LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(AUTONOMOUS)
Accredited by NAAC & NBA (Under Tier - I), ISO 9001:2015 Certified Institution
Approved by AICTE, New Delhi. and Affiliated to JNTUK, Kakinada
L.B. REDDY NAGAR, MYLAVARAM, KRISHNA DIST., A.P.-521 230.
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DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : **Mr. Seelam Srinivasa Reddy**
Course Name & Code : Machine Tools and Metrology & 23ME10
L-T-P Structure : **3-0-0** **Credits:** 3
Program/Sem/Sec : B.Tech/V/A-Section **A.Y.:** 2026-27

PREREQUISITE: Production Technology

COURSE EDUCATIONAL OBJECTIVES (CEOs): This course aims to impart fundamental knowledge and principles of material removal processes, along with a comprehensive understanding of the basic working principles of lathe, shaping, slotting, and planning machines. It also focuses on demonstrating the fundamentals of drilling, milling, and boring operations. Additionally, the course discusses advanced finishing processes, limits, and fits, while providing insight into the concepts of surface roughness and the application of optical measuring instruments.

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

CO1	Describe the principles of metal cutting, chip formation, tool nomenclature, and tool life, and demonstrate basic lathe operations. (**Understanding – L2**)
CO2	Identify the construction, working principles, specifications, and operations of shaping, slotting, planning, drilling, and boring machines, including their key components and mechanisms. (**Understanding – L2**)
CO3	Operate drilling, boring, and milling machines to perform machining processes, and demonstrate the ability to produce keyways and gears using milling machines by applying indexing mechanisms. (**Applying – L3**)
CO4	Select suitable finishing processes, grinding wheels, and apply concepts of limits, fits, and gauge design for quality control and dimensional accuracy. **(Applying – L3)**
CO5	Apply suitable instruments for angular, surface roughness, and optical measurements, and interpret the measurement data for quality inspection of components. **(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	3	3	2			2					2	2	3	2
CO2	3	1				2	2				2		3	
CO3	3	2				2	2				2		3	1
CO4	3	2					3				2		3	
CO5	3	2	3	2	1						3		3	

TEXTBOOKS:

T1 Manufacturing Processes / JP Kaushish/ PHI Publishers-2nd Edition

T2 Manufacturing Technology–Metal Cutting and Machine Tools, P.N. Rao, Tata McGraw Hill, New Delhi, 2000.

T3 Manufacturing, Engineering & Technology. Kalpakjian, S. and Steven R. Schmid, Pearson Education, 2013

T4 Machine Tool Design, N.K. Mehta, Tata McGraw Hill, 2012

T5 Engineering Metrology, I.C. Gupta, Dhanpat Rai & Sons,2003

T6 Engineering Metrology, R. K. Jain, Khanna Publishers, 19/e, 2005.

REFERENCE BOOKS:

R1 Metal cutting and machine tools /Geoffrey Boothroyd, Winston A.Knight/ Taylor & Francis

R2 Production Technology / H.M.T. Hand Book (Hindustan Machine Tools).

R3 Production Engineering/K.C Jain & A.K Chitaley/PHI Publishers

R4 Technology of machine tools/S.F.Krar, A.R. Gill, Peter SMID/ TMH

R5 Manufacturing Processes for Engineering Materials-Kalpak Jian S & Steven R Schmid/Pearson Publications 5th Edition

R6 Elements of Workshop Technology, Vol. II, S.K. Hajra Chowdary, and A.K. Hajra Chowdary, Asia Publishing House, Bombay, 2003.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: INTRODUCTION, FUNDAMENTALS OF MACHINING AND LATHE MACHINES:

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.	Syllabus,Importance of Subject, CO & PO's, Introduction of metal cutting, Machine tools, Metrology	1	30.06.2026		TLM2	
2.	Elementary treatment of metal cutting theory	1	02.07.2026		TLM2	
3.	Element of cutting process	1	03.07.2026		TLM2	
4.	Geometry of Single Point Cutting Tool	1	03.07.2026		TLM2	
5.	Tool signature	1	07.07.2026		TLM2	
6.	Mechanism of Chip formation	1	09.07.2026		TLM2	
7.	Types of Chip formation, Chip formation problems	1	10.07.2026		TLM6	
8.	Taylor's tool life equation	1	10.07.2026		TLM2	
9.	Introduction- to lathe, Types of lathes	1	14.07.2026		TLM2	
10.	Engine lathe – principle of working – construction	1	16.07.2026		TLM2	
11.	Specification of lathe, Accessories and attachments	1	17.07.2026		TLM2	
12.	lathe operations	1	17.07.2026		TLM1	
13.	Taper turning methods	1	21.07.2026		TLM2	
14.	Thread cutting – drilling on lathes.	1	23.07.2026		TLM2	
No. of classes required to complete UNIT-I: 14				**No. of classes taken:**		

UNIT-II: SHAPER, SLOTTER, PLANAR, DRILLING AND BORING MACHINES

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	Reciprocating Machines: **SHAPING** Principle of working	1	24.07.2026		TLM2	
16	Parts of Shaper Machine– Specifications,	1	24.07.2026		TLM2	
17	Size and Specifications of Shaper, classifications, Operations	1	28.07.2026		TLM2	
18	**SLOTTING** Principle of working – Principal parts – Specifications,	1	30.07.2026		TLM2	
19	Classifications, operations	1	31.07.2026		TLM2	
20	**PLANNER** Principle of working Principal parts – Size and Specifications	1	31.07.2026		TLM2	
21	Classifications, Operations	1	04.08.2026		TLM2	
22	Sliders crank mechanism.	1	06.08.2026		TLM2	
23	**DRILLING & BORING MACHINES:** Introduction – construction of drilling machines	1	07.08.2026		TLM2	
24	Principles of working – specifications-	1	07.08.2026		TLM2	
25	Types of drilling machines	1	11.08.2026		TLM2	
26	Operations performed, Types of drills	1	13.08.2026		TLM6	
27	Boring Machines – types.	1	14.08.2026		TLM2	
No. of classes required to complete UNIT-II: 13				**No. of classes taken:**		

UNIT-III: MILLING MACHINES, FINISHING PROCESSES

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	**MILLING MACHINES**: Principle of working –	1	14.08.2026		TLM2	
29	Specifications, Methods of Milling	1	18.08.2026		TLM2	
30	Classifications of milling machines	1	20.08.2026		TLM2	
31	Types of cutters, Operations	1	21.08.2026		TLM2	
32	Methods of indexing-	1	21.08.2026		TLM2	
33	**FINISHING PROCESSES:** Principle of working – Classification of grinding machines	1	01.09.2026		TLM2	

34	Types of abrasives, Bonds and selection	1	03.09.2026		TLM2	
35	Specification of a Grinding wheel	1	08.09.2026		TLM2	
36	Lapping & Honing	1	10.09.2026		TLM6	
37	Broaching Comparison to grinding.	1	11.09.2026		TLM2	
No. of classes required to complete UNIT-III: 10				**No. of classes taken:**		
I-Mid Exams : 24-08-2026 to 29-08-2026						

UNIT-IV: LIMITS, FITS AND LINEAR MEASUREMENT

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
38	Introduction to Metrology, Types of fits	1	11.09.2026		TLM2	
39	Unilateral and bilateral tolerance system	1	15.09.2026		TLM2	
40	hole and shaft basis systems	1	17.09.2026		TLM2	
41	interchangeability & selective assembly	1	18.09.2026		TLM2	
42	International standard system of tolerances	1	18.09.2026		TLM2	
43	Simple problems related to limits and fits	1	22.09.2026		TLM2	
44	Taylor's principle – design of go and no go gauges	1	24.09.2026		TLM2	
45	Plug, ring, snap, gap	1	25.09.2026		TLM2	
46	Taper, profile and position gauges.	1	25.09.2026		TLM2	
47	**LINEAR MEASUREMENT:** Length standards, end standards	1	29.09.2026		TLM2	
48	Slip gauges, Calibration of the slip Gauges	1	01.10.2026		TLM2	
49	Dial Indicators Micrometers.	1	06.10.2026		TLM6	
No. of classes required to complete UNIT-IV: 12				**No. of classes taken:**		

UNIT-V: ANGULAR MEASUREMENT, SURFACE ROUGHNESS MEASUREMENT, OPTICAL MEASURING INSTRUMENTS

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
50	**ANGULAR MEASUREMENT:** Bevel protractor, Angle slip gauges	1	08.10.2026		TLM2	
51	Angle dekkor, Spirit levels, sine bar- sine table	1	09.10.2026		TLM6	
52	**SURFACE ROUGHNESS MEASUREMENT:** Differences between surface roughness and surface waviness	1	09.10.2026		TLM2	

53	Numerical assessment of surface finish, Profilograph, Talysurf, ISI symbols.	1	27.10.2026		TLM2	
54	**OPTICAL MEASURING INSTRUMENTS:** Tools maker's microscope, Autocollimators	1	29.10.2026		TLM2	
55	Optical projector, Optical flats, Optical comparators.	1	30.10.2026		TLM2	
56	**Revision**	1	30.10.2026		TLM2	
No. of classes required to complete UNIT-V: 07				**No. of classes taken:**		
II-Mid Exams :				**02-11-2026 to 07-11-2026**		

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/Flipped Classes

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 (III), IV & V)	A2=5
II- Descriptive Examination (UNIT-III (III), IV & V)	M2=15
II-Quiz Examination (UNIT-III (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 engineeringpractice(technology)inthepracticeareasintheengineering 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	**Conductive 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 Teamwork:** Function, 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, mark effective representations 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	**Long Learning:** Recognize the need for, and have the preparation and ability for i) and life-long learning ii) 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	**Mr. Seelam Srinivasa Reddy**	**Mr. Subba Reddy**	**Dr. M.B.S.S Reddy**
Signature			

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DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor: Dr. V.DHANA RAJU
Course Name & Code : THERMAL ENGINEERING & 23ME11 Regulation: R23
L-T-P Structure : 3-1-0 **Credits:** 3
Program/Sem : B.Tech – V Sem **A.Y.:** 2026-27
PREREQUISITE: Thermodynamics

COURSE EDUCATIONAL OBJECTIVES (CEOs):

The objective of this course is to gain knowledge on construction, operation, combustion and performance of IC engines. To understand the fundamentals of steam and gas turbines cycles, essential components, their salient features, functioning and performance characteristics and its analysis.

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

CO1	**Discuss the fundamental concepts of IC engines and combustion phenomenon. (Understanding – L2)**
CO2	**Describe the functioning of a vapour power cycle, boilers and draught systems. (Understanding – L2)**
CO3	**Apply thermodynamic principles to find the performance parameters of steam nozzles and steam condensers. (Applying – L3)**
CO4	**Determine the power output from steam and gas turbines. (Applying – L3)**
CO5	**Demonstrate the working of different compressors and their comparisons (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	2	-	-	-	-	-	-	-	-	-	2	2	-	-
CO2	2	-	-	-	-	-	-	-	-	-	2	3	-	2
CO3	3	2	2	-	-	-	-	-	-	-	2	3	-	3
CO4	3	2	1	-	-	-	-	-	-	-	2	1	-	3
CO5	2	3	-	-	-	-	-	-	-	-	2	2	-	-

TEXT BOOKS:

T1 V. Ganesan, I.C. Engines, Mc Graw Hill, 4th Edition, 2017
T2 M.L.Mathur & F.S.Mehta, Thermodynamics and Heat Power Engineering
T3 Mahesh. M. Rathore, Thermal Engineering, TMH.

