & V)	A2=5
II- Descriptive Examination (UNIT-III, IV & V)	M2=15
II-Quiz Examination (UNIT-III , IV & V)	Q2=10
Mid Marks =80% of Max ((M1+Q1+A1), (M2+Q2+A2)) + 20% of Min ((M1+Q1+A1), (M2+Q2+A2))	M=30
Cumulative Internal Examination (CIE): M	30
Semester End Examination (SEE)	70
Total Marks = CIE + SEE	100

PART-D

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO 1	To build a professional career and pursue higher studies with sound knowledge in Mathematics, Science and Mechanical Engineering.
PEO 2	To inculcate strong ethical values and leadership qualities for graduates to become successful in multidisciplinary activities.
PEO 3	To develop inquisitiveness towards good communication and lifelong learning.

PROGRAMME OUTCOMES (POs):

PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis**: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
PO 6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

PO 10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	To apply the principles of thermal sciences to design and develop various thermal systems.
PSO 2	To apply the principles of manufacturing technology, scientific management towards improvement of quality and optimization of engineering systems in the design, analysis and manufacturability of products.
PSO 3	To apply the basic principles of mechanical engineering design for evaluation of performance of various systems relating to transmission of motion and power, conservation of energy and other process equipment.

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty				
Signature				

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DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor: Dr.Seelam Pichi Reddy
Course Name & Code : Material Science and Metallurgy
L-T-P Structure : **3**-0-0 **Credits:** 3
Program/Sem/Sec : B.Tech III Sem **A.Y.:** 2026-27

PREREQUISITE: Engineering Physics and Engineering Chemistry

COURSE EDUCATIONAL OBJECTIVES (CEOs):

- Understand the crystalline structure of different metals.
- Explain the stability of phases in different alloy systems.
- Study the behaviour of ferrous and non- ferrous metals and alloys and their application in different domains.
- Able to understand the effect of heat treatment, addition of alloying elements on properties of ferrous metals.
- Comprehend the properties and applications of ceramic, composites and other advanced methods.

COURSE OUTCOMES (COs): At the end of the course, student will be able to

CO1	Understand the crystalline structure of different metals **(Understanding-L2)**
CO2	Recognize the stability of phases in different alloy systems **(Remembering-L1)**
CO3	Explain the behavior of ferrous and non-ferrous metals and alloys and their application in different domains. **(Understanding-L2)**
CO4	Study the heat treatment and age hardening process. **(Remembering-L1)**
CO5	Identify the properties and applications of ceramic, composites and other advanced methods. **(Understanding-L2)**

COURSE ARTICULATION MATRIX (Correlation between COs, POs & PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	1	2	2	1	--	--	--	--	--	--	--	--	2	--
CO2	1	2	2	1	--	--	--	--	--	--	--	--	2	--
CO3	1	2	2	1	--	--	--	--	--	--	--	--	2	--
CO4	1	2	2	1	--	--	--	--	--	--	--	--	2	--
CO5	1	2	2	1	--	--	--	--	--	--	--	--	2	--

TEXTBOOKS:

T1	S.H.Avner, Introduction to Physical Metallurgy, 2/e, Tata McGraw- Hill, 1997.
T2	Donald R.Askeland, Essentials of Materials science and Engineering, 4/e, CL Engineering publications, 2018.

REFERENCE BOOKS:

R1	Dr. V.D.kodgire, Material Science and Metallurgy, 39/e, Everest Publishing House, 2017.
R2	V.Raghavan, Material Science and Engineering, 5/e, Prentice Hall of India, 2004.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Structure of Metals and Constitution of alloys

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction – CEOs, Cos and POs	1	**13-07-2026**		**TLM1, TLM2**	
2.	Crystallization of metals	1	**15-07-2026**		**TLM1, TLM2**	
3.	Packing Factor	1	**17-07-2026**		**TLM1, TLM2**	
4.	Simple Cubic,	1	**18-07-2026**		**TLM1, TLM2**	
5.	Body Centered Cubic	1	**20-07-2026**		**TLM1, TLM2**	
6.	Face Centered Cubic	1	**22-07-2026**		**TLM1, TLM2**	
7.	Hexagonal Closed Packed	1	**24-07-2026**		**TLM1, TLM2**	
8.	Grain and grain boundaries,	1	**25-07-2026**		**TLM1, TLM2**	
9.	Effect of grain boundaries on Properties of metals	1	**27-07-2026**		**TLM1, TLM2**	
10.	Determination of grain size.	1	**29-07-2026**		**TLM1, TLM2**	
11.	Necessity of alloying,	1	**31-07-2026**		**TLM1, TLM2**	
12.	Types of solid solutions	1	**01-08-2026**		**TLM1, TLM2**	
13.	Hume Rothery's rules, Intermediate alloy phases	1	**03-08-2026**		**TLM1, TLM2**	
14.	Electron compounds	1	**05-08-2026**		**TLM1, TLM2**	
No. of classes required to complete UNIT-I: 14				**No. of classes taken:**		

UNIT-II: Equilibrium Diagrams

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
15.	Importance of Equilibrium Diagrams	1	**07-08-2026**		**TLM1, TLM2**	
16.	Experimental methods of construction of equilibrium diagrams	1	**08-08-2026**		**TLM1, TLM2**	
17.	Isomorphous alloy systems	1	**10-08-2026**		**TLM1, TLM2**	
18.	Equilibrium cooling and heating of alloys	1	**12-08-2026**		**TLM1, TLM2**	
19.	Lever rule,	1	**14-08-2026**		**TLM1, TLM2**	
20.	Coring, miscibility gaps, Eutectic systems,	1	**17-08-2026**		**TLM1, TLM2**	
21.	Peritectic reaction.	1	**19-08-2026**		**TLM1, TLM2**	
22.	Transformations in the solid state	1	**22-08-2026**		**TLM1, TLM2**	
23.	Allotropy, Eutectoid, Peritectoid reactions	1	**24-08-2026**		**TLM1, TLM2**	
24.	Phase rule	1	**26-08-2026**		**TLM1, TLM2**	
25.	Relationship between equilibrium diagrams and properties of alloys	1	**28-08-2026**		**TLM1, TLM2**	
26.	Study of binary phase diagrams such as Cu-Ni	1	**29-08-2026**		**TLM1, TLM2**	
27.	Bi-Cd	1	**31-08-2026**		**TLM1, TLM2**	
28.	Fe-Fe_3C Equilibrium Diagram	1	**02-09-2026**		**TLM1, TLM2**	
29.	Fe-Fe_3C Phase changes with temperature	1	**05-09-2026**		**TLM1, TLM2**	
I Mid Examination -07-09-2026 to 09-09-2026						
No. of classes required to complete UNIT-II: 17				**No. of classes taken:**		

UNIT-III: Ferrous metals and alloys, Non-ferrous Metals and Alloys

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
30.	Structure and properties of White Cast iron, Malleable Cast iron	1	**11-09-2026**		TLM1, TLM2	
31.	Grey cast iron, Spheriodal graphite cast iron	1	**12-09-2026**		TLM1, TLM2	
32.	Alloy cast iron	1	**14-09-2026**		TLM1, TLM2	
33.	Classification of steels	1	**16-09-2026**		TLM1, TLM2	
34.	Structure and properties of plain carbon steels	1	**18-09-2026**		TLM1, TLM2	
35.	LCS, MCS and HCS	1	**19-09-2026**		TLM1, TLM2	
36.	Low alloy steels, Hadfield manganese	1	**21-09-2026**		TLM1, TLM2	
37.	Tool and die steels	1	**23-09-2026**		TLM1, TLM2	
38.	Structure and properties of Copper.	1	**25-09-2026**		TLM1, TLM2	
39.	Copper Alloys	1	**26-09-2026**		TLM1, TLM2	
40.	Structure and properties of Aluminum	1	**28-09-2026**		TLM1, TLM2	
41.	Aluminum Alloys	1	**30-09-2026**		TLM1, TLM2	
No. of classes required to complete UNIT-III: 12				**No. of classes taken:**		

