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 :Dr.MurahariKolli
Course Name & Code :Machine Tools and Metrology & 23ME10
L-T-P Structure : **3-0-0** **Credits:**3
Program/Sem/Sec : B.Tech/V/A **A.Y.:** 2025-26

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	01.07.2025		TLM2	
2.	Elementary treatment of metal cutting theory	1	02.07.2025		TLM2	
3.	Element of cutting process	1	03.07.2025		TLM2	
4.	Geometry of Single Point Cutting Tool	1	04.07.2025		TLM2	
5.	Tool signature	1	08.07.2025		TLM2	
6.	Mechanism of Chip formation	1	09.07.2025		TLM2	
7.	Types of Chip formation	1	10.07.2025		TLM2	
8.	Chip formation problems	1	11.07.2025			
9.	Taylor's tool life equation	1	15.07.2025		TLM2	
10.	Tool Life problems	1	16.07.2025			
11.	Introduction- to lathe	1	17.07.2025		TLM2	
12.	Types of lathes	1	18.07.2025		TLM1	
13.	Engine lathe – principle of working - construction	1	22.07.2025		TLM2	
14.	Specification of lathe	1	23.07.2025		TLM2	
15.	Accessories and attachments	1	24.07.2025		TLM2	
16.	lathe operations	1	25.07.2025		TLM2	
17.	Taper turning methods	1	29.07.2025		TLM2	
18.	Thread cutting – drilling on lathes.	1	30.07.2025		TLM2	

No. of classes required to complete UNIT-I: 18	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
19.	Reciprocating Machines: **SHAPING** Principle of working	1	31.07.2025		TLM2	
20.	Parts of Shaper Machine– Specifications,	1	01.08.2025		TLM2	
21.	Size and Specifications of Shaper, classifications, Operations	1	05.08.2024		TLM2	
22.	**SLOTTING** Principle of working – Principal parts – Specifications,	1	06.08.2024		TLM2	
23.	Classifications, operations	1	07.08.2025		TLM2	
24.	**PLANNER** Principle of working Principal parts – Size and Specifications	1	08.08.2025		TLM2	
25.	Classifications, Operations	1	12.08.2025		TLM2	
26.	Sliders crank mechanism.	1	13.08.2025		TLM2	
27.	**DRILLING & BORING MACHINES:** Introduction – construction of drilling machines	1	14.08.2025		TLM2	
28.	Principles of working – specifications-	1	19.08.2025		TLM2	
29.	Types of drilling machines	1	20.08.2025		TLM2	
30.	Operations performed, Types of drills	1	21.08.2025		TLM2	
31.	Boring Machines – types.	1	22.08.2025		TLM2	
No. of classes required to complete UNIT-II: 12				**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
32.	**MILLING MACHINES**: Principle of working –	1	02.09.2025		TLM2	
33.	Specifications, Methods of Milling	1	03.09.2025		TLM2	
34.	Classifications of milling machines	1	04.09.2025		TLM2	
35.	Types of cutters, Operations	1	05.09.2025		TLM2	
36.	Methods of indexing-	1	09.09.2025		TLM2	

37.	**FINISHING PROCESSES:** Principle of working – Classification of grinding machines	1	10.09.2025		TLM2	
38.	Types of abrasives, Bonds and selection	1	11.09.2025		TLM2	
39.	Specification of a Grinding wheel	1	12.09.2025		TLM2	
40.	Lapping & Honing	1	16.09.2025		TLM2	
41.	Broaching Comparison to grinding.	1	17.09.2025		TLM2	
No. of classes required to complete UNIT-III: 10				**No. of classes taken:**		
I-Mid Exams : 25.008.2025 to 30.08.2025						

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
42.	Introduction to Metrology	1	18.09.2024		TLM2	
43.	Types of fits	1	19.09.2025		TLM2	
44.	Unilateral and bilateral tolerance system	1	23.09.2025		TLM2	
45.	hole and shaft basis systems	1	24.09.2025		TLM2	
46.	interchangeability & selective assembly	1	25.09.2025		TLM2	
47.	International standard system of tolerances	1	26. 09.2025		TLM2	
48.	Simple problems related to limits and fits	1	30. 09.2025		TLM2	
49.	Simple problems related to limits and fits	1	01.10.2025		TLM2	
50.	Taylor's principle – design of go and no go gauges	1	02.10.2025		TLM2	
51.	Plug, ring, snap, gap	1	03.10.2025		TLM2	
52.	Taper, profile and position gauges.	1	07.10.2025		TLM2	
53.	**LINEAR MEASUREMENT:** Length standards, end standards	1	08.10.2025		TLM2	
54.	Slip gauges	1	09.10.2025		TLM2	
55.	Calibration of the slip Gauges	1	10.10.2025		TLM2	
56.	Dial indicators,	1	14.10.2025		TLM2	
57.	Micrometres.	1	15.10.2025		TLM2	
No. of classes required to complete UNIT-IV: 15				**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