REFERENCE BOOKS:

R1 Er.R.K.Rajput, Thermal Engineering, Laxmi Publications, 11th Edition, 2020.
R2 T.D. Eastop and A. McConkey, Applied Thermodynamics, Pearson, 5th Edition, 2013.
R3 P.K. Nag, Power Plant Engineering, McGraw Hill Education,4th Edition, 2017
R4 H.N Gupta, Fundamentals of Internal Combustion Engines, PHI, 2nd Edition, 2013.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: INTERNAL COMBUSTION ENGINES & COMBUSTION

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	I.C. engine components and nomenclature, Classification of I.C. Engines, Ideal and Actual Working Cycles.	1	29-06-2026		TLM1	
2	The working principles of 2-stroke and 4-stroke SI and CI engines, Comparison of 2-Stroke and 4-Stroke Engines; CI and SI Engines,	1	30-06-2026		TLM1, TLM4	
3	Valve timing and Port timing diagrams,	1	02-07-2026		TLM4	
4	Engine Performance and testing parameters	1	03-07-2026		TLM1	
5	Numerical problems on engine performance parameters	1	06-07-2026		TLM1, TLM2	
6	Heat balance test.	1	07-07-2026		TLM2	
7	Tutorial -1	1	09-07-2026		TLM3	
8	Normal and abnormal combustion**,** Stages of combustion in SI engines,	1	10-07-2026		TLM1	
9	Stages of combustion in CI engines, Knocking,	1	13-07-2026		TLM2	
10	Factors affecting the Knocking, and Detonation	1	14-07-2026		TLM2	
11	Octane Number and Cetane Number, Firing order.	1	16-07-2026		TLM1	
12	Short answer questions, Assignment -1, Revision and concluding points	1	17-07-2026		TLM1	
	No. of classes taken: 12					

UNIT-II: VAPOUR POWER CYCLES, BOILERS &DRAUGHT SYSTEMS

S.No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
13	Introduction, Carnot Vapour Power Cycle, Rankine Cycle, Actual Vapour Power Cycle	1	20-07-2026		TLM1	
14	Methods to improve efficiency of Rankine cycle – Reheating and Regeneration	1	21-07-2026		TLM1	
15	Numerical Problems	1	23-07-2026		TLM1	
16	Fuels used in steam power plants. – Concluding points	1	24-07-2026		TLM1	
17	Tutorial -2	1	27-07-2026		TLM3	
18	Introduction, Boiler - Function and Classification, Fire Tube boilers– Cochran,	1	28-07-2026		TLM2	
19	Cornish, Lancashire,	1	30-07-2026		TLM2	
20	Water Tube boilers - Babcock and Wilcox, Comparison of fire and water tube boilers	1	31-07-2026		TLM1	

21	High pressure boilers - Benson boiler, Lamont Boiler, Loeffler boiler	1	03-08-2026		TLM1	
22	Mountings and Accessories	1	04-08-2026		TLM4	
23	Draught Systems – Natural and artificial draught	1	06-08-2026		TLM1	
24	Height of chimney – Condition for maximum efficiency	1	07-08-2026		TLM1	
25	Numerical Problems	1	10-08-2026		TLM1	
26	Short answer questions, Assignment -2, and concluding points	1	11-08-2026		TLM5	
27	Revision –II unit	1	13-08-2026		TLM1	
28	Previous question papers discussion , Tutorial -3	1	14-08-2026		TLM3	
	No. of classes taken: 16					

UNIT-III: STEAM NOZZLES & STEAM CONDENSORS

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	Introduction**,** Types of nozzle, Flow through nozzles- thermodynamic Analysis, velocity of nozzle at exit.	1	17-08-2026		TLM1	
30	Numerical problems	1	18-08-2026		TLM1	
31	Condition for maximum discharge, critical pressure ratio,	1	20-08-2026		TLM2	
32	Numerical problems - Tutorial -4	1	21-08-2026		TLM3	
33	Ideal and actual expansion in nozzle, velocity coefficient.	1	31-08-2026		TLM2	
34	Introduction, Elements of a condenser plant, Types of Condensers- Jet condensers – working principle,	1	01-09-2026		TLM1	
35	Surface Condensers-working principle,	1	03-09-2026		TLM1	
36	Comparison of jet and surface condensers, Condenser performance parameters	1	04-09-2026		TLM2	
37	Numerical Problems	1	07-09-2026		TLM1	
38	Numerical Problems	1	08-09-2026		TLM1	
39	Tutorial -5	1	10-09-2026		TLM3	
40	Short answer questions, Assignment -2, and concluding points	1	11-09-2026		TLM1	
	No. of classes taken:11					

UNIT-IV: STEAM TURBINES, GAS TURBINES AND JET PROPULSION SYSTEMS

S.No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
41	Introduction, Classification, Impulse turbine - working principle, Velocity diagrams	1	14-09-2026		TLM1	
42	Effect of friction – power developed, axial thrust, blade or diagram efficiency – Condition for maximum efficiency.	1	15-09-2026		TLM2	
43	De-Laval Turbine - its features. Methods to reduce rotor speed-velocity compounding (Curtis Turbine), Pressure compounding (Rateau	1	17-09-2026		TLM2	

	Turbine) and pressure and velocity compounding.					
44	Reaction Turbines- Parson‘s reaction turbine, Performance analysis, degree of reaction, condition for maximum efficiency.	1	18-09-2026		TLM2	
45	**Numerical Problems -** Tutorial - 6	1	21-09-2026		TLM3	
46	Introduction, Classification, working and application of Gas Turbines, Ideal and Actual Cycles;	1	22-09-2026		TLM1	
47	Methods to improve the gas turbine performance- Inter cooling, Reheating, Regeneration.	1	24-09-2026		TLM2	
48	**Numerical Problems -** Tutorial -7	1	25-09-2026		TLM3	
49	Jet Propulsion: Introduction, Classification, -Turbo jet, Turbo Propeller	1	28-09-2026		TLM1	
50	Rocket Engines	1	29-09-2026		TLM1	
	No. of classes taken: 10					

UNIT-V: RECIPROCATING AND ROTARY, AXIAL AND CENTRIFUGAL COMPRESSORS

S.No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
51	Introduction, Classification, Reciprocating compressors –Single, double	1	01-10-2026		TLM1	
52	Multistage compressors working principle,	1	02-10-2026		TLM4	
53	Power requirement of reciprocating compressors - Tutorial -8	1	05-10-2026		TLM3	
54	Volumetric efficiency, condition for maximum efficiency in multi stage compressor.	1	06-10-2026		TLM1	
55	Introduction, general classification,	1	08-10-2026		TLM1	
56	Rotary compressors – Working principle of Root’s,	1	09-10-2026		TLM2	
57	Vane’s and Lysholm compressor	1	12-10-2026		TLM1	
58	Axial and centrifugal compressors– surging and choking in compressors and their comparisons- applications	1	13-10-2026		TLM1	
59	Revision	1	15-10-2026		TLM2	
	No. of classes taken:09					

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	HOD Sign Weekly
60	Exergy (availability) analysis of Boiler And Condenser	1	16-10-2026		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

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 CALANDER:

Commencement of V Semester Class work		29-06-2026	
I Phase of Instructions	29-06-2026	22-08-2026	8 Weeks
I Mid Examinations	24-08-2026	29-08-2026	1 Week
II Phase of Instructions	31-08-2026	17-10-2026	7 Weeks
Dasara Holidays	19-10-2026	24-10-2026	1 Week
Continuation of Phase-II	26-10-2026	31-10-2026	1 Week
II Mid Examinations	02-11-2026	07-11-2026	1 Week
Preparation and Practicals	09-11-2026	14-11-2026	1 Week
Semester End Examinations	16-11-2026	28-11-2026	2 Weeks
Commencement of VI Semester Class work			**30-11-2026**

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			

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Dr. P. V. Chandra Sekhara Rao
Course Name & Code : Design of Machine Elements & 23ME12
L-T-P Structure : 3-0-0 Credits: 3
Program/Sem/Sec : B.Tech, ME-A., V-Sem. A.Y : 2026-27

Pre-requisites: Engineering Mechanics, Mechanics of Solids

Course Educational Objective: The main objective of this course is to familiarize the steps involved in the design process of various machine elements and apply the standard procedure available for the design of mechanical components.

COURSE OUTCOMES (COs): At the end of the course, students are able to

CO 1	Apply various theories of failure to the mechanical systems under static and dynamic loading. **(Applying – L3)**
CO 2	Estimate the strength of joints subjected to various types of loads. **(Applying – L3)**
CO 3	Design the shafts and couplings for transmitting the power**. (Applying – L3)**
CO 4	Design the gears and springs for various applications of engineering. **(Analysis – L4)**
CO5	Select suitable bearings under various loading conditions**. (Analysis – L4)**

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

Cos	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PSO 1	PSO 2	PSO 3
CO1	3	3	1	-	2	-	-	-	-	-	2	-	-	3
CO2	2	2	1	-	-	-	-	-	-	-	2	-	-	3
CO3	2	1	3	-	-	-	-	-	-	-	2	-	-	3
CO4	3	2	3	-	-	-	-	-	-	-	2	-	-	3
CO5	3	2	3	-	-	-	-	-	-	-	2	-	-	3

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

TEXT BOOKS:

T1 R.L. Norton, Machine Design an Integrated approach, 2nd Edition, Pearson Education, 2004.

T2 Bhandari V.B, Design of Machine Elements, 3rd Edition, TataMcGraw-Hill2010

T3 Dr. N. C. Pandya & Dr. C. S. Shah, Machine design, 17th Edition, Charotar Publishing House Pvt. Ltd, 2009.

REFERENCE BOOKS:

R1 R.K. Jain, Machine Design, Khanna Publications, 1978.

R2 J.E. Shigley, Mechanical Engineering Design, 2nd Edition, Tata McGraw Hill, 1986

R3 M.F.Spotts and T.E.Shoup, Design of Machine Elements, 3rd Edition, Prentice Hall (Pearson Education), 2013.

Part - B
COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I : INTRODUCTION TO DESIGN, DESIGN FOR STATIC AND DYNAMIC LOADS

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.	Machine Design- Introduction, Classification & Basic Procedure	1	29-06-2026		TLM1	
2.	Basic considerations of machine elements	1	01-07-2026		TLM1	
3.	Designation of materials Selection of materials	1	04-07-2026		TLM1	
4.	Modes of failure Factor of safety	1	06-07-2026		TLM1	
5.	Theories of elastic failure – Maximum principal stress theory	1	08-07-2026		TLM1, TLM3	
6.	Maximum Shear stress theory Distortion energy theory	1	13-07-2026		TLM1, TLM3	
7.	Stress concentration- Stress concentration factors	1	15-07-2026		TLM1	
8.	Problems on Stress concentration factor Methods of reducing stress concentration	1	18-07-2026		TLM1	
9.	Notch sensitivity, Fluctuating stresses	1	20-07-2026		TLM1	
10.	Fatigue failure, Endurance limit, S-N diagram	1	22-07-2026		TLM1	
11.	Soderberg and Goodman theories	1	25-07-2026		TLM1, TLM3	
12.	Design for infinite life	1	27-07-2026		TLM1	
No. of classes required to complete UNIT-I : 12					No. of classes taken:	

UNIT-II : DESIGN OF BOLTED AND WELDED JOINTS

S.No.	Topics to be covered	No. Of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
13.	Threaded fasteners	1	29-07-2026		TLM1, TLM2	
14.	preload of bolts	1	01-08-2026		TLM1	
15.	various stresses induced in the bolts Torque requirement for bolt tightening	1	03-08-2026		TLM1	
16.	Gasketed joints	1	05-08-2026		TLM1, TLM3	
17.	Introduction to welding joints Butt joints-Fillet joints	1	10-08-2026		TLM1	
18.	Strength of butt welds- Strength of parallel fillet welds	1	12-08-2026		TLM1, TLM3	
19.	Strength of transverse fillet welds Maximum		17-08-2026		TLM1, TLM3	

	shear stress in parallel fillet & transverse Fillet welds	1				
20.	Axially loaded unsymmetrical Welded joints	1	19-08-2026		TLM1, TLM3	
21.	Welded joint subjected to bending moment	1	22-08-2026		TLM1, TLM3	
No. of classes required to complete UNIT-II : 9					No. of classes taken:	

UNIT-III: POWER TRANSMISSION SHAFTS, KEYS AND COUPLINGS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
22.	Introduction to transmission shafts Shaft design on strength basis	1	31-08-2026		TLM1	
23.	Shafts subjected to combined twisting moment and bending moment	1	02-09-2026		TLM1	
24.	Design of shafts carrying gears & pulleys with flat belts	1	05-09-2026		TLM1	
25.	Problems on shafts Shaft design on torsional rigidity basis	1	07-09-2026		TLM1	
26.	Types of keys Key failures by shear and compression Design of saddle and sunk keys	1	09-09-2026		TLM1	
27.	Types of couplings Design of flange couplings	1	16-09-2026		TLM1	
28.	Design of bushed pin couplings	1	19-09-2026		TLM1	
No. of classes required to complete UNIT-III : 7					No. of classes taken:	

UNIT-IV : DESIGN OF GEARS AND SPRINGS

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.	Introduction to spur gears	1	21-09-2026		TLM1, TLM2	
30.	Lewis Equation	1	23-09-2026		TLM1	
31.	Beam strength of gear tooth	1	26-09-2026		TLM1	
32.	Design of spur gears for dynamic & wear loads	1	28-09-2026		TLM1	
33.	Types of springs	1	30-09-2026		TLM1	
34.	Design of helical compression & tension springs	1	03-10-2026		TLM1	
35.	Problems on design of helical springs	1	05-10-2026		TLM1	
No. of classes required to complete UNIT-IV : 7					No. of classes taken:	