UNIT-IV: Mechanical Working, Heat treatment of Steels

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
42.	Hot Working, Cold Working	1	**03-10-2026**		TLM1, TLM2	
43.	Strain Hardening	1	**05-10-2026**		TLM1, TLM2	
44.	Recovery, Recrystallization and Grain Growth	1	**07-10-2026**			
45.	Comparison-Properties of Cold Worked and Hot Worked parts	1	**09-10-2026**		TLM1, TLM2	
46.	Heat Treatment Introduction, Annealing,	1	**10-10-2026**			
47.	Normalizing, Hardening, TTT diagrams	1	**12-10-2026**			
48.	CCC Diagrams, Critical Cooling Rate	1	**14-10-2026**		TLM1, TLM2	
49.	Tempering, hardenability, Jominy End Quench Test	1	**16-10-2026**		TLM1, TLM2	
50.	Surface - hardening methods – Flame and Induction Hardening	1	**17-10-2026**		TLM1, TLM2	
51.	Carburizing, Nitriding and Carbo-nitriding	1	**26-10-2026**		TLM1, TLM2	
52.	Age hardening treatment	1	**28-10-2026**		TLM1, TLM2	
No. of classes required to complete UNIT-IV: 11				**No. of classes taken:**		

UNIT-V: Ceramic and Advanced materials

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
53.	Crystalline ceramics,	1	**30-10-2026**		TLM1, TLM2	
54.	Glasses, cermets, Abrasive materials	1	**31-10-2026**		TLM1, TLM2	
55.	Classification of composites,	1	**02-11-2026**		TLM1, TLM2	

56.	Manufacturing methods of fiber reinforced composites., Particle reinforced composites	1	**04-11-2026**		TLM1, TLM2	
57.	fiber reinforced composites	1	**06-11-2026**		TLM1, TLM2	
58.	PMC, MMC, CMC and CCCs	1	**07-11-2026**		TLM1, TLM2	
No. of classes required to complete UNIT-V: 06				**No. of classes taken:**		

Contents beyond the Syllabus

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
59.	Smart Materials	**1**	**09-11-2026**		TLM1, TLM2	
60.	Nano Materials	**1**	**11-11-2026**		TLM1, TLM2	

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

ACADEMIC CALENDER:

Commencement of Class work		**13-07-2026**	
I Phase of Instructions	13-07-2026	05-09-2026	8 W
I Mid Examinations	**07-09-2026**	**09-09-2026**	**3 Days**
II Phase of Instructions	10-09-2026 26-10-2026	17-10-2026 11-11-2026	8 W
II Mid Examinations	**12-11-2026**	**14-11-2026**	**3 Days**
Preparation and Practical's	16-11-2026	21-11-2026	1 W
Semester End Examinations	**23-11-2026**	**05-12-2026**	**2 W**

PART-C

EVALUATION PROCESS (R 23 Regulation):

Evaluation Task	**Marks**
Assignment-I (Units-I & II)	A1=5
I-Descriptive Examination (Units-I, & II)	M1=15
I-Quiz Examination (Units-I, & II)	Q1=10
Assignment-II (Unit-III ,IV & V)	A2=5
II- Descriptive Examination (Unit-III ,IV & V)	M2=15
II-Quiz Examination (Unit-III ,IV & V)	Q2=10
Mid Marks =80% of Max ((M1+Q1+A1), (M2+Q2+A2)) + 20% of Min ((M1+Q1+A1), (M2+Q2+A	M=30
Cumulative Internal Examination (CIE): M	30
Semester End Examination (SEE)	70
Total Marks = CIE + SEE	100

Knowledge and Attitude Profile (WK)

WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.
WK2: Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.
WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.
WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the forefront of the discipline.
WK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost, re-use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.
WK6: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.
WK7: Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.
WK8: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.
WK9: Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect, and of inclusive attitudes.

PART-D

PROGRAMME OUTCOMES (POs):

PO 1	**Engineering Knowledge:** Apply knowledge of mathematics, natural science, Computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
PO 2	**Problem Analysis:** Identify, formulate, review research literature and analyze Complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
PO 3	**Design/Development of Solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
PO 4	**Conduct Investigations of Complex Problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & interpretation of data to provide valid conclusions. (WK8).
PO 5	**Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
PO 6	**The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal framework, culture and environment. (WK1, WK5, and WK7).
PO 7	**Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
PO 8	**Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams.
PO 9	**Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
PO 10	**Project Management and Finance:** Apply knowledge and understanding of engineering management principles and economic decision-making and apply these to one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments
PO 11	**Life-Long Learning:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	To apply the principles of thermal sciences to design and develop various thermal systems.
PSO 2	To apply the principles of manufacturing technology, scientific management towards improvement of quality and optimization of engineering systems in the design, analysis and manufacturability of products.
PSO 3	To apply the basic principles of mechanical engineering design for evaluation of performance of various systems relating to transmission of motion and power, conservation of energy and other process equipment.

Title	**Course Instructor/ Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**Dr. S.Pichi Reddy**	**Mr.J.Subba Reddy**	**Dr. M.B.S.S Reddy**
Signature			

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Phone: 08659-222933, Fax: 08659-222931

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor: K. LAKSHMI PRASAD
Course Name : UHV- 2- Understanding Harmony and Ethical Human Conduct
Course Code : (23HS01) **Credits** : 3 **L-T-P Structure:** 2-1-0
Program/Sem/Sec : B.Tech III Semester – ME Section-A **A.Y.** : 2026-27

PREREQUISITE: Nil

COURSE EDUCATIONAL OBJECTIVES (CEOs): To become more aware of themselves and their surroundings (family, society, nature); they would become more responsible in life and in handling problems with sustainable solutions while keeping human relationships and human nature in mind.

COURSE OUTCOMES (COs): At the end of the course, student will be able to

- **CO1:** Describe the terms like Natural Acceptance, Happiness and Prosperity (L2)
- **CO2:** Identify one's self, and one's surroundings (family, society nature) (L2)
- **CO3:** Relate human values with human relationship and human society. (L2)
- **CO4:** Illustrate the need for universal human values and harmonious existence (L2)
- **CO5:** Develop as socially and ecologically responsible engineers (L3)

COURSE ARTICULATION MATRIX (Correlation between COs, POs & PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1						3	3	1			3			
CO2						1	3	3			2			
CO3						3	1	1			2			
CO4						3	2	2			2			
CO5						2	3	1			3			

TEXTBOOKS:

T1 R R Gaur, r singal, G P Bagaria, "Human values and Professional Ethics", Excel Books, New Delhi,2010

REFERENCE BOOKS:

R1 Jeevan vidya: Ek Parichaya, A.Nagaraj, Jeevan Vidya Prakashan, Amarkantak,1999
R2 Human values, A N Tripathi, New Age Publishers, New Delhi, 2004
R3 The story of my experiments with Truth, Mohandas Karamchand Gandhi

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction to Value Education

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction, Cos	1	13.07.26		TLM2	
2.	Process for self exploration: Natural Acceptance	1	15.07.26		TLM.2	
3.	Right Understanding, Relationship and Physical Facility	1	18.07.26		TLM2	
4.	Understanding Value Education	1	20.07.26		TLM2	
5.	self-exploration as the Process for Value Education	1	22.07.26		TLM2	
6.	Continuous Happiness and Prosperity	1	25.07.26		TLM2	
7.	Happiness and Prosperity	1	27.07.26		TLM2	
8.	Method to Fulfill the Basic Human Aspirations	1	29.07.26		TLM2	
9.	Tutorial	1	01.08.26		TLM2	
No. of classes required to complete UNIT-I: 09				**No. of classes taken:**		

UNIT-II: Harmony in the Human Being

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
10.	Understanding Human being as the Co-existence of the self and the body	1	03.08.26		TLM2	
11.	Distinguishing between the Needs of the self and the body	1	05.08.26		TLM2	
12.	The body as an Instrument of the self	1	10.08.26		TLM2	
13.	Understanding Harmony in the self	1	12.08.26		TLM2	
14.	Harmony of the self with the body	1	17.08.26		TLM2	
15.	Programme to ensure self-regulation and Health	1	19.08.26		TLM2	
16.	Tutorial - 1	1	22.08.26		TLM2	
17.	Tutorial -2	1	24.08.26		TLM1	
No. of classes required to complete UNIT-II: 08				**No. of classes taken:**		