58.	**ANGULAR MEASUREMENT:** Bevel protractor, Angle slip gauges	1	16.10.2025		TLM2	
59.	Angle dekkor, Spirit levels-	1	17.10.2025		TLM2	
60.	sine bar- sine table	1	15.10.2025		TLM2	
61.	**SURFACE ROUGHNESS MEASUREMENT:** Differences between surface roughness and surface waviness	1	21.10.2025		TLM2	
62.	–Numerical assessment of surface finish,	1	22.10.2025		TLM2	
63.	Profilograph, Talysurf,	1	23.10.2025		TLM2	
64.	ISI symbols.	1	24.10.2025		TLM2	
65.	**OPTICAL MEASURING INSTRUMENTS:** Tools maker's microscope,	1	28.10.2025		TLM2	
66.	Autocollimators	1	29.10.2025		TLM2	
67.	Optical projector	1	30.10.2025		TLM2	
68.	Optical flats, Optical comparators.	1	31.10.2025		TLM2	
No. of classes required to complete UNIT-V: 11				**No. of classes taken:**		
II-Mid Exams :				**3.11.2025 to 08.11.2025**		

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 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, statisticsand 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 knowledgefortheacceptedpracticeareasintheengineeringdiscipline;muchisatthe forefront of the discipline.

WK5: Knowledge,includingefficientresourceuse,environmentalimpacts,whole-lifecost,re- use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

WK6: Knowledgeofengineeringpractice(technology)inthepracticeareasintheengineering discipline.

WK7: Knowledge of the role of engineering insociety and identified issues in engineering practiceinthediscipline,suchastheprofessionalresponsibilityofanengineertopublic safety and sustainable development.

WK8: Engagementwithselectedknowledgeinthecurrentresearchliteratureofthediscipline, 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,andnormsofengineeringpractice.Awarenessoftheneedfordiversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding andrespect,

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	**ConductInvestigationsofComplexProblems**: Conductinvestigationsofcomplex engineering problems using research-based knowledge including design of experiments,modelling,analysis&interpretationofdatatoprovidevalidconclusions. (WK8).
PO 5	**EngineeringToolUsage:** Create, select and applyappropriatetechniques,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 withreferencetoeconomy,health,safety,legalframework,cultureandenvironment. (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	**IndividualandCollaborativeTeamwork:**Functioneffectivelyasanindividual,and as a member or leader in diverse/multi-disciplinary teams
PO 9	**Communication:** Communicate effectively and inclusively within the engineering communityandsocietyatlarge,suchasbeingabletocomprehendandwriteeffective reportsanddesigndocumentation,makeeffectivepresentationsconsidering 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	**LongLearning:**Recognizetheneedfor,andhavethepreparationandabilityfor i)independentandlife-longlearningii)adaptabilitytonewandemergingtechnologies 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. Murahari Kolli**	**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. P. RAVINDRA KUMAR
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.:** 2025-26
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	30-06-25		1	
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	01-07-25		1,2	
3	Valve timing and Port timing diagrams,	1	02-07-25		1,2	
4	Engine Performance and testing parameters	1	05-07-25		1,2	
5	Numerical problems on engine performance parameters	1	07-07-25		1,2	
6	Heat balance test.	1	08-07-25		1,2	
7	Tutorial -1	1	09-07-25		3	
8	Normal and abnormal combustion, Stages of combustion in SI engines,	1	14-07-25		1,2	
9	Stages of combustion in CI engines, Knocking,	1	15-07-25		1,2	
10	Factors affecting the Knocking, and Detonation	1	16-07-25		3	
11	Octane Number and Cetane Number, Firing order.	1	19-07-25		1,2	
12	Short answer questions, Assignment -1, Revision and concluding points	1	22-07-25		1,2	
	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	23-07-25		1,2	
14	Methods to improve efficiency of Rankine cycle – Reheating and Regeneration	1	28-07-25		1,2	
15	Numerical Problems	1	29-07-25		1,2	
16	Fuels used in steam power plants. – Concluding points	1	30-07-25		1,2	
17	Tutorial -2	1	02-08-25		3	
18	Introduction, Boiler - Function and Classification, Fire Tube boilers– Cochran,	1	04-08-25		1,2	
19	Cornish, Lancashire,	1	05-08-25		1,2	
20	Water Tube boilers - Babcock and Wilcox, Comparison of fire and water tube boilers	1	06-08-25		1,2	
21	High pressure boilers - Benson boiler, Lamont Boiler, Loeffler boiler	1	09-08-25		1,2	