UNIT-V: DESIGN OF BEARINGS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
36.	Types of Journal bearings	1	07-10-2026		TLM1, TLM2	
37.	Bearing materials Bearing failures Theory of lubrication	1	12-10-2026		TLM1, TLM2	
38.	Selection of bearing modulus from design tables, Mc Kee's equation	1	14-10-2026		TLM1	
39.	Heat generation and heat dissipation of Bearings Journal bearing design	1	17-10-2026		TLM1	
40.	Static load carrying capacity, Dynamic load carrying capacity	1	26-10-2026		TLM1, TLM4	
41.	Selection of bearings from manufacturer's catalogue	1	28-10-2026		TLM1	
42.	Load factors, Equivalent bearing load, Selection of bearing life Design for cyclic loads and speeds	1	31-10-2026		TLM1	
No. of classes required to complete UNIT-V : 7					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
43.	Design of Cotter & Knuckle joints	1	30-10-2026		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

Innovative Teaching Methods:

S.No	Method	Title	Propossed date	Actual Date
1	Flipped Class Room	Failure Analysis Through Flipped Learning (Theories of Failure-Unit-I)	17-07-2026	
2	Design Challenge	Real-Time Shaft Design Engineering Challenge (Design of Shafts-Unit-III)	11-09-2026	
3	CAD Design Challenge	Digital Product Design & CAD Modelling Challenge (Machine Components)	25-09-2026	
4	Demonstration-Based Learning	Demonstration on Bearings (Design of Bearings-Unit-V)	26-10-2026	
5	AI-Assisted Learning Activity	AI-Driven Design Optimization and Engineering Innovation Activity (Beyond Syllabus)	14-08-2026	

PART-C

EVALUATION PROCESS (R20 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

ACADEMIC CALENDAR:

Description	From	To	Weeks
I Phase of Instructions-1	29/06/2026	22/08/2026	8
I Mid Examinations	24/08/2026	29/08/2026	1
II Phase of Instructions	31/08/2026	17/10/2026	7
Dassehra Holidays	19/10/2026	24/10/2026	1
II Phase of Instructions Contd...	26/10/2026	31/10/2026	1
II Mid Examinations	01/11/2026	07/11/2026	1
Preparation and Practicals	09/11/2026	14/11/2026	1
Semester End Examinations	16/11/2026	28/11/2026	2

PART-D

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
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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):

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.

Dr.P. V. Chandra Sekhara Rao	Mr.K.V.Viswanadh	Dr.B.Sudheer Kumar	Dr. M.B.S.Sreekara Reddy
Course Instructor	**Course Coordinator**	**Module Coordinator**	**HOD**

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
(AUTONOMOUS)
Accredited by NAAC & NBA (CSE, IT, ECE, EEE & ME)
Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada
L.B.Reddy Nagar, Mylavaram-521230, Krishna Dist, Andhra Pradesh, India

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART - A

PROGRAM : **B.Tech. - V-Sem. - Mechanical Engineering – A Section**
ACADEMIC YEAR : 2026-27
COURSE NAME & CODE : **INDUSTRIAL ROBOTICS – 23ME16**
L-T-P STRUCTURE : 3-0-0
COURSE CREDITS : 3
COURSE INSTRUCTOR : **J. Subba Reddy, Associate Professor & K. Venkateswara Reddy, Asst Prof**
COURSE COORDINATOR : **J.Subba Reddy, Associate Professor (T668)**
PER-REQUISITE : Engineering Mechanics & Kinematics of Machines

COURSE EDUCATIONAL OBJECTIVES:

This course aims to provide students with a comprehensive understanding of industrial robotic systems, including robot anatomy, configurations, actuators, sensors, end effectors, and their applications in modern manufacturing. It develops the ability to analyze manipulator kinematics, trajectory planning, robot programming, and control strategies for industrial automation. The course also introduces image processing and machine vision techniques to enable intelligent robotic inspection, guidance, and automation in Industry 4.0 environments.

COURSE OUTCOMES:

At the end of the course, the student will be able to:

CO1: Identify the anatomy, configurations, components, drive systems, end effectors, and industrial applications of robotic systems. **(Understand – L2)**

CO2: Describe the characteristics, working principles, and selection of actuators, sensors, and feedback devices used in industrial robotic systems. **(Understand – L2)**

CO3: Analyze robotic manipulators using homogeneous transformations, Denavit–Hartenberg (D-H) notation, and forward and inverse kinematic models. **(Analyze – L4)**

CO4: Apply trajectory planning, path planning, obstacle avoidance, and robot programming techniques for industrial robotic applications. **(Apply – L3)**

CO5: Apply the role of image processing and machine vision in robotic inspection, guidance, and intelligent manufacturing systems. **(Apply – L3)**

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

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	3					1						1		2	3
CO2	3	3	2									1		2	3
CO3	3	3	2									2		2	3
CO4	3	2	1		2		2					2		2	1
CO5	1	2	2		2	2	3					1	2	2	2

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 TEXTBOOKS:

T1 Saeed B. Niku, Introduction to Robotics- analysis, systems & application, Second Edition, Willy India Private Limited, New Delhi,2011.

T2 R.K. Mittal and IJ Nagrath, Robotics and Control, Tata McGraw–Hill Publishing Company Limited, New Delhi,2003.

BOS APPROVED REFERENCE BOOKS:

R1 Mikell P.Groover, Mitchell Weiss, Roger N. Nagel & Nicholas G. Odrey, Ashish Dutta, Industrial Robotics, Second Edition McGraw-Hill Education (India) Private Limited, 2012

R2 Robert J. Schilling, Fundamentals of robotics analysis & control, PHI learning private limited, New Delhi,4thEdition 2002

R3 John. J Criag, Introduction to Robotics-Mechanics and Control, Third Edition, Pearson Education, Inc.,2008

COURSE DELIVERY PLAN (LESSON PLAN): INDUSTRIAL ROBOTICS (23ME16)

PART - B

UNIT-I: INTRODUCTION AND ROBOT ANATOMY

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 Robotics: CEOs, Course Outcomes, POs and PSOs, Automation and Robotics	1	29-06-2026 (Mon)		TLM2	CO1	T1, R1	
2	CAD/CAM and Robotics – Overview of Industrial Robotics, Robotics Applications and Industrial Trends	1	30-06-2026 (Tue)		TLM2	CO1	T1, R1	
3	**Innovative Practice**	1	03-07-2026 (Fri)		TLM3	CO1	T1, R1	
4	Present and Future Applications of Industrial Robots	1	04-07-2026 (Sat)		TLM2	CO1	T1, R1	
5	Classification based on Coordinate System and Control System	1	06-07-2026 (Mon)		TLM2	CO1	T1, R1	
6	Robot Anatomy, Configurations and Work Volume and Components	1	07-07-2026 (Tue)		TLM2	CO1	T1, R1	
7	**Innovative Practice**	1	10-07-2026 (Fri)		TLM3	CO1	T1, R1	
8	Degrees of Freedom (DOF) and Robot Drive Systems	1	11-07-2026 (Sat)		TLM2	CO1	T1, R1	
9	Functional Line Diagram Representation and Common Types of Robot Arms	1	13-07-2026 (Mon)		TLM2	CO1	T1, R1	
10	Requirements and Challenges of End Effectors, Selection of End Effectors – Industrial Case Studies	1	14-07-2026 (Tue)		TLM2	CO1	T1, R1	
11	**Innovative Practice**	1	17-07-2026 (Fri)		TLM6	CO1	T1, R1	
12	Determination and Selection of End Effectors	1	18-07-2026 (Sat)		TLM2	CO1	T1, R1	
13	Unit-I Revision and Assignment / Quiz–1	1	20-07-2026 (Mon)		TLM6	CO1	T1, R1	
No. of classes required to complete UNIT-I:		**13**			**No. of classes taken:**			

UNIT-II: ROBOT ACTUATORS AND FEEDBACK COMPONENTS

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	Introduction to Robot Actuation Systems	1	21-07-2026 (Tue)		TLM2	CO2	T1, R1	
15	Pneumatic Actuators – Construction, Working, Pneumatic Actuation System – Numerical Problems & Applications	1	24-07-2026 (Fri)		TLM2	CO2	T1, R1	
16	**Innovative Practice**	1	25-07-2026 (Sat)		TLM3	CO2	T1, R1	
17	Hydraulic Actuators – Construction, Working and Applications	1	27-07-2026 (Mon)		TLM2	CO2	T1, R1	
18	Electric Actuators – DC, AC Servo and Stepper Motors	1	28-07-2026 (Tue)		TLM2	CO2	T1, R1	
19	Comparison of Pneumatic, Hydraulic and Electric Actuation Systems, Selection of Actuators for Industrial Robotic Applications	1	31-07-2026 (Fri)		TLM2	CO2	T1, R1	
20	**Innovative Practice**	1	01-08-2026 (Sat)		TLM3	CO2	T1, R1	
21	Introduction to Feedback Components and Position Sensors	1	03-08-2026 (Mon)		TLM2	CO2	T1, R1	
22	Potentiometers, Resolvers and Encoders	1	04-08-2026 (Tue)		TLM2	CO2	T1, R1	
23	Velocity Sensors and their Industrial Applications, Selection of Sensors for Robotic Systems – Case Studies	1	07-08-2026 (Fri)		TLM2	CO2	T1, R1	
24	**Innovative Practice**	1	08-08-2026 (Sat)		TLM6	CO2	T1, R1	
25	Integration of Actuators and Sensors in Industrial Robots	1	10-08-2026 (Mon)		TLM2	CO2	T1, R1	
26	Unit-II Revision and Assignment / Quiz–2	1	11-08-2026 (Tue)		TLM6	CO2	T1, R1	
No. of classes required to complete UNIT-II:		**13**			**No. of classes taken:**			

UNIT-III: MANIPULATOR KINEMATICS

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
27	Introduction to Manipulator Kinematics and Motion Analysis	1	14-08-2026 (Fri)		TLM2	CO3	T1, R2	
28	Homogeneous Transformations – Rotation and Translation	1	15-08-2026 (Sat)		TLM2	CO3	T1, R2	
29	Problems on Homogeneous Transformations	1	17-08-2026 (Mon)		TLM3	CO3	T1, R2	
30	Matrix Representation and Transformation Matrices, Problems on Homogeneous Transformations	1	18-08-2026 (Tue)		TLM2	CO3	T1, R2	
31	**Innovative Practice**	1	21-08-2026 (Fri)		TLM3	CO3	T1, R2	
32	Denavit–Hartenberg (D-H) Notation	1	22-08-2026 (Sat)		TLM2	CO3	T1, R2	
I MID EXAMINATIONS (24-08-2026 to 29-08-2026)								
33	Joint Coordinates and World Coordinates	1	31-08-2026 (Mon)		TLM2	CO3	T1, R2	
34	Forward Kinematics, Problems on Forward Kinematics	1	01-09-2026 (Tue)		TLM2	CO3	T1, R2	
35	**Innovative Practice**	1	04-09-2026 (Fri)		TLM3	CO3	T1, R2	
36	Forward Kinematics – Numerical Problems	1	05-09-2026 (Sat)		TLM3	CO3	T1, R2	
37	Inverse Kinematics	1	07-09-2026 (Mon)		TLM2	CO3	T1, R2	
38	Inverse Kinematics – Numerical Problems	1	08-09-2026 (Tue)		TLM3	CO3	T1, R2	
39	**Innovative Practice**	1	11-09-2026 (Fri)		TLM6	CO3	T1, R2	
40	D-H Representation, Forward & Inverse Kinematics – Case Studies, Unit-III Revision and Assignment / Quiz–3	1	12-09-2026 (Sat)		TLM6	CO3	T1, R2	
41	Comprehensive Problem Solving on Manipulator Kinematics	1	14-09-2026 (Mon)		TLM3	CO3	T1, R2	
No. of classes required to complete UNIT-III:		**15**			**No. of classes taken:**			