UNIT III: Harmony in the Family and Society

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
18.	Harmony in the Family	1	26.08.26		TLM2	
19.	'Trust' – the Foundational Value in Relationship	2	29.08.26 31.08.26		TLM2	
20.	Practice Session PS7 Exploring the Feeling of Trust	1	02.09.26		TLM2	
21.	'Respect' – as the Right Evaluation	1	05.09.26		TLM2	
22.	Practice Session PS8 Exploring the Feeling of Respect	1	15.09.26		TLM2	
23.	Other Feelings, Justice in Human-to-Human Relationship	1	16.09.26		TLM2	
24.	Understanding Harmony in the Society	1	19.09.26		TLM2	
25.	Vision for the Universal Human Order	1	21.09.26		TLM2	
No. of classes required to complete UNIT-III: 09				**No. of classes taken:**		

UNIT-IV: Harmony in the Nature/Existence

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
26.	Understanding Harmony in the Nature	2	23.09.26 26.09.26		TLM2	
27.	Interconnectedness, self-regulation	1	28.09.26		TLM2	
28.	Mutual Fulfilment among the Four Orders of Nature	1	30.09.26		TLM2	
29.	Realizing Existence as Co-existence at All Levels	1	03.10.26		TLM2	
30.	The Holistic Perception of Harmony in Existence	2	05.10.26 07.10.26		TLM2	
31.	Tutorial -1	1	12.10.26		TLM2	
No. of classes required to complete UNIT-IV: 08				**No. of classes taken:**		

UNIT-V: Implications of the Holistic Understanding

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
32.	Natural acceptance of human values	1	14.10.26		TLM2	
33.	Definitiveness of ethical human conduct	1	17.10.26		TLM2	
34.	Basis for humanistic education	1	26.10.26		TLM2	
35.	A Basis for Humanistic Education, Humanistic Constitution and Universal Human	2	28.10.26 31.10.26		TLM2	
36.	Competence in professional ethics	1	02.11.26		TLM2	
37.	Strategy for transition from the present state to universal human order	2	04.11.26 07.11.26		TLM2	
38.	Holistic Technologies, Production Systems and Management Models-Typical Case	2	09.11.26 11.11.26		TLM2	
No. of classes required to complete UNIT-V: 10				No. of classes taken:		

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

ACADEMIC CALENDAR:

Description	From	To	Weeks
Commencement of Class Work: 13.07.2026			
I Phase of Instructions	13.07.2026	05.09.2026	8
I Mid Examinations	**07.09.2026**	**09.09.2026**	**1/2**
II Phase of Instructions	10.09.2026	17.10.2026	51/2
Dussehra Holidays	19.10.2026	24.10.2026	1
II Phase of Instructions	26.10.2026	11.11.2026	21/2
II Mid Examinations	**12.11.2026**	**14.11.2026**	**1/2**
Preparation and Practical	16.11.2026	21.11.2026	1
Semester End Examinations	**23.11.2026**	**05.12.2026**	**2**

PART-C

EVALUATION PROCESS (R17 Regulation):

Evaluation Task	Marks
Assignment-I (Units-I & II)	A1=5
I-Descriptive Examination (Units-I & II)	M1=15
I-Quiz Examination (Units-I & II)	Q1=10
Assignment-II (Unit-III, IV & V)	A2=5
II- Descriptive Examination (UNIT-III, IV & V)	M2=15
II-Quiz Examination (UNIT-III, IV & V)	Q2=10
Mid Marks =80% of Max ((M1+Q1+A1), (M2+Q2+A2)) + 20% of Min ((M1+Q1+A1), (M2+Q2+A2))	M=30
Cumulative Internal Examination (CIE): M	30
Semester End Examination (SEE)	70
Total Marks = CIE + SEE	100

PART-D

WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

WK2: Conceptually-based mathematics, numerical analysis, data analysis, statistics and form al aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted; much is at the forefront of the discipline.

WK5: Knowledge, including efficient resource use, environmental impacts, whole-life cost, re- use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

WK6: Knowledge of engineering practice (technology) in the practice areas in the engineering discipline.

WK7: Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

WK8: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

WK9: Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect and of inclusive attitudes

PROGRAMME OUTCOMES (POs):

PO 1	**Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
PO 2	**Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
PO 3	**Design/Development of Solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
PO 4	**Conduct Investigations of Complex Problems:** Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & Interpretation of data to provide valid conclusions. (WK8).
PO 5	**Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
PO 6	**The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal frame work, culture and environment. (WK1, WK5, and WK7).
PO 7	**Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
PO 8	**Individual and Collaborative Team work:** Function effectively as an individual, and as a member or leader in diverse/multi-disciplinary teams
PO 9	**Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations considering cultural, language, and learning differences
PO 10	**Project Management and Finance:** Apply knowledge and understanding of engineeringmanagementprinciplesandeconomicdecision-makingandapplytheseto one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
PO 11	**Life Long Learning:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	To apply the principles of thermal sciences to design and develop various thermal systems.
PSO 2	To apply the principles of manufacturing technology, scientific management towards improvement of quality and optimization of engineering systems in the design, analysis and manufacturability of products.
PSO 3	To apply the basic principles of mechanical engineering design for evaluation of performance of various systems relating to transmission of motion and power, conversion of energy and other process equipment

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**K. LAKSHMI PRASAD**	**Dr. B. SRINIVASA RAO**	**Dr. B. SRINIVASA RAO**	**Dr. M. B. S. SREEKARA REDDY**
Signature				

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FRESHMAN ENGINEERING DEPARTMENT

COURSE HANDOUT

Part-A

PROGRAM : II B. Tech., III-Sem., MECH
ACADEMIC YEAR : 2026-27
COURSE NAME & CODE : **Environmental Science**
L-T-P STRUCTURE : 2-0-0
COURSE CREDITS : 0
COURSE INSTRUCTOR : Dr. Shaheda Niloufer
COURSE COORDINATOR : Dr. Shaheda Niloufer
PRE-REQUISITES : Biology, Chemistry, Geology, Mathematics or Physics

Course Objectives:

1	To enlighten the learners in the concept of differential equations and multivariable calculus
2	To furnish the learners with basic concepts and techniques at intermediate level to lead them into advanced level by handling various real-world applications.

Course Outcomes (COs): At the end of the course, students will be able to

CO 1	The necessity of resources, their exploitation and sustainable management	L2
CO 2	The interactions of human and ecosystems and their role in the food web in the natural world and the global biodiversity, threats to biodiversity and its conservation.	L2
CO 3	Environmental problems like pollution, disasters and possible solutions.	L1
CO 4	The importance of environmental decision making in organizations through understanding the environmental law and environmental audits.	L2
CO 5	Environmental issues like over population, human health etc related to local, regional and global levels.	L2

COURSE ARTICULATION MATRIX (Correlation between Cos &POs, PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	3	-	-	-	3	3	3	-	-	-	3	-	-	-
CO2	3	3	-	-	-	3	3	-	-	-	-	3	-	-	-
CO3	3	-	3	-	-	-	2	-	-	-	-	2	-	-	-
CO4	3	-	-	-	-	2	3	2	-	-	-	3	-	-	-
CO5	3	3	3	3	-	3	3	3	-	-	-	3	-	-	-

Note: Enter Correlation Levels **1** or **2** or **3.**
If there is no correlation, **put '-',** Slight (Low), **2** – Moderate (Medium), **3 -** Substantial (High).

BOS APPROVED TEXT BOOKS:

T1. Erach Bharucha, Text book of Environmental Studies for Undergraduate Courses, Universities Press (India) Private Limited, 2019.

T2. Palaniswamy, Environmental Studies,2/e, Pearson education,2014.

T3. S. Azeem Unnisa, Environmental Studies, Academic Publishing Company,2021.

T4. K. Raghavan Nambiar, "Text book of Environmental Studies for Undergraduate Courses as per UGC model syllabus", SciTech Publications (India), Pvt. Ltd, 2010.

Reference Books:

R1. KVSG Murali Krishna, The Book of Environmental Studies, 2/e, VGS Publishers, 2011.

R2. Deeksha Daveand E. Sai Baba Reddy, Text book of Environmental Science,2/e, Cengage Publications, 2012.

R3. M. Anji Reddy, "Text book of Environmental Sciences and Technology", B S Publication, 2014.

R4. J.P. Sharma, Comprehensive Environmental studies, Laxmi publications,2006.

R5. J. Glynn Henryand GaryW. Heinke, Environmental Sciences and Engineering, Prentice Hall of India Private limited, 1988.

R6. G.R. Chatwal, A Text Book of Environmental Studies, Himalaya Publishing House, 2018.

R7. Gilbert M. Masters and Wendell P. Ela, Introduction to Environmental Engineering and Science,1/e, Prentice Hall of India Private limited, 1991.

Part-B

COURSE DELIVERY PLAN (LESSON PLAN):

S. No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
1.	Introduction to the course	1	13-07-2026		TLM2			
2.	Multidisciplinary Nature ofEnvironmental Studies	1	16-07-2026		TLM2			

UNIT-I: Multidisciplinary Nature of Environmental Studies

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
3.	Natural Resources – Forest resources	1	20-07-2026		TLM1	CO1	T1, T2	
4.	Water resources	1	23-07-2026		TLM2	CO1	T1, T2	
5.	Mineral resources	1	27-07-2026		TLM1	CO1	T1, T2	
6.	Food resources	1	30-07-2026		TLM2	CO1	T1, T2	
7.	Energy resources	1	03-08-2026		TLM2			
No. of classes required to complete UNIT-I		07			No. of classes taken:			

UNIT-II: Ecosystems and Biodiversity

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
8.	Ecosystems – Structure & Functions	1	06-08-2026		TLM4	CO2	T1, T2	
9.	Ecological succession &	1	10-08-2026		TLM1	CO2	T1, T2	
10.	Food chains, Food webs & Ecological Pyramids	1	13-08-2026		TLM4	CO2	T1, T2	
11.	Types of ecosystems	1	17-08-2026		TLM1	CO2	T1, T2	

12.	Biodiversity – introduction, levels, bio geographic classification	1	20-08-2026		TLM2	CO2	T1, T2	
13.	Values of Biodiversity, India as mega diversity nation, Threats to biodiversity and Conservation of biodiversity	1	24-08-2026		TLM2	CO2	T1, T2	
No. of classes required to complete UNIT-II		06			No. of classes taken:			

I MID EXAMINATIONS (26-01-2026 TO 31-01-2026)

UNIT-III: Environmental Pollution

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
14.	Environmental pollution -Air pollution	1	10-09-2026		TLM1	CO3	T1, T2	
15.	Water pollution, Marine pollution, Thermal pollution	1	17-09-2026		TLM1	CO3	T1, T2	
16.	Soil pollution	1	21-09-2026		TLM1	CO3	T1, T2	
17.	Solid waste management	1	24-09-2026		TLM1	CO3	T1, T2	
18.	Disaster management	1	28-09-2026		TLM1	CO3	T1, T2	
No. of classes required to complete UNIT-III		05			No. of classes taken:			

UNIT-IV: Social Issues and Environment

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
19.	From Unsustainable to Sustainable development	1	01-10-2026		TLM1	CO4	T1, T2	
20.	Urban problems related to energy – Resettlement and rehabilitation of people; its problems and concerns	1	05-10-2026		TLM1	CO4	T1, T2	
21.	Environmental ethics, Climate change	1	08-10-2026		TLM6	CO4	T1, T2	
22.	Carbon credits & Mission LiFE - Wasteland reclamation. – Consumerism and waste products	1	12-10-2026		TLM1	CO4	T1, T2	
23.	Environmental Acts	1	15-10-2026		TLM1	CO4	T1, T2	
24.	Environmental Acts	1	26-10-2026		TLM1	CO4	T1, T2	
No. of classes required to complete UNIT-IV		06			No. of classes taken:			

UNIT-V: Human Population & Environment

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
25.	Population growth, variation among nations. Population explosion – Family Welfare Programmes.	1	29-10-2026		TLM1	CO5	T1, T2	
26.	Environment and human health –Human Rights – Value Education	1	02-11-2026		TLM1	CO5	T1, T2	
27.	HIV/AIDS – Women and Child Welfare	1	05-11-2026		TLM1	CO5	T1, T2	
28.	Role of information Technology in Environment and human health	1	09-11-2026		TLM1	CO5	T1, T2	
29.	Revision	1	09-11-2026		TLM3	CO5	T1, T2	
No. of classes required to complete UNIT-V		05			No. of classes taken:			

Content beyond the Syllabus

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
30.	Awareness on ozone layer Case studies	2	19-09-2026 26-03-2026		TLM2	CO2	T1, T2	
No. of classes		2			No. of classes taken:			
II MID EXAMINATIONS (06-04-2026 TO 11-04-2026)								

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/SwayamPrabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

PART-C EVALUATION PROCESS (R23 Regulation):

Evaluation Task	Marks
Assignment-I (Units-I, II)	A1=5
I-Descriptive Examination (Units-I, II)	M1=15
I-Quiz Examination (Units-I, II)	Q1=10
Assignment-II (Unit-III, IV & V)	A2=5
II- Descriptive Examination (UNIT-III, IV & V)	M2=15
II-Quiz Examination (UNIT-III, IV & V)	Q2=10
Mid Marks =80% of Max ((M1+Q1+A1), (M2+Q2+A2)) + 20% of Min ((M1+Q1+A1), (M2+Q2+A2))	M=30
Cumulative Internal Examination (CIE):	30
Semester End Examination (SEE)	70
Total Marks = CIE + SEE	100

PART-D PROGRAMME OUTCOMES (POs):

PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis**: Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety and the cultural, societal and environmental considerations.
PO 4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
PO 6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts and demonstrate the knowledge of and need for sustainable development.
PO 8	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work**: Function effectively as an individual and as a member or leader in diverse teams and in multidisciplinary settings.
PO 10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as being able to comprehend and write effective reports and design documentation, make effective presentations and give and receive clear instructions.
PO 11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning**: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

Dr. Shaheda Niloufer	**Dr. Shaheda Niloufer**	**Dr. Shaheda Niloufer**	**Dr. T. Satyanarayana**
Course Instructor	Course Coordinator	Module Coordinator	HOD

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DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor: Dr.S.Pichi Reddy, Dr.Siva Sankara Babu Chinka, Dr.B.Sudheer Kumar, Mr.S.Uma Maheswara Reddy

Course Name & Code : **Mechanics of Solids & Materials Science Lab &23ME53**
Regulation: R23
L-T-P Structure : **0-0-3** **Credits: 1.5**
Program/Sem/Sec :B.Tech/III **A.Y.:** 2026-27

PREREQUISITE: Mechanics of Solids, Material Science and Metallurgy

COURSE EDUCATIONAL OBJECTIVES (CEOs):

The main objective of the course is to determine various mechanical properties of materials by testing under different load conditions and observe the microstructure of various materials and perform heat treatment of materials.

COURSE OUTCOMES (COs): At the end of the course, student will be able to

CO	Statements
CO1	Estimate the behaviour of various materials under different loading. **(Understanding L2)**
CO2	Calculate the hardness of different materials. **(Applying – L3)**
CO3	Evaluate the mechanical properties of materials by conducting various tests. **(Applying-L3)**
CO4	Identify the material by observing the microstructure. **(Applying-L3)**
CO5	Evaluate hardness of treated and untreated steels. **(Applying-L3)**

COURSE ARTICULATION MATRIX (Correlation between COs, POs & PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
CO1	2	3	--	--	--	--	--	--	--	--	--	2	--	2	3
CO2	3	--	1	--	--	--	--	--	--	--	--	2	--	3	2
CO3	3	1	2	--	--	--	--	--	--	--	--	2	--	2	3
CO4	3	2	--	--	--	--	--	--	--	--	--	2	--	3	--
CO5	2	3	--	--	--	--	--	--	--	--	--	2	--	3	2

References:

Lab Manual

PART-B

LIST OF EXPERIMENTS

NOTE: Any 6 experiments from each section A and B.