UNIT-IV: GENERAL CONSIDERATIONS IN PATH DESCRIPTION AND GENERATION

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
42	Introduction to Trajectory Planning	1	15-09-2026 (Tue)		TLM2	CO4	T1, R2	
43	Trajectory Planning and Obstacle Avoidance, Problems on Trajectory Planning	1	18-09-2026 (Fri)		TLM2	CO4	T1, R2	
44	**Innovative Practice**	1	19-09-2026 (Sat)		TLM3	CO4	T1, R2	
45	Path Planning Techniques	1	21-09-2026 (Mon)		TLM2	CO4	T1, R2	
46	Skew Motion and Joint Integrated Motion	1	22-09-2026 (Tue)		TLM2	CO4	T1, R2	
47	Straight Line Motion, Problems on Path Planning and Motion Control	1	25-09-2026 (Fri)		TLM2	CO4	T1, R2	
48	**Innovative Practice**	1	26-09-2026 (Sat)		TLM3	CO4	T1, R2	
49	Introduction to Robot Programming	1	28-09-2026 (Mon)		TLM2	CO4	T1, R2	
50	Robot Programming Languages	1	29-09-2026 (Tue)		TLM2	CO4	T1, R2	
51	Robot Software Packages, Robot Programming Exercises using Industrial Examples	1	02-10-2026 (Fri)		TLM5	CO4	T1, R2	
52	**Innovative Practice**	1	03-10-2026 (Sat)		TLM3	CO4	T1, R2	
53	Path Description using Robot Programming Language	1	05-10-2026 (Mon)		TLM2	CO4	T1, R2	
54	Industrial Case Studies on Robot Programming and Path Planning	1	06-10-2026 (Tue)		TLM6	CO4	T1, R2	
55	Unit-IV Revision and Assignment / Quiz–4	1	09-10-2026 (Fri)		TLM6	CO4	T1, R2	
No. of classes required to complete UNIT-IV:		**14**			**No. of classes taken:**			

UNIT-V: IMAGE PROCESSING AND MACHINE VISION

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
56	Introduction to Machine Vision and Image Processing	1	26-10-2026 (Mon)		TLM2	CO5	T1, R3	
57	Sensing Function in Machine Vision, Industrial Applications of Machine Vision	1	27-10-2026 (Tue)		TLM2	CO5	T1, R3	
58	**Innovative Practice**	1	30-10-2026 (Fri)		TLM3	CO5	T1, R3	
59	Digitizing Function in Machine Vision	1	31-10-2026 (Sat)		TLM2	CO5	T1, R3	
60	Training and Vision Systems	1	26-10-2026*		TLM2	CO5	T1, R3	
61	Robotic Applications of Machine Vision	1	27-10-2026*		TLM2	CO5	T1, R3	
62	Industrial Case Studies on Machine Vision Systems, Machine Vision in Quality Inspection and Intelligent Manufacturing	1	30-10-2026*		TLM6	CO5	T1, R3	
63	**Innovative Practice**	1	31-10-2026*		TLM3	CO5	T1, R3	
64	Unit-V Revision, Assignment / Quiz–5 and Course Review	1	31-10-2026*		TLM6	CO5	T1, R3	
No. of classes required to complete UNIT-V:		**09**			**No. of classes taken:**			
II MID EXAMINATIONS (02-11-2026 to 07-11-2026)								

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/Assignment/Quiz

Innovative Practices:

UNIT-I (c)

S.No	Topic / Innovative Practice	Date	TLM	CO
3	Activity Based Learning (ABL): Identification of Industrial Robot Configurations using Physical Models/Charts	03-07-2026 (Fri)	TLM3	CO1
7	Lab-to-Class Demonstration: Robot Anatomy, Robot Components and Degrees of Freedom using Educational Robot Kit/Physical Models	10-07-2026 (Fri)	TLM4	CO1
11	Flipped Classroom: Industrial Applications of ABB, FANUC, KUKA, Yaskawa and Universal Robots	17-07-2026 (Fri)	TLM6	CO1

UNIT-II (Innovative Practices)

S.No	Topic / Innovative Practice	Date	TLM	CO
16	Demonstration using Physical Models: Pneumatic, Hydraulic and Electric Actuators	31-07-2026 (Fri)	TLM4	CO2
20	Activity Based Learning: Selection of Suitable Actuators and Sensors for Industrial Robots	07-08-2026 (Fri)	TLM3	CO2
24	Industrial Video & Case Study: Servo Motors, Encoders and Industrial Robot Drive Systems	14-08-2026 (Fri)	TLM5	CO2

UNIT-III (Innovative Practices)

S.No	Topic / Innovative Practice	Date	TLM	CO
31	Activity Based Learning: D-H Parameter Assignment for Simple Robot Manipulators	21-08-2026 (Fri)	TLM3	CO3
35	Lab-to-Class Activity: Simulation of Forward and Inverse Kinematics using RoboDK/CoppeliaSim/MATLAB	04-09-2026 (Fri)	TLM4	CO3
39	Problem-Based Learning: Kinematic Analysis of a 2R Robotic Manipulator (Group Activity)	11-09-2026 (Fri)	TLM6	CO3

UNIT-IV (Innovative Practices)

S.No	Topic / Innovative Practice	Date	TLM	CO
44	Flipped Classroom: Robot Programming Languages and Industrial Programming Examples	25-09-2026 (Fri)	TLM6	CO4
48	Simulation Activity: Trajectory Planning and Path Planning using RoboDK/CoppeliaSim	02-10-2026 (Fri)	TLM5	CO4
52	Mini Capstone Activity: Design of a Robotic Work Cell for Pick-and-Place/Palletizing Applications	09-10-2026 (Fri)	TLM6	CO4

(After Dasara Holidays: 19-10-2026 to 24-10-2026)

UNIT-V (Innovative Practices)

S.No	Topic / Innovative Practice	Date	TLM	CO
58	Industrial Video Demonstration: Machine Vision Systems in Smart Manufacturing and Quality Inspection	30-10-2026 (Fri)	TLM5	CO5
63	Case Study & Group Discussion: Vision-Guided Robots in Industry 4.0, Intelligent Manufacturing and Quality Control	31-10-2026*	TLM6	CO5

ACADEMIC CALANDER:

Commencement of V Semester Class work		**29-06-2026**	
I Phase of Instructions	29-06-2026	22-08-2026	8 Weeks
I Mid Examinations	24-08-2026	29-08-2026	1 Week
II Phase of Instructions	31-08-2026	17-10-2026	7 Weeks
Dasara Holidays	19-10-2026	24-10-2026	1 Week
Continuation of Phase-II	26-10-2026	31-10-2026	1 Week
II Mid Examinations	02-11-2026	07-11-2026	1 Week
Preparation and Practicals	09-11-2026	14-11-2026	1 Week
Semester End Examinations	16-11-2026	28-11-2026	2 Weeks
Commencement of VI Semester Class work			**30-11-2026**

PART – C

Evaluation Process:

Evaluation Task	**COs**	**Marks**
Assignment-I (Units-I, II)	**1, 2**	**A1=5**
I-Descriptive Examination (Units-I, II)	**1, 2**	**M1=15**
I-Quiz Examination (Units-I, II)	**1, 2**	**Q1=10**
Assignment-II (Unit-III, IV & V)	**3, 4, 5**	**A2=5**
II- Descriptive Examination (UNIT-III, IV & V)	**3, 4, 5**	**M2=15**
II-Quiz Examination (UNIT-III , IV & V)	**3, 4, 5**	**Q2=10**
Mid Marks =80% of Max ((M1+Q1+A1), (M2+Q2+A2)) + 20% of Min ((M1+Q1+A1), (M2+Q2+A2))	**1, 2, 3, 4, 5**	**M=30**
Cumulative Internal Examination (CIE): M	**1, 2, 3, 4, 5**	**30**
Semester End Examinations	**1, 2, 3, 4, 5**	**D=70**
Total Marks = CIE + SEE	**1, 2, 3, 4, 5**	**100**

Class Time Table - B.Tech – V Sem: MECH A - Section (R23)

↓Day / Date→	**09.00 – 10.00**	**10.00 – 11.00**	**11.00 – 12.00**	**12.00 – 13.00**	**13.00 – 14.00**	**14.00 – 15.00**	**15.00 – 16.00**
Monday			**IR**	**LUNCH BREAK**			
Tuesday	**IR**						
Wednesday							
Thursday							
Friday			**IR (T)**				
Saturday							**IR**

PART – D

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

PEO1: To build a professional career and pursue higher studies with sound knowledge in Mathematics, Science and Mechanical Engineering.

PEO2: To inculcate strong ethical values and leadership qualities for graduates to become successful in multidisciplinary activities.

PEO3: To develop inquisitiveness towards good communication and lifelong learning.

PROGRAMME OUTCOMES (POs):

Engineering Graduates will be able to:

1. Engineering knowledge: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.

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.
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.
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.
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.
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.
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.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
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.
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.
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):

PSO1: To apply the principles of thermal sciences to design and develop various thermal systems.
PSO2: 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.
PSO3: 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.

Signature				
Faculty Name	**J. Subba Reddy**	**J.Subba Reddy**	**J.Subba Reddy**	**Dr. M.B.S. Sreekara Reddy**
Designation	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**HOD**

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

PART-A

Name of Course Instructor: Mr P. Rathnakar Kumar
Course Name & Code : Electric Vehicles-23EE84
L-T-P Structure : 3-0-0 **Credits:** 3
Program/Sem/Sec : B.Tech., V-Sem., MECH **A.Y:** 2026-27

PREREQUISITE: Basic Electrical Engineering

COURSE EDUCATIONAL OBJECTIVES (CEOs):

This course enables the student to acquire Knowledge on basic concepts related to mechanics, kinetics and dynamics of electric vehicles, technical characteristics and properties of batteries. It also introduces the concepts of different configurations of drive trains.

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

CO1	Illustrate propulsion system for an electric vehicle. (**Understand-L2**)
CO2	Understand characteristics and properties of batteries. (**Understand-L2**)
CO3	Analyze ratings and requirements of electrical machines. (**Understand-L2**)
CO4	Analyze mechanism of electrical vehicle drive train. (**Understand-L2**)
CO5	Understand configuration of hybrid electric vehicles**. (Understand-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	2	2										1			
CO2	2	2													
CO3	2	2													
CO4	2	2										1			
CO5	2	2										1			
1 - Low			**2 –**Medium								**3 -** High				

TEXTBOOKS:

Text book(s) and/or required materials

i. IqbalHussain, "Electric & Hybrid Vehicles – Design Fundamentals", Second Edition, CRC Press, 2011.
ii. James Larminie, "Electric Vehicle Technology Explained", John Wiley & Sons, 2003.

Reference Books:

i. MehrdadEhsani, YiminGao, Ali Emadi, "Modern Electric, Hybrid Electric, and Fuel Cell Vehicles: Fundamentals", CRC Press, 2010.
ii. SandeepDhameja, "Electric Vehicle Battery Systems", Newnes, 2000
http://nptel.ac.in/courses/108103009/

PART-B

COURSE DELIVERY PLAN (LESSON PLAN): Section - A

UNIT-I: ELECTRIC VEHICLES

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 the subject and Course Outcomes	1	01-07-2026		TLM1	
2.	Components	1	03-07-2026		TLM1	
3.	Vehicle Mechanics	1	04-07-2026		TLM1	
4.	Roadway Fundamentals	1	08-07-2026		TLM1	
5.	Roadway Fundamentals	1	10-07-2026		TLM1	
6.	Vehicle Kinetics	1	11-07-2026		TLM1	
7.	Dynamics of vehicle motion	1	15-07-2026		TLM1	
8.	Dynamics of vehicle motion	1	17-07-2026		TLM1	
9.	Propulsion system design.	1	18-07-2026		TLM1	
10.	Propulsion system design.	1	22-07-2026		TLM1	
No. of classes required to complete UNIT-I		10				

UNIT-II : BATTERY

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.	Basics-Types	1	24-07-2026		TLM1	
12.	Parameters	1	25-07-2026		TLM1	
13.	Capacity	1	29-07-2026		TLM1	
14.	Discharge Rate	1	31-07-2026		TLM1	
15.	Sate of charge	1	01-08-2026		TLM1	
16.	State of Discharge	1	05-08-2026		TLM1	
17.	Depth od Discharge				TLM1	
18.	Technical Characteristics	1	07-08-2026		TLM1	
19.	Battery pack Design	1	08-08-2026		TLM2	
20.	Battery pack Design	1	12-08-2026		TLM2	
21.	Properties of Batteries	1	14-08-2026		TLM2	
No. of classes required to complete UNIT-II		10				

UNIT-III : DC & AC ELECTRICAL MACHINES

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
22.	Motor & Engine rating, requirements	1	19-08-2026		TLM1	

23.	Motor & Engine rating, requirements	1	21-08-2026		TLM1	
24.	DC machines	1	22-08-2026		TLM1	
25.	DC machines	1	02-09-2026		TLM1	
26.	Three phase A.C. Machines	1	05-09-2026		TLM1	
27.	Three phase A.C. Machines	1	09-09-2026		TLM1	
28.	Induction Machines	1	11-09-2026		TLM1	
29.	Permanent magnet machines	1	12-09-2026		TLM1	
30.	Permanent magnet machines	1	16-09-2026		TLM1	
31.	Switched reluctance machines	1	18-09-2026		TLM1	
No. of classes required to complete UNIT-III		10				