A) MECHANICS OF SOLIDS LAB:

1. Tensile test. **(MOS1)**
2. Bending test on a) Simply supported beam b) Cantilever beam. **(MOS2)**
3. Torsion test. **(MOS3)**
4. Hardness test

   a) Brinell's hardness test b) Rockwell hardness test c) Vickers hardness test. **(MOS4)**
5. Test on springs. **(MOS5)**
6. Impact test a) Charpy test b) Izod test. **(MOS6)**
7. Shear test. **(MOS7)**

B) MATERIAL SCIENCE LAB:

1. Preparation and study of the Microstructure of pure metals. **(MSC1)**
2. Preparation and study of the Microstructure of Mild steel, medium carbon steels, and High carbon steels. **(MSC2)**
3. Study of the Microstructures of Cast Irons. **(MSC3)**
4. Study of the Microstructures of Non-Ferrous alloys. **(MSC4)**
5. Study of the Microstructures of Heat-treated steels. **(MSC5)**
6. Hardenability of steels by Jominy End Quench Test. **(MSC6)**

Virtual lab:

- To investigate the principal stresses σa and σb at any given point of a structural element or machine component when it is in a state of plane stress. (https://virtual- labs.github.io/exp-rockwell-hardness-experiment-iiith/objective.html)
- To find the impact resistance of mild steel and cast iron.(https://sm- nitk.vlabs.ac.in/exp/izod-impact-test).
- To find the impact resistance of mild steel.(https://sm-nitk.vlabs.ac.in/exp/charpy- impact-test/index.html)
- To find the Rockwell hardness number of mild steel, cast iron, brass, aluminum and spring steel etc. (https://sm-nitk.vlabs.ac.in/exp/rockwell-hardness-test)
- To determine the indentation hardness of mild steel, brass, aluminum etc. using Vickers hardness testing machine. (https://sm-nitk.vlabs.ac.in/exp/vickers-hardness- test).

REFERENCES

Lab Manual

Batch- Schedule

S.No	Date	Batches											
		B1	B2	B3	B4	B5	B6	B7	B8	B9	B10	B11	B12
1	14/07/2026	Demonstration of Mechanics of Solids & Materials Science Lab											
2	21/07/2026	MOS-1	MOS-2	MOS-3	MOS-4	MOS-5	MOS-6	MSC-1	MSC-2	MSC-3	MSC-4	MSC-5	MSC-6
3	28/07/2026	MOS-2	MOS-3	MOS-4	MOS-5	MOS-6	MOS-1	MSC-2	MSC-3	MSC-4	MSC-5	MSC-6	MSC-1
4	04/08/2026	MOS-3	MOS-4	MOS-5	MOS-6	MOS-1	MOS-2	MSC-3	MSC-4	MSC-5	MSC-6	MSC-1	MSC-2
5	11/08/2026	MOS-4	MOS-5	MOS-6	MOS-1	MOS-2	MOS-3	MSC-4	MSC-5	MSC-6	MSC-1	MSC-2	MSC-3
6	18/08/2026	MOS-5	MOS-6	MOS-1	MOS-2	MOS-3	MOS-4	MSC-5	MSC-6	MSC-1	MSC-2	MSC-3	MSC-4
7	25/08/2026	MOS-6	MOS-1	MOS-4	MOS-3	MOS-4	MOS-5	MSC-6	MSC-1	MSC-2	MSC-3	MSC-4	MSC-5
8	01/09/2026	Virtual Lab											
07-09-2026 to 09-09-2026		I Mid Examinations											
8	15/09/2026	MSC-1	MSC-2	MSC-3	MSC-4	MSC-5	MSC-6	MOS-1	MOS-2	MOS-3	MOS-4	MOS-5	MOS-6
9	22/09/2026	MSC-2	MSC-3	MSC-4	MSC-5	MSC-6	MSC-1	MOS-2	MOS-3	MOS-4	MOS-5	MOS-6	MOS-1
10	29/09/2026	MSC-3	MSC-4	MSC-5	MSC-6	MSC-1	MSC-2	MOS-3	MOS-4	MOS-5	MOS-6	MOS-1	MOS-2
11	06/10/2026	MSC-4	MSC-5	MSC-6	MSC-1	MSC-2	MSC-3	MOS-4	MOS-5	MOS-6	MOS-1	MOS-2	MOS-3
12	13/10/2026	MSC-5	MSC-6	MSC-1	MSC-2	MSC-3	MSC-4	MOS-5	MOS-6	MOS-1	MOS-2	MOS-3	MOS-4
19-10-2026 to 24-10-2026		Dussehra Holidays											
13	27/10/2026	MSC-6	MSC-1	MSC-2	MSC-3	MSC-4	MSC-5	MOS-6	MOS-1	MOS-4	MOS-3	MOS-4	MOS-5
14	03/11/2026	Repetition											
15	10/11/2026	Internal Examination											
12-11-2026 to 14-11-2026		II Mid Examinations											
No. of classes required to complete:								No. of classes taken:					

Batches:

S. No	Batch	Registered Nos	Total
1	B1	24761A0321, 25761A0301-305	6
2	B2	25761A0306-313	6
3	B3	25761A0314-319	6
4	B4	25761A0320-325	6
5	B5	25761A0326-332	6
6	B6	25761A0333-338	6

S. No	Batch	Registered Nos	Total
7	B7	25761A0339-344	6
8	B8	25761A0345-350	6
9	B9	25761A0351-356	6
10	B10	25761A0357-362	6
11	B11	LE STUDENTS	
12	B12	LE STUDENTS	

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

PART-C

EVALUATION PROCESS (R20 Regulation):

Evaluation Task	Expt. no's	Marks
Day to Day work = **A**	1,2,3,4,5,6,7,8…	A=15
Record = **B**	1,2,3,4,5,6,7,8	B=05
Internal Test = **C**	1,2,3,4,5,6,7,8	C = 15
Cumulative Internal Examination: A + B + C = 30	1,2,3,4,5,6,7,8	**30**
Semester End Examinations = D	1,2,3,4,5,6,7,8	**D = 70**
Total Marks: A + B + C + D = 100	1,2,3,4,5,6,7,8	**100**

PART-D

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO 1	To build a professional career and pursue higher studies with sound knowledge in Mathematics, Science and Mechanical Engineering.
PEO 2	To inculcate strong ethical values and leadership qualities for graduates to become successful in multidisciplinary activities.
PEO 3	To develop inquisitiveness towards good communication and lifelong learning.

PROGRAMME OUTCOMES (POs):

PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis**: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complexengineering activities with an understanding of the limitations.
PO 6	**The Engineer and the World:** Analyse and evaluate societal and environmental aspects while solving complex engineering problems, considering their impact on sustainability with reference to economy, health, safety, legal frameworks, culture, and the environment.
PO 7	**Ethics**: Apply ethical principles and commit to professional ethics and responsibilitiesand norms of the engineering practice.
PO 8	**Individual and team work**: Function effectively as an individual, and as a member orleader in diverse teams, and in multidisciplinary settings.
PO 9	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 10	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 11	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	To apply the principles of thermal sciences to design and develop various thermal systems.
PSO 2	To apply the principles of manufacturing technology, scientific management towardsimprovement of quality and optimization of engineering systems in the design, analysis and manufacturability of products.
PSO 3	To apply the basic principles of mechanical engineering design for evaluation ofperformance of various systems relating to transmission of motion and power, conservation of energy and other process equipment.