UNIT-IV : ELECTRIC VEHICLE DRIVE TRAIN

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.	Transmission Configuration	1	19-09-2026		TLM1	
33.	Components	1	23-09-2026		TLM1	
34.	gears	1	25-09-2026		TLM1	
35.	differential	1	26-09-2026		TLM1	
36.	clutch	1	30-09-2026		TLM1	
37.	brakes	1	03-10-2026		TLM2	
38.	Regenerative braking	1	07-10-2026		TLM1	
39.	Motor sizing	1	09-10-2026		TLM1	
No. of classes required to complete UNIT-IV		08				

UNIT-V: HYBRID ELECTRIC VEHICLES

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
40.	Types	1	10-10-2026		TLM1	
41.	Series	1	14-10-2026		TLM1	
42.	Parallel and series	1	16-10-2026		TLM1	
43.	Parallel configuration	1	17-10-2026		TLM1	
44.	Design				TLM1	
45.	Drive train	1	28-10-2026		TLM2	
46.	Sizing of components	1	30-10-2026		TLM2	
47.	Revision unit-V	1	31-10-2026		TLM2	
No. of classes required to complete UNIT-V		08				

CONTENT BEYOND SYLLABUS:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods
1		1	30-10-2026		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

PART-C

EVALUATION PROCESS (R17 Regulation):

Evaluation Task	Marks
Assignment-I (Units-I, II & UNIT-III (Half of the Syllabus))	A1=5
I-Descriptive Examination (Units-I, II & UNIT-III (Half of the Syllabus))	M1=15
I-Quiz Examination (Units-I, II & UNIT-III (Half of the Syllabus))	Q1=10
Assignment-II (Unit-III (Remaining Half of the Syllabus), IV & V)	A2=5
II- Descriptive Examination (UNIT-III (Remaining Half of the Syllabus), IV & V)	M2=15
II-Quiz Examination (UNIT-III (Remaining Half of the Syllabus), 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 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	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 ring 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	Specify, design and analyze systems that efficiently generate, transmit and distribute electrical power
PSO 2	Design and analyze electrical machines, modern drive and lighting systems
PSO 3	Specify, design, implement and test analog and embedded signal processing electronic systems
PSO4	Design controllers for electrical and electronic systems to improve their performance.

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**Mr P.Rathnakar Kumar**	**Mr P.Rathnakar Kumar**	**Dr.G.Nageswara Rao**	**Dr P.Sobha Rani**
Signature				

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Phone: 08659-222933, Fax: 08659-222931

DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code : **23ME58** **Thermal Engineering Lab**
Lab/Practical's : **3 hrs/ Week** **Continuous Internal Assessment** : **30**
A.Y. : **2026-27** **Semester End Examination** : **70**
Class & Semester : **B. Tech – V Sem**
Instructors : **Dr. V.DHANA RAJU /Mr. D.MALLIKARJUNA RAO**

PRE-REQUISITES: Thermodynamics, Thermal Engineering

COURSE EDUCATIONAL OBJECTIVE:

The students gain practical exposure on working principles of IC engines, carrying out experimental test procedures for finding out the performance characteristics through load test, Morse test and heat balance tests. Also, to gain knowledge on principles of working, operation of Refrigeration test rig, Air Condition test rig, Air compressor apparatus and their performance characteristics analysis.

COURSE OUTCOMES: At the end of the course students will be able to

CO1: Find the performance characteristics of an internal combustion engines. **(Applying – L3)**

CO2: Estimate the energy distribution and frictional power of diesel engine using heat balance and Morse test. **(Applying - L3)**

CO3: Compute the performance parameters of refrigeration systems. **(Applying – L3)**

CO4: Determine the reciprocating air compressor performance characteristics. **(Analyzing – L4)**

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	2	3	-	-	-	2	2	2	-	3	-	-
CO2	3	2	3	3	-	-	-	2	2	2	-	3	-	3
CO3	3	2	2	3	-	-	-	2	2	2	-	3	-	-
CO4	2	3	2	2	-	-	-	2	2	2	-	2	-	-

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DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code	**: 23ME58**	**Thermal Engineering Lab**	
Lab/Practical's	**: 3 hrs/ Week**	**Continuous Internal Assessment**	**: 30**
A.Y.	**: 2026-27**	**Semester End Examination**	**: 70**
Class & Semester	**: B. Tech – V Sem**		
Instructors	**: Dr. V.DHANA RAJU /Mr. D.MALLIKARJUNA RAO**		

At least 10 experiments are to be conducted:

LIST OF EXPERIMENTS:

1. Study of Valve & Port Timing Diagrams of diesel engine and petrol engine.
2. Test on single cylinder 4 -Stroke Diesel Engine by using Mechanical Dynamometer
3. Evaluation of performance parameters of twin cylinder 4-stroke diesel engine.
4. Determination of performance characteristics of 2-Stroke Petrol Engine.
5. Evaluation of engine friction power by conducting Morse test on Multi cylinder diesel engine.
6. Heat Balance of 4 stroke single cylinder diesel engine
7. Performance Test on Reciprocating Air – Compressor.
8. Determination of COP of Vapour Compression Refrigeration Unit.
9. Performance Test on Air Conditioning Unit.
10. Demonstration of automobile working components.
11. Measurement of exhaust emissions and smoke of diesel engine.
12. Analysis of combustion characteristics of the diesel engine.
13. Experimentation on the installation of Solar PV Cells.
14. To conduct a performance test on a VCR engine, under different compression ratios.

References:

Thermal engineering lab manuals

TE Lab Incharge

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

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Phone: 08659-222933, Fax: 08659-222931

DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code	**: 23ME58**	**Thermal Engineering Lab**	
Lab/Practical's	**: 3 hrs/ Week**	**Continuous Internal Assessment**	**: 30**
A.Y.	**: 2026-27**	**Semester End Examination**	**: 70**
Class & Semester	**: B. Tech – V Sem**		
Instructors	**: Dr. V.DHANA RAJU /Mr. D.MALLIKARJUNA RAO**		

TE Lab list of experiments

CYCLE-I

1. Valve timing diagram of a single cylinder4-stroke compression ignition engine
2. Port timing diagram of single cylinder 2-stroke spark ignition engine.
3. Performance test on single cylinder 4-stroke diesel engine
4. Performance test on twin cylinder 4-stroke diesel engine
5. Performance test on single cylinder 2-stroke petrol engine

CYCLE-II

6. Heat balance test on twin cylinder four stroke compression ignition engine
7. Performance test on reciprocating air compressor
8. Morse test on twin cylinder four stroke compression ignition engine
9. Performance test on Vapour compression refrigeration system
10. Performance test on Air Conditioning system

TE Lab In-Charge

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, making 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 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.**

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DEPARTMENT OF MECHANICAL ENGINEERING

Thermal Engineering Lab

Batches

Total No. of students : 23761A0301-364, & 24765A0301-307 = 69

Thursday : Batch B1 :24761A0301 to 337 = 35
Monday : Batch B2 :24761A0338 to 25765A0307 = 34

Sub Batches of B1:

S. No	Batch	Registered Nos	Total
1	$B1_1$	24761A0301-307	07
2	$B1_2$	24761A0308-314	07
3	$B1_3$	24761A0315-323	07
4	$B1_4$	24761A0324-330	07
5	$B1_5$	24761A0331-337	07
Total			35

Sub Batches of B2:

S. No	Batch	Registered Nos	Total
1	$B2_1$	24761A0338-344	07
2	$B2_2$	24761A0346-352	07
3	$B2_3$	24761A0353-359	07
4	$B2_4$	24761A0360-25765A0301	07
5	$B2_5$	25765A0302-25765A0307	06
Total			34

TE Lab Incharge

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DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code : 23ME58 — **Thermal Engineering Lab**
Lab/Practical's : 3 hrs/ Week — **Continuous Internal Assessment** : 30
A.Y. : 2026-27 — **Semester End Examination** : 70
Class & Semester : B. Tech – V Sem
Instructors : Dr. V.DHANA RAJU /Mr. D.MALLIKARJUNA RAO

S. No	Date		Batch (Wednesday)			
		$B1_1$	$B1_2$	$B1_3$	$B1_4$	$B1_5$
1	01/07/2026	Demonstration of TE Lab, COs, POs, PSOs, Cycle -I				
2	08/07/2026	TE – 1	TE – 2	TE – 3	TE – 4	TE – 5
3	15/07/2026	TE – 2	TE – 3	TE – 4	TE – 5	TE – 1
4	22/07/2026	TE – 3	TE – 4	TE – 5	TE – 1	TE – 2
5	29/07/2026	TE – 4	TE – 5	TE – 1	TE – 2	TE – 3
6	05/08/2026	TE – 5	TE – 1	TE – 2	TE – 3	TE – 4
7	12/08/2026	Repetition/Revision/Viva -Voce				
8	19/08/2026	Repetition/Revision/Viva-Voce				
24/08/2026-29/08/2026		I Mid Examinations				
S. No	**Date**	**$B1_6$**	**$B1_7$**	**$B1_8$**	**$B1_9$**	**$B1_{10}$**
9	02/09/2026	Demonstration of TE Lab - Cycle II				
10	09/09/2026	TE – 6	TE – 7	TE– 8	TE – 9	TE- 10
11	16/09/2026	TE – 7	TE – 8	TE –9	TE – 10	TE – 6
12	23/09/2026	TE – 8	TE –9	TE – 10	TE – 6	TE –7
13	30/09/2026	TE – 9	TE – 10	TE – 6	TE –7	TE – 8
14	14/10/2026	TE – 10	TE – 6	TE– 7	TE– 8	TE – 9
15	21/10/2026	Repetition/Revision/Viva-Voce				
16	28/10/2026	Internal Examination				
02/11/2026-07/11/2026		II Mid Examinations				

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DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code : 23ME58 **Lab: Thermal Engineering Lab**
Lab/Practicals : 3 hrs/ Week
A.Y. : 2025-26
Class & Semester : B. Tech – V Semester
Instructors : Dr. V.DHANA RAJU / Mr. D.MALLIKARJUNA RAO

S. No	Date		Batch (Saturday)			
		$B2_1$	$B2_2$	$B2_3$	$B2_4$	$B2_5$
1	04/07/2026		Demonstration of TE Lab, COs, POs, PSOs, Cycle -I			
2	18/07/2026	TE – 1	TE – 2	TE – 3	TE – 4	TE – 5
3	25/07/2026	TE – 2	TE – 3	TE – 4	TE – 5	TE – 1
4	01/08/2026	TE – 3	TE – 4	TE – 5	TE – 1	TE – 2
5	08/08/2026	TE – 4	TE – 5	TE – 1	TE – 2	TE – 3
6	22/08/2026	TE – 5	TE – 1	TE – 2	TE – 3	TE – 4
24/08/2026 t 29-08-2026		I Mid Examinations				
S. No	Date	$B2_6$	$B2_7$	$B2_8$	$B2_9$	$B2_{10}$
	05/09/2026	Demonstration of TE Lab - Cycle II				
7	12/09/2026	TE – 6	TE – 7	TE– 8	TE – 9	TE- 10
8	19/09/2026	TE – 7	TE – 8	TE –9	TE – 10	TE – 6
9	26/09/2026	TE – 8	TE –9	TE – 10	TE – 6	TE –7
10	03/10/2026	TE – 9	TE – 10	TE – 6	TE –7	TE – 8
11	10/10/2026	TE – 10	TE – 6	TE– 7	TE– 8	TE – 9
12	24/10/2026	Repetition/Revision/Viva -Voce				
13	31/10/2026	Internal Examination				
02/11/2026-07/11/2026		II Mid Examinations				

TE Lab Incharge

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DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code : **23ME58** **Lab: Thermal Engineering Lab**
Lab/Practicals : **3 hrs/ Week**
A.Y. : **2025-26**
Class & Semester : **B. Tech – V Semester**
Instructors : **Dr. V.DHANA RAJU / Mr. D.MALLIKARJUNA RAO**

VIVA QUESTIONS

1. Define retardation test?
2. Which is the various energy losses associated with an IC engine?
3. Explain the construction and working of dynamometers?
4. What is need of measurement of speed of an I.C. Engine?
5. What is the brake power of I.C. Engines?
6. Define Volumetric efficiency
7. What is Indicated thermal efficiency?
8. What is Brake thermal efficiency?
9. Define Mechanical efficiency
10. Define Brake mean effective pressure
11. What is air fuel ratio?
12. Define the friction power?
13. Define Willian's lines methods?
14. What is knocking?
15. What is detonation?
16. How knocking can be prevented?
17. What is octane number?
18. What is cetane number?
19. What is carburation?
20. Explain the working and construction of a carburettor?
21. What is indicated power?
22. Explain the rich mixture, Lean Mixture & Stoichiometric Mixture
23. Define valve timing in four stroke petrol engines?
24. What is overlapping?
25. What do you mean by ignition?
26. What are the various types of ignition systems that are commonly used?
27. Explain the construction and working of fuel pump and fuel injector.
28. What is viscosity?
29. State Newton's law of viscosity?
30. Differentiate absolute and kinematic viscosity.
31. What are the different types of lubrication systems for IC engines?
32. What are the properties of lubricating oil?

33. What are the properties of fuel?
34. What is flash point and fire point?
35. What are the major emissions from an IC engine?
36. How can we reduce emissions?
37. Explain the working of a silencer.
38. Explain the working of a catalytic converter.
39. What is supercharging of an engine?
40. What is turbo charger?
41. What you mean by turbo lag?
42. Define MPFI system.
43. What is CRDI?
44. What is the function of a decompression valve?
45. Define COP.
46. Define compression ratio.
47. What is scavenging?
48. What is meant by self-ignition temperature?
49. Define calorific value.
50. What are the reasons for incomplete combustion?

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			

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DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PROGRAM : B.Tech. V-Sem., ME A/S

ACADEMIC YEAR : 2026-2027

COURSE NAME & CODE : Theory of Machines Lab, 23ME59

L-T-P STRUCTURE : 0-0-3

COURSE CREDITS : 1.5

COURSE INSTRUCTOR : Dr.B.Sudheer Kumar/Mr.V.Sankara Rao

COURSE COORDINATOR : Dr. B. Sudheer Kumar

PRE-REQUISITE: Engineering Mechanics, Theory of Machines

COURSE OBJECTIVE:

The main objective of this course is to demonstrate the concepts of theory of machines.

COURSE OUTCOMES (CO)

CO 1	Apply the dynamics of cams, gyroscopes for any practical problems. **(Applying-L3)**
CO 2	Evaluate the speed regulations in governors. **(Applying-L3)**
CO 3	Verify the balancing for rotating and reciprocating parts of a machine. **(Applying-L3)**
CO 4	Determine the vibration parameters of oscillating bodies. **(ApplyingL3)**

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

COs	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO 1	PSO 2	PSO 3
CO1	1	1	1						3	2		2			3
CO2	2	1	1						3	2		2			3
CO3	2	1	1						3	2		2			3
CO4	2	2	1						3	2		2			3

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

REFERENCE:

R1	Lab Manual

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

Batch: A1 (24761A0301 to 24761A0337)

S.No.	Experiment to be conducted	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Reference	HOD Sign Weekly
1.	Demonstration	3	01-07-2026		TLM8	-	
2.	Experiment-1	3	08-07-2026		TLM8	R1	
3.	Experiment-2	3	15-07-2026		TLM8	R1	
4.	Experiment-3	3	22-07-2026		TLM8	R1	
5.	Experiment-4	3	29-07-2026		TLM8	R1	
6.	Experiment-5	3	05-08-2026		TLM8	R1	
7.	Demonstration	3	12-08-2026		TLM8	-	
8.	Experiment-6	3	19-08-2026		TLM8	R1	
9.	**I MID EXAMINATION (24-08-2026 TO 29-08-2026)**						
10.	Experiment-7	3	02-09-2026		TLM8	R1	
11.	Experiment-8	3	09-09-2026		TLM8	R1	
12.	Experiment-9	3	16-09-2026		TLM8	R1	
13.	Experiment-10	3	23-09-2026		TLM8	R1	
14.	Repetition	3	30-09-2026		TLM8	R1	
15.	Repetition	3	07-10-2026		TLM8	R1	
16.	Lab Internal	3	28-10-2026		-	-	

Additional Experiments:

S.No.	Experiment to be conducted	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Reference	HOD Sign Weekly
16.	Study the cam jump phenomenon of various cams and followers.	3	14-10-2025		TLM8	-	

Batch: A2 (24761A0338 to 24761A0365 &25765A0301 to 24765A0307)

S.No.	Experiment to be conducted	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Reference	HOD Sign Weekly
1.	Demonstration	3	04-07-2026		TLM8	-	
2.	Experiment-1	3	11-07-2026		TLM8	R1	
3.	Experiment-2	3	18-07-2026		TLM8	R1	
4.	Experiment-3	3	25-07-2026		TLM8	R1	
5.	Experiment-4	3	01-08-2026		TLM8	R1	
6.	Experiment-5	3	08-08-2026		TLM8	R1	
7.	Demonstration	3	22-08-2026		TLM8	-	
8.	**I MID EXAMINATION (24-08-2026 TO 29-08-2026)**						
9.	Experiment-6	3	05-09-2026		TLM8	R1	
10.	Experiment-7	3	12-09-2026		TLM8	R1	
11.	Experiment-8	3	19-09-2026		TLM8	R1	
12.	Experiment-9	3	26-09-2026		TLM8	R1	

13.	Experiment-10	3	03-10-2026		TLM8	R1	
14.	Repetition	3	10-10-2026		TLM8	R1	
15.	Lab Internal	3	31-10-2026		-	-	

Additional Experiments:

S.No.	Experiment to be conducted	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Reference	HOD Sign Weekly
16.	Study the cam jump phenomenon of various cams and followers	3	17-10-2026		TLM8	-	

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

ACADEMIC CALENDAR:

Description	From	To	Weeks
I Phase of Instructions-1	29/06/2026	22/08/2026	8W
I Mid Examinations	24/08/2026	29/08/2026	1W
II Phase of Instructions	31/08/2026	17/10/2026	7W
19/10/2026 to 24/10/2026 DUSSEHRA HOLIDAYS (1 WEEK)			
II Mid Examinations	02/11/2026	07/11/2026	1W
Preparation and Practical's	09/11/2026	14/11/2026	1W
Semester End Examinations	16/11/2026	28/11/2026	2W

EVALUATION PROCESS:

Evaluation Task	COs	Marks
Day to Day Evaluation: A	1,2,3,4	A=10
Record: B	1,2,3,4	B=05
Internal Test: C	1,2,3,4	C=15
Cumulative Internal Examination : CIE=A+B+C	**1,2,3,4**	**CIE=30**
Semester End Examinations: SEE	**1,2,3,4**	**SEE=70**
Total Marks: CIE+SEE	**1,2,3,4**	**100**

Details of Batches:

Batch No.	Reg. No. of Students	Number of Students
A1A	24761A0301-307	07
A1B	24761A0308-314	07
A1C	24761A0315-323	07
A1D	24761A0324-330	07
A1E	24761A0331-337	07

Batch No.	Reg. No. of Students	Number of Students
A2A	24761A0338-344	07
A2B	24761A0345-352	07
A2C	24761A0353-359	07
A2D	20461A0360-365, 25765A0301	07
A2E	25765A0302-307	06

Batch No:	Exp. 01	Exp. 02	Exp. 03	Exp. 04	Exp. 05	Exp. 06	Exp. 07	Exp. 08	Exp. 09	Exp. 10
A1A	TOM1	TOM2	TOM3	TOM4	TOM5	TOM6	TOM7	TOM8	TOM9	TOM10
A1B	TOM2	TOM3	TOM4	TOM5	TOM1	TOM7	TOM8	TOM9	TOM10	TOM6
A1C	TOM3	TOM4	TOM5	TOM1	TOM2	TOM8	TOM9	TOM10	TOM6	TOM7
A1D	TOM4	TOM5	TOM1	TOM2	TOM3	TOM9	TOM10	TOM6	TOM7	TOM8
A1E	TOM5	TOM1	TOM2	TOM3	TOM4	TOM10	TOM6	TOM7	TOM8	TOM9
A2A	TOM1	TOM2	TOM3	TOM4	TOM5	TOM6	TOM7	TOM8	TOM9	TOM10
A2B	TOM2	TOM3	TOM4	TOM5	TOM1	TOM7	TOM8	TOM9	TOM10	TOM6
A2C	TOM3	TOM4	TOM5	TOM1	TOM2	TOM8	TOM9	TOM10	TOM6	TOM7
A2D	TOM4	TOM5	TOM1	TOM2	TOM3	TOM9	TOM10	TOM6	TOM7	TOM8
A2E	TOM5	TOM1	TOM2	TOM3	TOM4	TOM10	TOM6	TOM7	TOM8	TOM9

LIST OF EXPERIMENTS:

Exp.No.	Name of the Experiment	Related CO
TOM1	Determination of gyroscopic couple on Motorized Gyroscope.	CO1
TOM2	Determination of whirling speed of rotating shaft with various boundary conditions.	CO4
TOM3	Determination of centrifugal forces and draw the characteristics curve of Watt and Porter governor.	CO2
TOM4	Determination of centrifugal forces and draw the characteristics curve of Proell governor.	CO2
TOM5	Determination of centrifugal forces and draw the characteristics curve of Hartnell governor.	CO2
TOM6	Determination of natural frequency of the spring-mass damped and undamped systems.	CO4
TOM7	Verification of Dunkerley's formula for transverse vibrations of beams with different end conditions.	CO4
TOM8	Determination of natural frequency of torsional vibrations of a single rotor system.	CO4
TOM9	Determination of damped and undamped forced vibrations of beams.	CO4
TOM10	Balance the given rotor system dynamically with the aid of the force polygon and the couple polygon.	CO3
TOM11	Study the cam jump phenomenon of various cams and followers	CO4
TOM12	Balancing of reciprocating masses on slider crank mechanism.	CO4

NOTIFICATION OF CYCLE

Cycle	Exp.No.	Name of the Experiment	Related CO
Cycle-1	TOM1	Determination of gyroscopic couple on Motorized Gyroscope.	CO1
	TOM2	Determination of whirling speed of rotating shaft with various boundary conditions.	CO4
	TOM3	Determination of centrifugal forces and draw the characteristics curve of Watt and Porter governor.	CO2
	TOM4	Determination of centrifugal forces and draw the characteristics curve of Proell governor.	CO2
	TOM5	Determination of centrifugal forces and draw the characteristics curve of Hartnell governor.	CO2
Cycle-2	TOM6	Determination of natural frequency of the spring-mass damped and undamped systems.	CO4
	TOM7	Verification of Dunkerley's formula for transverse vibrations of beams with different end conditions.	CO4
	TOM8	Determination of natural frequency of torsional vibrations of a single rotor system.	CO4
	TOM9	Determination of damped and undamped forced vibrations of beams.	CO4
	TOM10	Balance the given rotor system dynamically with the aid of the force polygon and the couple polygon.	CO3
	TOM11	Study the cam jump phenomenon of various cams and followers	CO1
	TOM12	Balancing of reciprocating masses on slider crank mechanism.	CO3

PROGRAMME EDUCATIONAL OBJECTIVES:

PEO1: To build a professional career and pursue higher studies with sound knowledge in Mathematics, Science and Mechanical Engineering.

PEO2: To inculcate strong ethical values and leadership qualities for graduates to become successful in multidisciplinary activities.

PEO3: To develop inquisitiveness towards good communication and lifelong learning.

PROGRAM OUTCOMES (POs)
Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
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.
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.
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.
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.

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.
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.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
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.
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.
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):

1. To apply the principles of thermal sciences to design and develop various thermal systems.
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.
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.

Dr.B.Sudheer Kumar Mr.V.Sankara Rao	**Dr.B.Sudheer Kumar**	**Dr.B.Sudheer Kumar**	**Dr.M.B.S.Sreekara Reddy**
Course Instructor(s)	**Course Coordinator**	**Module Coordinator**	**HOD**

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Phone: 08659-222933, Fax: 08659-222931

DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code	**:** 23MES2	**Lab**	: Machine Tools and Metrology Lab
A.Y.	**:** 2026-27	**Class**	**:** B. Tech – V Semester (Section –A)
Lab/ Practical's	**:** 3 hrs./ Week	**Continuous Internal Assessment**	**:** 30
Credits	**:** 01	**Semester End Examination**	**:** 70
Name of the Faculty	**:** Dr. Murahari Kolli / Mr.S.Srinivasa Reddy/ Mr.S.Uma Maheswara Reddy		

COURSE EDUCATIONAL OBJECTIVES *(CEOs) and* COURSE OUTCOMES *(COs):*

PRE-REQUISITES: Production Technology, Machine Tools and Metrology.

COURSE EDUCATIONAL OBJECTIVES:

To understand the parts of various machine tools and about different shapes of products that can be produced on them. To measure bores, angles and tapers and to perform alignment tests on various machines.