Sign				
Name of the Faculty	Dr. S .Pichi Reddy Dr. CH. Siva Sankara Babu Dr.B.Sudheer Kumar Mr.S.Uma Maheswara Reddy	Mr.K.Viswanadh	Dr.B.Sudheer Kumar	Dr.M.B.S.Sreekara Reddy
Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of theDepartment**

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DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor: Mr.K.V.Viswanadh/Dr.Ch.Siva Sankara Babu/Mr.K.Sai Babu

Course Name & Code : CAMD LAB & 23ME54 **Regulation**:R23

L-T-P Structure : **0-0-3** **Credits:** 1.5

Program/Sem/Sec : B.Tech/III **A.Y.:** 2026-27

PREREQUISITE: Engineering Graphics

COURSE EDUCATIONAL OBJECTIVES (CEOs):

- Introduce conventional representations of material and machine components.
- Train to use software for 2D and 3D modeling.
- Familiarize with thread profiles, riveted, welded and key joints.
- Teach solid modeling of machine parts and their sections.
- Explain creation of 2D and 3D assembly drawings and familiarize with limits, fits, and tolerances in mating components.

COURSE OUTCOMES (COs): At the end of the course, student will be able to

CO1	Demonstrate the conventional representations of materials and machine components. (Understanding-L2)
CO2	Model riveted, welded and key joints using CAD system. (Applying-L3)
CO3	Create solid models and sectional views of machine components. (Applying-L3)
CO4	Assemble the solid models of machine parts. (Evaluating-L5)
CO5	Generate part drawings from assembly. (Evaluating-L5)

OURSE ARTICULATION MATRIX (Correlation between COs, POs & PSOs):

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	2				2		3				2		3	3
CO2	2		2		3						2		2	3
CO3	2		3		3						2		2	3
CO4	2		3		3			2			3		2	3
CO5	3	2	3		3			3			3		3	3
	1 - Low				**2 –**Medium						**3 -** High			

SOFTWARE PACKAGES: Auto CAD, CATIA V5

REFERENCES:

- Lab Manuals

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

Schedule of Experiments

S.No	Batches	Regd. Nos	Total No. of Students
1	Batch B1	24761A0301-365, 25765A0301-307	69

S. No.	Topics to be covered (Experiment Name)	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Demonstration	3	18-07-2026		TLM4	
2.	Experiment-1	3	25-07-2026		TLM4	
3.	Experiment-2	3	01-08-2026		TLM4	
4.	Experiment-3	3	22-08-2026		TLM4	
5.	Experiment-4	3	29-08-2026		TLM4	
6.	Experiment-5	3	05-09-2026		TLM4	
7.	Experiment-6	3	19-09-2026		TLM4	
8.	Experiment-7	3	26-09-2026		TLM4	
9.	Experiment-8	3	03-10-2026		TLM4	
10.	Experiment-9	3	17-10-2026		TLM4	
11.	Experiment-10	3	31-10-2026		TLM4	
12.	Lab Internal	3	07-11-2026		TLM4	
No. of classes required to complete:				**No. of classes taken:**		

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

ACADEMIC CALENDAR:

Description	From	To	Weeks
I Phase of Instructions-1	13/07/2026	05/09/2026	8
I Mid Examinations	07/09/2026	09/09/2026	0.5
II Phase of Instructions	10/09/2026	17/10/2026	5.5
Dassehra Holidays	19/10/2026	24/10/2026	1
II Phase of Instructions Contd…	26/10/2026	11/11/2026	2.5
II Mid Examinations	12/11/2026	14/11/2026	0.5
Preparation and Practicals	16/11/2026	21/11/2026	1
Semester End Examinations	23/11/2026	05/12/2026	2

PART-C

EVALUATION PROCESS (R20 Regulation):

Evaluation Task	Expt. no's	Marks
Day to Day Evaluation: A (Manual, Record, Viva)	1-10	A=15
Internal Lab Exams: B	1-10	B=15
Cumulative Internal Examination : CIE=A+B	**1-10**	**CIE=30**
Semester End Examinations: SEE	**1-10**	**SEE=70**
Total Marks: CIE+SEE	**1-10**	**100**

LIST OF EXPERIMENTS:

Exp.No.	Name of the Experiment	Related CO
Exp1	Conventional representation of various materials	CO1
Exp2	Conventional representation of various machine parts	CO1
Exp3	Sectional views	CO3
Exp4	Thread Profiles	CO1
Exp5	Bolt with Nut and Washer, Keys, Flanged Coupling	CO2
Exp6	Riveted Joint	CO2
Exp7	Plummer block Assembly	CO4
Exp8	Eccentric/ Lathe Tail Stock	CO4
Exp9	Screw Jack Assembly	CO3
Exp10	Part of Drawing of Simple Parts	CO5

NOTIFICATION OF CYCLE

Cycle	Exp. No.	Name of the Experiment	Related CO
Convensions	Exp1	Conventional representation of various materials	CO1
	Exp2	Conventional representation of various machine parts	CO1
	Exp3	Sectional views	CO3
	Exp4	Thread Profiles	CO1
Machine Parts Modeling	Exp5	Bolt with Nut and Washer, Keys, Flanged Coupling	CO2
	Exp6	Riveted Joint	CO2
Assembly Drawings	Exp7	Plummer block Assembly	CO4
	Exp8	Eccentric/ Lathe Tail Stock	CO4
Drafting & Sections	Exp9	Screw Jack Assembly	CO3
Part Drawings	Exp10	Part Drawing of Simple Parts	CO5

PART-D

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO 1	To build a professional career and pursue higher studies with sound knowledge in Mathematics, Science and Mechanical Engineering.
PEO 2	To inculcate strong ethical values and leadership qualities for graduates to become successful in multidisciplinary activities.
PEO 3	To develop inquisitiveness towards good communication and lifelong learning.

KNOWLEDGE ATTRIBUTES:

WK1: A systematic, theory-based understanding of the natural sciences applicable to the discipline and awareness of relevant social sciences.

WK2: Conceptually-based mathematics, numerical analysis, data analysis, statistics and formal aspects of computer and information science to support detailed analysis and modelling applicable to the discipline.

WK3: A systematic, theory-based formulation of engineering fundamentals required in the engineering discipline.

WK4: Engineering specialist knowledge that provides theoretical frameworks and bodies of knowledge for the accepted practice areas in the engineering discipline; much is at the fore front of the discipline.

WK5: Knowledge, including efficient resource use, environmental impacts, whole life cost, reuse of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

WK6: Knowledge of engineering practice (technology) in the practice are as in the engineering discipline.

WK7: Knowledge of the role of engineering in society and identified issues in engineering practice in the discipline, such as the professional responsibility of an engineer to public safety and sustainable development.

WK8: Engagement with selected knowledge in the current research literature of the discipline, awareness of the power of critical thinking and creative approaches to evaluate emerging issues.

WK9: Ethics, inclusive behavior and conduct. Knowledge of professional ethics, responsibilities, and norms of engineering practice. Awareness of the need for diversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding and respect.

PROGRAMME OUTCOMES (POs):

PO 1	**Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
PO 2	**Problem Analysis:** Identify, formulate, review research literature and analyze complex engineering problems reaching substantiated conclusions with consideration for sustainable development. (WK1 to WK4)
PO 3	**Design/Development of Solutions:** Design creative solutions for complex engineering problems and design/develop systems/components/processes to meet identified needs with consideration for the public health and safety, whole-life cost, net zero carbon, culture, society and environment as required. (WK5)
PO 4	**Conduct Investigations of Complex Problems**: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & Interpretation of data to provide valid conclusions. (WK8).
PO 5	**Engineering Tool Usage:** Create, select and apply appropriate techniques, resources and modern engineering & IT tools, including prediction and modelling recognizing their limitations to solve complex engineering problems. (WK2 and WK6)
PO 6	**The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal frame work, culture and environment. (WK1, WK5, and WK7).

PO 7	**Ethics:** Apply ethical principles and commit to professional ethics, human values, diversity and inclusion; adhere to national & international laws. (WK9)
PO 8	**Individual and Collaborative Team work:**Function effectively as an individual,and as a member or leader in diverse/multi-disciplinary teams
PO 9	**Communication:** Communicate effectively and inclusively within the engineering community and society at large, such as being able to comprehend and write effective reports and design documentation,make effective presentations considering cultural, language, and learning differences
PO 10	**Project Management and Finance**: Apply knowledge and understanding of engineeringmanagementprinciplesandeconomicdecision-makingandapplytheseto one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
PO 11	**Life Long Learning:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	To apply the principles of thermal sciences to design and develop various thermal systems.
PSO 2	To apply the principles of manufacturing technology, scientific management towards Improvement of quality and optimization of engineering systems in the design, analysis and manufacturability of products.
PSO 3	To apply the basic principles of mechanical engineering design for evaluation of performance of various systems relating to transmission of motion and power, conservation of energy and other process equipment.

Title	Course Instructor	Course Coordinator	Module Coordinator	Head of the Department
Name of the Faculty				
Signature	**Mr.K.V.Viswanadh/ Dr.Ch.Siva Sankara Babu/ Mr.K.Sai Babu**	**Mr.K.V.Viswanadh**	**Dr.B.Sudheer Kumar**	**Dr.M.B.S.Sreekara Reddy**

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(AUTONOMOUS)
Accredited by NAAC with 'A' Grade & NBA (Under Tier - I),
An ISO 21001:2018,14001:2015,50001:2018 Certified Institution
Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada
L.B. REDDY NAGAR, MYLAVARAM, NTR DIST., A.P.-521 230.

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor: ADK/KVR/KSB
Course Name & Code : PYTHON PROGRAMMING & 23CS57
L-T-P Structure : **0-1-2** **Credits:** 2
Program/Sem/Sec : B.Tech/ME/III **A.Y.:** 2026-27

PREREQUISITE: INTRODUCTION TO PROGRAMMING

COURSE EDUCATIONAL OBJECTIVE:
The main objectives of the course are to

1. Introduce core programming concepts of Python programming language.
2. Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries
3. Implement Functions, Modules and Regular Expressions in Python Programming and to create practical and contemporary applications using these

COURSE OUTCOMES (CO):
CO1: Implement the core programming concepts of Python programming language**. (Apply-L3)**
CO2: Demonstrate about Python data structures like Lists, Tuples, Sets and dictionaries **(Apply-L3)**
CO3: Implement Functions, Modules and Regular Expressions in Python Programming and to create practical and contemporary applications**. (Apply-L3)**
CO4: Improve individual / teamwork skills, communication & report writing skills with ethical values

COURSE ARTICULATION MATRIX (Correlation between Cos, Pos & PSOs):

Cos	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PSO1	PSO2	PSO3
CO1	3	2	-	-	-	-	-	-	-	-	-	-	-	
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	
CO3	3	2	-	-	-	-	-	-	-	-	-	-	-	
CO4	-	-	-	-	-	-	-	2	2	2	-	-	-	-

Note: 1- Slight (Low), **2 -** Moderate (Medium), **3 -** Substantial (High)

PART-B:

COURSE DELIVERY PLAN (LESSON PLAN):

	Topic to be covered	Number of Hours	Tentative Date of Completion	Actual Date of Completion	HOD Signature
1.	**Exp-1:** Introduction,Course Outcomes, Introduction to Python, Installation,Variables,Data types.Reading Input, Print output, Comments	3	24-07-2026		
2.	**Exp-2:**Control statements – if, else, nestedif, elif, Loop statements, Programs on Loop statements	3	31-07-2026		
3.	**Exp-3:** Function Definition and Calling the function, return Statement and void Function	3	07-08-2026		
4.	**EXP-4:** creating lists,tuples,Indexing and Slicing in Lists, tuples,Built-In Functions Used on Lists, List Methods, del Statement, tuple methods	3	14-08-2026		
5.	**EXP-5:** Introduction to Dictionaries, Creating Dictionary, Accessing and Modifying key: value Pairs in Dictionaries, Built-In Functions Used on Dictionaries, Dictionary Methods, del Statement. Sample programs on dictionaries, set operations	3	21-08-2026		
6.	**EXP-6:** Accessing Characters in String by Index Number, String Slicing and Joining, String Methods, Formatting Strings., Sample Programs on strings	3	28-08-2026		
7.	**EXP-7:** Introduction to files ,Types of Files, Creating and Reading Text Data, File Methods to Read and Write Data, Reading and Writing Binary Files, sample programs on files.	3	11-09-2026		
8.	**EXP-8:Object-Oriented Programming**: Classes and Objects, Creating Classes in Python, Creating Objects in	3	18-09-2026		

	Python, Constructor Method, Encapsulation, Inheritance, Polymorphism,				
9.	**EXP-9:**Install and use librariesnumpy,pandas	3	25-09-2026		
10.	**EXP-10:**Data Manipulation and Visuvalization	3	09-10-2026		
11.	**EXP-11:** JSON and XML in Python, NumPy with Python, Pandas.	3	16-10-2026		
12.	**EXP-12:**Programs on Database queries	3	30-10-2026		
13.	**Internal Exam**	3	06-11-2026		

PART-C

EVALUATION PROCESS (R23 Regulation):

Evaluation Task	**Marks**
Day to Day Work:	15
Internal Test	15
Continuous Internal Assessment	30
Procedure	20
Execution & Results	30
Viva-voce	20
Semester End Examination (SEE)	70
Total Marks = CIE + SEE	100

PART-D

PROGRAMME OUTCOMES (POs):

PO 1	**Engineering Knowledge:** Apply knowledge of mathematics, natural science, computing, engineering fundamentals and an engineering specialization as specified in WK1 to WK4 respectively to develop to the solution of complex engineering problems.
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PO 4	**Conduct Investigations of Complex Problems**: Conduct investigations of complex engineering problems using research-based knowledge including design of experiments, modelling, analysis & Interpretation of data to provide valid conclusions. (WK8).
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PO 6	**The Engineer and The World:** Analyze and evaluate societal and environmental aspects while solving complex engineering problems for its impact on sustainability with reference to economy, health, safety, legal frame work, culture and environment. (WK1, WK5, and WK7).
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PO 10	**Project Management and Finance**: Apply knowledge and understanding of engineeringmanagementprinciplesandeconomicdecision-makingandapplytheseto one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
PO 11	**Life Long Learning:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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PSO 3	To apply the basic principles of mechanical engineering design for evaluation of performance of various systems relating to transmission of motion and power, conservation of energy and other process equipment.

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**ADK/KVR/KSB**	**Dr.A.Dhanunjay Kumar**	**J.Subba Reddy**	**Dr.M.B.S.Sreekara Reddy**
Signature				

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
(Autonomous Status Since the Academic Year 2010-11 & Extended up to 2031-32)
NAAC Accredited with CGPA of 3.20 on 4-point scale at 'A' Grade
NIRF-2022 (Positioned in the Band of 251-300 in the Engineering Category)
NIRF-2023 (Positioned in the Band of 101-150 in the Innovation Category)
NBA Accredited under Tier-I (ECE, EEE, CSE, IT, ME, CIV, ASE)
Recognized as Scientific Industrial Research Organization(SIRO) by DSIR
Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada
L.B.Reddy Nagar, Mylavaram-521230, N.T.R Dist., Andhra Pradesh, India.

DEPARTMENT OF MECHANICAL ENGINEERING

Course Name & Code	: EMBEDDED SYSTEMS & IoT – 23ECS1
L-T-P Structure	: 0-1-3
Credits	: 3
Program	: II-Year B.Tech., Mech
A.Y	: 2026 - 27

Pre requisite: BEE, C Programming.

Course Objectives:

- To comprehend Microcontroller-Transducers Interface techniques
- To establish Serial Communication techniques with Arduino
- To analyze the basics of SPI communication, and interfacing techniques of Stepper Motor, Accelerometer with Arduino
- To introduce the Raspberry PI platform, that is widely used in IoT applications
- To introduce the implementation of distance sensor on IoT devices.