COURSE OUTCOMES: at the end of the course, the student will be able to

CO1: Identify the components and working principles of general-purpose machine tools, and perform basic operations such as step turning, taper turning, and gear cutting. **(Applying - L3)**
CO2: Perform indexing and keyway cutting operations on milling and slotting machines to manufacture specific shapes and features. **(Applying – L3)**
CO3: Calibrate and use precision instruments such as vernier caliper's, micrometers, and height gauges to measure linear and angular dimensions. **(Applying – L3)**
CO4: Conduct machine tool alignment tests and surface roughness measurements using appropriate instruments to assess machine accuracy and component quality. **(Analyzing – L4)**

Mapping of COs with POs and PSOs:

Laboratory Course Articulation Matrix (Correlation between COs and POs and PSOs):

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) & PSOs – Machine Tools and Metrology Lab (20ME61)															
		POs											**PSOs**		
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**PSO 1**	**PSO 2**	**PSO 3**
COs	**CO1**	**2**	**1**	**2**	**3**			**2**				**2**		**3**	
	CO2	**3**	**2**	**2**	**3**			**2**				**2**		**3**	
	CO3	**3**		**2**	**3**							**1**			**3**
	CO4	**3**		**2**	**3**	**1**						**2**			**3**
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)															

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Credits	**:** 01	**Semester End Examination**	**:** 70
Name of the Faculty	**:** Dr. Murahari Kolli / Mr.S.Srinivasa Reddy/Mr.S.Uma Maheswara Reddy		

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, statistic sand 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 are as in the engineering discipline; much is at the forefront of the discipline.

WK5: Knowledge, including efficient resource use, environment a 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 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 withs elected 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 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 Teamwork:** 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 present at ions 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	**Lifelong 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.

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DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code	**:** 23MES2	**Lab**	: Machine Tools and Metrology Lab
A.Y.	**:** 2026-27	**Class**	**:** B. Tech – V Semester (Section –A)
Lab/ Practical's	**:** 3 hrs./ Week	**Continuous Internal Assessment**	**:** 30
Credits	**:** 01	**Semester End Examination**	**:** 70
Name of the Faculty	**:** Dr. Murahari Kolli / Mr. S. Srinivasa Reddy/Mr. S. Uma Maheswara Reddy		

LIST OF EXPERIMENTS

At least 06 Experiments from each laboratory and 12 overall should be conducted

PART-A (Machine Tools Lab)

List of Experiments: (At least five experiments may be conducted)

- Study of various machine tools like Lathe, drilling machine, Milling machine, Shaper, Planing machine, Slotting machine, cylindrical grinder, Surface grinder and Tool and cutter grinder.
- Operations on Lathe machines- **Step turning, Knurling, Taper turning, Thread cutting and Drilling**
- Operations on Drilling machine - **Drilling, reaming, tapping**, rectangular drilling, and circumferential drilling
- Operations on Shaping machine - (i) **Round to square** (ii) Round to Hexagonal
- Operations on Slotter - (i) Keyway (T –slot) (ii) **Keyway cutting**
- Operations on milling machines - (i) Indexing (ii) **Gear manufacturing**

PART-B (Metrology Lab)

List of Experiments (At least five experiments may be conducted)

- Calibration of vernier callipers, micrometres, vernier height gauge and dial gauges.
- Measurement of bores by internal micrometres and dial bore indicators.
- Use of gear tooth vernier calliper for tooth thickness inspection and flange micrometre for checking the chordal thickness of the spur gear.
- Machine tool alignment test on the lathe, drilling machine and milling machine.
- Angle and taper measurements with bevel protractor, Sine bar, rollers and balls.
- Use of a spirit level in finding the straightness of a bed and the flatness of a surface.
- Thread inspection with two-wire/three-wire method & tool makers' microscope.
- Surface roughness measurement with a roughness measuring instrumentby Taly Surf.

Staff In-charge – I **Staff In-charge – II** **Head of the Department**

Laboratory Code **:** 23MES2 **Lab** : Machine Tools and Metrology Lab

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DEPARTMENT OF MECHANICAL ENGINEERING

A.Y. : 2025-26 **Class** : B. Tech – V Semester (Section –A)
Lab/Practicals : 3 hrs/ Week **Continuous Internal Assessment** : 30
Credits : 01 **Semester End Examination** : 70
Name of the Faculty : Dr. Murahari Kolli / Mr.S.Srinivasa Reddy/Mr.S.Uma Maheswara Reddy/ Mr.S.Srinivasa Reddy

Batches (Section – A)

S. No	Batches	Regd. Nos	Total No. of Students
1	B. Tech – V Sem - A/S	24761A0301-320, 323- 344,24761A0346-365, 25765A0301-307	69
2	Batch B1	24761A0301-320,323- 337	35
3	Batch B2	24761A0338-365, 25765A0301-307	34

Sub Batch of A1: Machine Tools

S. No	Batch	Registered Nos	Total
1		24761A0301-303	03
2		24761A0304-306	03
3		24761A0307-309	03
4		24761A0310-312	03
5		24761A0313-315	03
6		24761A0316-318	03
Total (Cycle 1) Lathe machines			18

S. No	Batch	Registered Nos	Total
7		24761A0319-323	03
8		24761A0324-326	03
9		24761A0327-329	03
10		24761A0330-332	03
11		24761A0333-335	03
12		24761A0336-337	02
Total (C12) Special Machines			17

Sub Batches of A2: Metrology

S. No	Batch	Registered Nos	Total
1		24761A0338-340	03
2		24761A0341-343	03
3		24761A0344-347	03
4		24761A0348-350	03
5		24761A0351-353	03
6		24761A0354-355	02
Total (C21)			17

S. No	Batch	Registered Nos	Total
7		24761A0356-358	03
8		24761A0359-361	03
9		24761A0362-364	03
10		24761A0365, 25765A0301-302	03
11		25765A0303-305	03
12		25765A0306-307	02
Total (C22)			17

Staff In-charge – I **Staff In-charge – II** **Head of the Department**

Laboratory Code : 23MES2 **Lab** : Machine Tools and Metrology Lab
A.Y. : 2026-27 **Class** : B. Tech – V Semester (Section –A)

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DEPARTMENT OF MECHANICAL ENGINEERING

Lab/Practicals : 3 hrs/ Week **Continuous Internal Assessment** : 30
Credits : 01 **Semester End Examination** : 70
Name of the Faculty : Dr. Murahari Kolli / Mr.S.Srinivasa Reddy/Mr.S.Uma Maheswara Reddy/ Mr.S.Srinivasa Reddy

Notification of Cycles

Cycle – I: MACHINE TOOLS LAB

At least SIX experiments may be conducted.

LIST OF EXPERIMENTS:

- Study of various machine tools like Lathe, Drilling machine, Milling machine, Shaper, Planing machine, Slotting machine, Cylindrical grinder, Surface grinder and Tool and cutter grinder.
- Operations on Lathe machines- **Step turning, Knurling, Taper turning, Thread cutting and Drilling**
- Operations on Drilling machine - **Drilling, reaming, tapping**, rectangular drilling, and circumferential drilling
- Operations on Shaping machine - (i) **Round to square** (ii) Round to Hexagonal
- Operations on Slotter - (i) Keyway (T –slot) (ii) **Keyway cutting**
- Operations on milling machines - (i) Indexing (ii) **Gear manufacturing**

Cycle – II: METROLOGY LAB

At least SIX experiments may be conducted.

LIST OF EXPERIMENTS

- Calibration of vernier callipers, micrometres, vernier height gauge and dial gauges.
- Measurement of bores by internal micrometres and dial bore indicators.
- Use of gear tooth vernier calliper for tooth thickness inspection and flange micrometre for checking the chordal thickness of the spur gear.
- Machine tool alignment test on the lathe, drilling machine and milling machine.
- Angle and taper measurements with bevel protractor, Sine bar, rollers and balls.
- Use of a spirit level in finding the straightness of a bed and the flatness of a surface.
- Thread inspection with two-wire/three-wire method & tool makers' microscope.
- Surface roughness measurement with a roughness measuring instrument by Taly Surf.

Staff In-charge – I **Staff In-charge – II** **Head of the Department**

Laboratory Code : 23MES2 **Lab** : Machine Tools and Metrology Lab

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DEPARTMENT OF MECHANICAL ENGINEERING

A.Y. : 2026-27 **Class** : B. Tech – V Semester (Section –A)
Lab/Practicals : 3 hrs/ Week **Continuous Internal Assessment** : 30
Credits : 01 **Semester End Examination** : 70
Name of the Faculty : Dr. Murahari Kolli / Mr.S.Srinivasa Reddy/Mr.S.Uma Maheswara Reddy/ Mr.S.Srinivasa Reddy

Schedule of Experiments (Section –A: B1 Batch) Machine Tools

S.No	Batches	Regd.No's	Total No. of Students
1	B. Tech –A/S	24761A0301-320, 323- 344, 24761A0346-365, 25765A0301-307	69
2	Batch B1	24761A0301-320,323- 337	35
3	Batch B2	24761A0338-365, 25765A0301-307	34

Date	Experiment (Batch)					
	Ex - 1	**Ex – 2**	**Ex – 3**	**Ex – 4**	**Ex – 5**	**Ex – 6**
29-06-2026	**Demonstration of all experiments, CEOs and COs of the Laboratory (Ex – 01 to 06)**					
MACHINE TOOLS LAB						
06-07-2026	B111	B112	B113	B114	B115	B116
13.07.2026	B116	B111	B112	B113	B114	B115
20.07.2026	B115	B116	B111	B112	B113	B114
27.07.2026	B114	B115	B116	B111	B112	B113
03-08-2026	B113	B114	B115	B116	B111	B112
10-08-2026	B112	B113	B114	B115	B116	B111
I Mid Examinations 24-08-2026 TO 29-08-2026						
	Ex - 1	**Ex – 2**	**Ex – 3**	**Ex – 4**	**Ex – 5**	**Ex – 6**
17-08-2026						
31-08-2026	B121	B122	B123	B124	B125	B126
07-09-2026	B126	B121	B122	B123	B124	B125
21-09-2026	B125	B126	B121	B122	B123	B124
28-09-2026	B124	B125	B126	B121	B122	B123
05-10-2026	B123	B124	B125	B126	B121	B122
12-09-2026	B122	B123	B124	B125	B126	B121
***II Mid Examinations* 02-11-2026 TO 07-11-2026**						

Staff In-charge **Head of the Department**

Laboratory Code : 23MES2 **Lab** : Machine Tools and Metrology Lab

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DEPARTMENT OF MECHANICAL ENGINEERING

A.Y. : 2025-26 **Class** : B. Tech – V Semester (Section –A)
Lab/Practicals : 3 hrs/ Week **Continuous Internal Assessment** : 30
Credits : 01 **Semester End Examination** : 70
Name of the Faculty : Dr. Murahari Kolli / Mr.S.Srinivasa Reddy/Mr.S.Uma Maheswara Reddy/ Mr.S.Srinivasa Reddy

Schedule of Experiments (Section – A: B2 Batch): Metrology

S.No	Batches	Regd.No's	Total No. of Students
1	B. Tech –A/S	24761A0301-320, 323- 344, 24761A0346-365, 25765A0301-307	69
2	Batch B1	24761A0301-320,323- 337	35
3	Batch B2	24761A0338-365, 25765A0301-307	34

Date	Experiment (Batch)					
	Ex - 1	**Ex – 2**	**Ex – 3**	**Ex – 4**	**Ex – 5**	**Ex – 6**
	Demonstration of all experiments, CEOs and COs of the Laboratory (Ex – 01 to 06)					
MACHINE TOOLS LAB						
06-07-2026	B121	B122	B123	B124	B125	B126
13.07.2026	B126	B121	B122	B123	B124	B125
20.07.2026	B125	B126	B121	B122	B123	B124
27.07.2026	B124	B125	B126	B121	B122	B123
03-08-2026	B123	B124	B125	B126	B121	B122
10-08-2026	B122	B123	B124	B125	B126	B121
I Mid Examinations 24-08-2026 TO 29-08-2026						
	Ex - 1	**Ex – 2**	**Ex – 3**	**Ex – 4**	**Ex – 5**	**Ex – 6**
17-08-2026	**Demonstration**					
31-08-2026	B111	B112	B113	B114	B115	B116
07-09-2026	B116	B111	B112	B113	B114	B115
21-09-2026	B115	B116	B111	B112	B113	B114
28-09-2026	B114	B115	B116	B111	B112	B113
05-10-2026	B113	B114	B115	B116	B111	B112
12-09-2026	B112	B113	B114	B115	B116	B111
***II Mid Examinations* 02-11-2026 TO 07-11-2026**						

Staff In-charge **Head of the Department**

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
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 HANDOUT

PART-A:

Program : B.Tech. V-Sem., Mechanical Engineering
Academic Year : 2026-27
Course Name & Code : Tinkering Lab – 23EM01
L-T-P-Cr : 0-0-3-1.5
Course Instructure : Mr.M.Sambasiva Reddy, Mr.V.Sankararao, Mr.K. Sai Babu

Course Objectives:

The main objective of this course is to understand the basics of all the emerging technologies and apply the learnings to solve real-world problems. This is designed to be a hands-on learning program that empowers students to analyze the facts, connect the dots and apply what they learn in school rather than memorizing them which will lead to the creation of the next generation of entrepreneurs, engineers and innovators.

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

CO 1	Turn ideas into reality by brainstorming, modelling and prototyping. (Applying L3)
CO 2	Inculcate innovative and entrepreneurial mind-set through Design thinking and Hands-on Learning. (Applying-L3)
CO 3	Develop basic knowledge in electrical and mechanical engineering principles. (Applying-L3)
CO4	Develop skills of using hand tools to construct a prototype of an engineering design. (Applying L3)

Course Articulation Matrix - Correlation between COs, POs & PSOs

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

Correlation Levels: **1**-Slight (Low), **2**-Moderate (Medium), **3**-Substantial (High) and No correlation: **'-'**

PART-B: COURSE DELIVERY PLAN (LESSON PLAN):

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.	Introduction to Lab experiments, COs ,POs and PSOs.	**2**	30-06-2026		TLM4	
2.	Make your own parallel and series circuits using breadboard for any application of your choice.	2	07-07-2026		TLM4	
3.	Demonstrate a traffic light circuit using breadboard.	2	14-07-2026		TLM4	
4.	Build and demonstrate automatic Street Light using LDR.	2	21-07-2026		TLM4	
5.	Simulate the Arduino LED blinking activity in Tinkercad	2	28-07-2026		TLM4	
6.	Build and demonstrate an Arduino LED blinking activity using Arduino IDE.	2	04-08-2026		TLM4	
7.	Interfacing IR Sensor and Servo Motor with Arduino.	2	11-08-2026		TLM4	
8.	Blink LED using ESP32	2	18-08-2026		TLM4	
9.	LDR Interfacing with ESP32.	2	01-09-2026		TLM4	
10.	Control an LED using Mobile App.	2	08-09-2026		TLM4	
11.	Design and 3D print a Walking Robot	2	15-09-2026		TLM4	
12.	Design and 3D Print a Rocket.	2	22-09-2026		TLM4	
13.	Build a live soil moisture monitoring project, and monitor soil moisture levels of a remote plan in your computer dashboard.	2	29-09-2026		TLM4	
14.	Demonstrate all the steps in design thinking to redesign a motor bike.	2	06-10-2026		TLM4	
15.	Revision Lab	2	13-10-2026			
16.	Internal Lab Exam	2	27-10-2026			
No. of classes required:32				**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

PART-C

EVALUATION PROCESS (R23 Regulation):

Evaluation Task	Expt. no's	Marks
Day to Day work	1,2,3,4,5,6,7,8…	A1 =10
Record and observation	1,2,3,4,5,6,7,8…	B1 = 5
Internal Exam	1,2,3,4,5,6,7,8…	**C1=15**
Cumulative Internal Examination (CIE):(A1+B1+C1)	1,2,3,4,5,6,7,8…	**30**
Semester End Examination (SEE)	1,2,3,4,5,6,7,8…	**70**
Total Marks=CIE+SEE		**100**

Program Educational Objectives (PEOs):

PEO 1: To Attain a solid foundation in Electronics & Communication Engineering fundamentals with an attitude to pursue continuing education.

PEO 2: To Function professionally in the rapidly changing world with advances in technology.

PEO 3: To Contribute to the needs of the society in solving technical problems using Electronics & Communication Engineering principles, tools and practices.

PEO 4: To Exercise leadership qualities, at levels appropriate to their experience, which addresses issues in a responsive, ethical, and innovative manner.

Program 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 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.

Program 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 Instructors	Course Coordinator	Module Coordinator	HOD
Mr.M. Sambasiva Reddy Mr.V. sankara Rao Mr.K. Sai babu	Mr.N. Dharmachari	Dr. P. Lachi Reddy	Dr. G. Srinivasulu

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L.B.REDDY NAGAR, MYLAVARAM. NTR District, AP, India. 521230.
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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

COURSE HANDOUT

PART-A

Name of Course Instructor: Mr P. Gandhi Prakash
Course Name & Code : Predictive Machine Learning Algorithms(23ADM3)
L-T-P Structure : 3-0-0
Program/Sem/Sec : B.Tech/V/M-ASE, CIVIL, EEE, MECH **Credits:** 3
A.Y.:2026-27

PREREQUISITE: Probability and Statistics

COURSE EDUCATIONAL OBJECTIVES (CEOs): The objective of the course is to provide the basic concepts and techniques of Machine Learning and help to use recent machine learning approaches for solving practical problems. It enables students to gain experience to do independent study and research.

CO1	Identify the characteristics of machine learning. (Understand- L2)
CO2	Understand the model-building and evaluation approaches. (Understand- L2)
CO3	Apply regression algorithms for real-world Problems. (Apply- L3)
CO4	Handle classification problems via supervised learning algorithms. (Apply- L3)
CO5	Learn advanced learning techniques to deal with complex data. (Apply- 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	2	-	-	-	-	-	-	-	-	-	-	-	3
CO2	3	2	-	-	-	-	-	-	-	-	-	-	-	3
CO3	3	2	1	-	-	-	-	-	-	-	-	-	-	3
CO4	-	2	1	-	-	-	-	-	-	-	-	-	-	3
CO5	2	3	1	-	-	-	-	-	-	-	-	-	-	3

TEXTBOOKS:

T1 Subramanian Chandramouli, Saikat Dutt, Amit Kumar Das, "Machine Learning", Pearson Education India,1st edition,2015
T2 Tom M. Mitchell, "Machine Learning, MGH, 1997

REFERENCE BOOKS:

R1 Shai Shalev-Shwartz, ShaiBen David, "Understanding Machine Learning: From Theory to Algorithms", Cambridge.
R2 Peter Harington, "Machine Learning in Action", Cengage, 1st edition, 2012.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction to Machine Learning

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 Machine Learning - Introduction	1	01-07-2026		TLM1	
2	Types of Machine Learning, Applications of Machine Learning	2	02-07-2026		1 & 2	
3	Issues in Machine Learning	1	08-07-2026		1 & 2	
4	Preparing to Model- Introduction, Machine Learning Activities	2	9-07-2026		1 & 2	
5	Basic Types of Data in Machine Learning	1	15-07-2026		1 & 2	
6	Exploring the Structure of Data	2	16-07-2026		TLM1	
No. of classes required to complete UNIT-I: 09				**No. of classes taken:09**		

UNIT-II: Modelling & Evaluation, Basics of Feature Engineering

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
7	Modelling & Evaluation- Introduction,	1	22-07-2026		TLM1	
8	Selecting a Model, Training a Model (for Supervised Learning)	2	23-07-2026		TLM1	
9	Model Representation and Interpretability	1	29-07-2026		TLM1	
10	Evaluating Performance of a Model, Basics of Feature Engineering- Introduction	2	30-07-2026		TLM1	
11	Feature Transformation – Feature Construction	1	05-08-2026		TLM1	
12	Feature Extraction, Principal Component Analysis (PCA), Singular Value Decomposition (SVD)	2	06-08-2026		TLM1	
13	Linear Discriminant Analysis (LDA) & Feature Subset Selection	1	12-08-2026		TLM1	
No. of classes required to complete UNIT-II: 10				**No. of classes taken:**		

UNIT-III: Regression

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
14	Introduction to Regression Analysis, Simple linear regression model	2	13-08-2026		TLM1	
15	Multilinear regression model	1	19-08-2026		1 & 2	
16	Assumptions in Regression Analysis & Problems in Regression Analysis	2	20-08-2026		TLM1	
17	Improving the Accuracy of the linear regression model	1	02-09-2026		TLM1	
18	Polynomial regression model, Logistic Regression	2	03-09-2026		1 & 2	
19	Regularization	1	09-09-2026		TLM1	
20	regularized Linear Regression, regularized Logistic Regression	2	10-09-2026		TLM1	
No. of classes required to complete UNIT-III: 11				**No. of classes taken:**		

UNIT-IV: Supervised Learning: Classification

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	Supervised Learning: Classification-Introduction	1	16-09-2026		TLM1	
22	Example of Supervised Learning, Classification Model	2	17-09-2026		TLM1	
23	Classification Learning Steps.	1	23-09-2026		TLM1	
24	Common Classification Algorithms, k-Nearest Neighbour (KNN)	2	24-09-2026		1 & 2	
25	Support Vector Machines (SVM)	1	30-09-2026		1 & 2	
26	Random Forest model	2	01-10-2026		1 & 2	
No. of classes required to complete UNIT-IV: 09				**No. of classes taken:**		

UNIT-V: Other Types of Learning

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
27	Other Types of Learning	1	07-10-2026		TLM1	
28	Ensemble Learning, Bagging, Boosting	2	08-10-2026		TLM1	
29						
30	Stacking and its impact on bias and variance	1	14-10-2026		TLM1	
31	AdaBoost, Gradient Boosting Machines	2	15-10-2026		1 & 2	
32						
33	Boost	1	28-10-2026		TLM1	
34	Reinforcement Learning, Introduction, Q Learning	2	29-10-2026		1 & 2	
35						
No. of classes required to complete UNIT-V: 09				**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

PART-C

EVALUATION PROCESS (R20 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 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	**Engineering 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 the world:** 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	**Ethics:** Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 8	**Individual and team work**: Function effectively as an individual, and as a member or leader 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
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	The ability to apply Software Engineering practices and strategies in software project development using an open-source programming environment for the success of the organization.
PSO 2	The ability to design and develop computer programs in networking, web applications and IoT as per the society's needs.
PSO 3	To inculcate an ability to analyze, design and implement database applications.

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**Mr.P.Gandhi Prakash**	**Mr. P. Gandhi Prakash**	**Dr. Ch.Rajendra Babu**	**Dr.P.Bhagath**
Signature				

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

COURSE HANDOUT
PART-A

Name of Course Instructor : Mr P.Gandhi Prakash
Course Name & Code : Predictive Machine Learning Algorithms Lab (23ADM4)
L-T-P Structure : 0-0-3
Program/Sem/Sec : B.Tech /V-Sem/ASE, CIVIL, EEE, MECH. **Credits:** 1.5
A.Y.:2026-27

PRE-REQUISITE: Probability and Statistics, Python Programming

COURSE EDUCATIONAL OBJECTIVES (CEOs): The objective of this lab is to make use of Data sets in implementing the machine learning algorithms in any suitable language of choice.

COURSE OUTCOMES (COs): At the end of the course, students can

CO 1	Apply the appropriate pre-processing techniques to the set. (Apply – L3)
CO 2	Implement supervised Machine Learning algorithms. (Apply – L3)
CO 3	Implement advanced Machine Learning algorithms (Apply – L3)
CO 4	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	-	2	2	-	2	-	-	-	-	-	-	-	-	3
CO2	-	1	1	1	1	-	-	-	-	-	-	-	-	3
CO3	3	-	1	1	1	-	-	-	-	-	-	-	-	3
CO4	-	-	-	-	-	-	2	2	2	-	-	-	-	-

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

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	HOD Sign Weekly
1	Basic statistical functions for data exploration	3	03-07-2026 10-07-2026		TLM4	
2	Data visualisation: Box plot, scatter plot, histogram	3	17-07-2026		TLM4	
3	Data pre-processing: Handling missing values, outliers, normalization, and scaling.	3	24-07-2026		TLM4	
4	Principal Component Analysis (PCA)	3	31-07-2026		TLM4	
5	Singular Value Decomposition (SVD)	3	07-08-2026		TLM4	
6	Linear Discriminant Analysis (LDA)	3	14-08-2026		TLM4	
7	Regression Analysis: Linear regression, Logistic regression, Polynomial regression	3	21-08-2026		TLM4	
8	Regularized Regression	3	11-09-2026		TLM4	
9	K-Nearest Neighbour (KNN) Classifier	3	18-09-2026		TLM4	
10	Support Vector Machines (SVMs)	3	25-09-2026		TLM4	
11	Random Forest model	3	09-10-2026		TLM4	
12	AdaBoost Classifier and XG Boost	3	16-10-2026		TLM4	
13	Internal Exam	3	30-10-2026		TLM4	

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

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 the research literature, and analyze complex engineering problems, reaching substantiated conclusions using the first principles of mathematics, the natural sciences, and the 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 public health and safety, and the cultural, societal, and environmental considerations.
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PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	The ability to apply Software Engineering practices and strategies in software project development using an open-source programming environment for the success of the organization.
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Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**Mr P. Gandhi Prakash**	**Mr P.Gandhi Prakash**	**Dr Ch. Rajendra Babu.**	**Dr.P. Bhagath**
Signature				