Course Outcomes:

After competition of this course, the student will be able to:

CO1 : Comprehend Microcontroller-Transducers Interface techniques. **(Understand)**
CO2 : Identify the programming concepts of IOT. **(Design)**
CO3: Develop real time applications using Internet of Things. **(Apply)**
CO4 : Demonstrate the integration of sensors with IOT.. **(Apply)**
CO5 : Adapt effective Communication, presentation and report writing skills. **(Apply)**

HANDS–ON Laboratory Sessions:

PART-A: Embedded Systems Experiments- (Any 5 from the following)

List of experiments:

1. Measure Analog signal from Temperature Sensor.
2. Generate PWM output.
3. Drive single character generation on Hyper Terminal.
4. Drive a given string on Hyper Terminal.
5. Full duplex Link establishment using Hyper terminal.
6. Drive a given value on a 8 bit DAC consisting of SPI.
7. Drive Stepper motor using Analog GPIOs.
8. Drive Accelerometer and Display the readings on Hyper Terminal.

Components / Boards: 1. Arduino Duemilanove Board 2. Arduino Software IDE.

Text Books:

1. Embedded Systems Architecture- By Tammy Noergaard, Elsevier Publications, 2013.
2. Embedded Systems-By Shibu. K.V-Tata McGraw Hill Education Private Limited, 2013.
3. Embedded System Design, Frank Vahid, Tony Givargis, John Wiley Publications, 2013.
4. Embedded Systems-Lyla B.Das-Pearson Publications, 2013.

PART-B: Internet of Things Experiments-(Any 5 from the following)

1. Getting started with Raspberry Pi, Install Raspian on your SD card.
1. Python-based IDE (integrated development environments) for the Raspberry Pi and how to trace and debug Python code on the device.
2. Using Raspberry pi a. Calculate the distance using distance sensor. b. Basic LED functionality.
3. Raspberry Pi interact with online services through the use of public APIs and SDKs.
4. Study and Install IDE of Arduino and different types of Arduino.
5. Study and Implement Zigbee Protocol using Arduino / Raspberry Pi.
6. Calculate the distance using distance sensor Using Arduino.
7. Basic LED functionality Using Arduino.
8. Calculate temperature using temperature sensor Using Arduino.
9. Calculate the distance using distance sensor Using Node MCU.
10. Basic LED functionality Using Node MCU.

Text Books:

1. Arsheep Bahga &Vijay Madisetti, Internet of Things - A Hands-on Approach, 1/e, Orient Blackswan Private Limited - New Delhi, 2015.
2. Arshdeep Bahga and Vijay Madisetti, Universities Press, 2015.
3. Getting Started with Raspberry Pi, Matt Richardson & Shawn Wallace, O'Reilly (SPD), 2014,

Online Learning Sources

1. https://onlinecourses.nptel.ac.in/noc21_cs17/preview
2. https://onlinecourses.nptel.ac.in/noc20_ee98/preview
3. https://archive.nptel.ac.in/courses/108/105/108105057/

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

PART-A: Embedded Systems Experiments						
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
1.	Introduction to Arduino Duemilanove Board and installation of Arduino Software IDE.	1	15-07-2026		TLM5	
2.	Demonstration on Temperature Sensor and to measure Analog signal from Temperature Sensor.	1	22-07-2026		TLM5	
3.	Demonstration on generation of PWM wave	1	29-07-2026		TLM5	
4.	Demonstration on driving single character generation and drive a given string on Hyper Terminal.	1	05-08-2026		TLM5	
5.	Demonstration on full duplex Link establishment using Hyper terminal.	1	12-08-2026		TLM5	
6.	Demonstration on driving a given value on a 8 bit DAC consisting of SPI.	1	19-08-2026		TLM5	
7.	Demonstration on driving Stepper motor using Analog GPIOs.	1	02-09-2026		TLM5	

PART-B: Internet of Things Experiments						
S.No.	**Topics to be covered**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
8.	Getting started with Raspberry Pi, Install Raspian on your SD card .	1	16-09-2026		TLM5	
9.	Python-based IDE (integrated development environments) for the Raspberry Pi and how to trace and debug Python code on the device.	1	23-09-2026		TLM5	
10.	Using Raspberry pi a. Calculate the distance using distance sensor. b. Basic LED functionality.	1	30-09-2026		TLM5	
11.	Raspberry Pi interact with online services through the use of public APIs and SDKs.	1	07-10-2026		TLM5	
12.	Study and Install IDE of Arduino and different types of Arduino and Implement Zigbee Protocol using Arduino / Raspberry Pi.	1	14-10-2026		TLM5	
13.	Calculate the distance using distance sensor Using Arduino.	1	28-10-2026		TLM5	
14.	Basic LED functionality Using Arduino and to calculate temperature using temperature sensor Using Arduino.	1	03-11-2026		TLM5	
15.	Basic LED functionality and calculate the distance using distance sensor Using Node MCU.	1	10-11-2026		TLM5	

Hands – on Laboratory Session						
S.No.	**Experiments to be conducted**	**No. of Classes Required**	**Tentative Date of Completion**	**Actual Date of Completion**	**Teaching Learning Methods**	**HOD Sign Weekly**
	PART-A: Embedded Systems Experiments					
1.	Measuring Analog signal from Temperature Sensor.	3	16-07-2026		TLM8	
2.	Generation of PWM output.	3	23-07-2026		TLM8	
3.	Drive single character generation and a given string on Hyper Terminal.	3	30-07-2026		TLM8	
4.	Full duplex Link establishment using Hyper terminal.	3	06-08-2026		TLM8	
5.	Drive a given value on a 8 bit DAC consisting of SPI.	3	13-08-2026		TLM8	
6.	Drive Stepper motor using Analog GPIOs.	3	20-08-2026		TLM8	
7.	Drive Accelerometer and Display the readings on Hyper Terminal	3	27-08-2026		TLM8	
	PART-B: Internet of Things Experiments					
8.	Getting started with Raspberry Pi, Install Raspian on your SD card.	3	10-09-2026		TLM8	
9.	Python-based IDE (integrated development environments) for the Raspberry Pi and how to trace and debug Python code on the device.	3	17-09-2026		TLM8	
10.	Using Raspberry pi a. Calculate the distance using distance sensor. b. Basic LED functionality.	3	24-09-2026		TLM8	
11.	Raspberry Pi interact with online services through the use of public APIs and SDKs.	3	01-10-2026		TLM8	
12.	Study and Install IDE of Arduino, different types of Arduino and Implement Zigbee Protocol using Arduino / Raspberry Pi.	3	08-10-2026		TLM8	
13.	Calculate the distance using distance sensor Using Arduino.	3	15-10-2026		TLM8	
14.	Basic LED functionality and calculate temperature using temperature sensor Using Arduino.	3	29-10-2026		TLM8	
15.	Basic LED functionality and calculate the distance using distance sensor Using Node MCU	3	05-11-2026		TLM8	
No.of classes required to complete:		**45**	**No.of classes conducted:**			

Teaching Learning Methods					
TLM1	Chalk and Talk	**TLM4**	Problem Solving	**TLM7**	Seminars or GD
TLM2	PPT	**TLM5**	Programming	**TLM8**	Lab Demo
TLM3	Tutorial	**TLM6**	Assignment or Quiz	**TLM9**	Case Study

PART-C: EVALUATION PROCESS:

Evaluation Task	Marks
Semester End Examination (SEE)	**100**
Total Marks = SEE	**100**

PART – D

PROGRAMME OUTCOMES (POs):

PO 1:	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2:	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3:	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4:	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5:	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
PO 6:	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO 7:	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8:	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9:	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10:	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11:	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12:	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1:	**Communication:** Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.
PSO 2:	**VLSI and Embedded Systems:** Design and Analyze Analog and Digital Electronic Circuits or systems and Implement real time applications in the field of VLSI and Embedded Systems using relevant tools
PSO 3:	**Signal Processing:** Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

Course Instructor	Course Coordinator	Module Coordinator	HOD
[Mr. K.V.Ashok]	[Mr. K.V.Ashok]	[Dr. P. Lachi Reddy]	[Dr. G. Srinivasulu]