22	Mountings and Accessories	1	11-08-25		3	
23	Draught Systems – Natural and artificial draught	1	12-08-25		1,2	
24	Height of chimney – Condition for maximum efficiency	1	13-08-25		1	
25	Numerical Problems	1	18-08-25		1,2	
26	Short answer questions, Assignment -2, and concluding points	1	19-08-25		3	
27	Revision –II unit	1	20-08-25		1,2	
28	Previous question papers discussion , Tutorial -3	1	23-08-25		1,2	
	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	01-09-25		1,2	
30	Numerical problems	1	02-09-25		1,2	
31	Condition for maximum discharge, critical pressure ratio,	1	03-09-25		1	
32	Numerical problems - Tutorial -4	1	06-09-25		1,2	
33	Ideal and actual expansion in nozzle, velocity coefficient.	1	08-09-25		1,2	
34	Introduction, Elements of a condenser plant, Types of Condensers- Jet condensers – working principle,	1	09-09-25		3	
35	Surface Condensers-working principle,	1	10-09-25		1,2	
36	Comparison of jet and surface condensers, Condenser performance parameters	1	13-09-25		1,2	
37	Numerical Problems	1	15-09-25		1,2	
38	Numerical Problems	1	16-09-25		3	
39	Tutorial -5	1	17-09-25		1	
40	Short answer questions, Assignment -2, and concluding points	1	20-09-25		1,2	
	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	22-09-25		1,2,4	
42	Effect of friction – power developed, axial thrust, blade or diagram efficiency – Condition for maximum efficiency.	1	23-09-25		1,2,4	
43	De-Laval Turbine - its features. Methods to reduce rotor speed-velocity compounding (Curtis Turbine), Pressure compounding (Rateau Turbine) and pressure and velocity compounding.	1	24-09-25		1,2,4	
44	Reaction Turbines- Parson‘s reaction turbine, Performance analysis, degree of	1	27-09-25		1,2,5,6	

	reaction, condition for maximum efficiency.					
45	**Numerical Problems -** Tutorial - 6	1	06-10-25		3	
46	Introduction, Classification, working and application of Gas Turbines, Ideal and Actual Cycles;	1	07-10-25		1,2	
47	Methods to improve the gas turbine performance- Inter cooling, Reheating, Regeneration.	1	08-10-25		1,2	
48	**Numerical Problems -** Tutorial -7	1	11-10-25		1,2	
49	Jet Propulsion: Introduction, Classification, -Turbo jet, Turbo Propeller	1	13-10-25		3	
50	Rocket Engines	1	14-10-25		1,2	
	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	15-10-25		1,2	
52	Multistage compressors working principle,	1	18-10-25		1,2	
53	Power requirement of reciprocating compressors - Tutorial -8	1	20-10-25		1,2	
54	Volumetric efficiency, condition for maximum efficiency in multi stage compressor.	1	22-10-25		3	
55	Introduction, general classification, Rotary compressors – Working principle of Root's, Vane's and Lysholm compressor	1	25-10-25		1,2	
56	Axial and centrifugal compressors– surging and choking in compressors and their comparisons- applications	1	27-10-25		1,2	
57	Short answer questions, Assignment -2, and concluding points	1	28-10-25		1,2	
58	Revision	1	01-11-25		1,2	
	No. of classes taken:8					

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

PART-C

EVALUATION PROCESS (R23 Regulation):

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

ACADEMIC CALENDER:

Commencement of Class work		30-06-2025	
I Phase of Instructions	30-06-2025	23-08-2025	8 Weeks
I Mid Examinations	25-08-2025	30-08-2025	1 Week
II Phase of Instructions	01-09-2025	01-11-2025	9 Weeks
II Mid Examinations	03-11-2025	08-11-2025	1 Week
Preparation and Practical's	10-11-2025	15-11-2025	1 Week
Semester End Examinations	17-11-2025	29-11-2025	2 Weeks

Knowledge and Attitude Profile (WK)

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

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

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

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

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

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

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

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

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

PART-D

PROGRAMME OUTCOMES (POs):

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

Title	Course Instructor/ Coordinator	Module Coordinator	Head of the Department
Name of the Faculty	**Dr. P. Ravindra Kumar**	**Dr. P. Vijay Kumar**	**Dr. M.B.S.S Reddy**
Signature			

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Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada
L.B.Reddy Nagar, Mylavaram-521230, Krishna Dist, Andhra Pradesh, India

DEPARTMENT OF ELECTRICAL & ELECTRONICS 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 : 2025-26

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	30-06-2025		TLM1	
2.	Basic considerations of machine elements	1	01-07-2025		TLM1	
3.	Basic considerations of machine elements	1	02-07-2025		TLM1	
4.	Designation of materials Selection of materials	1	05-07-2025		TLM1	
5.	Modes of failure Factor of safety	1	07-07-2025		TLM1	
6.	Theories of elastic failure – Maximum principal stress theory	1	08-07-2025		TLM1	
7.	Maximum Shear stress theory	1	09-07-2025		TLM1	
8.	Distortion energy theory	1	14-07-2025		TLM1	
9.	Problems on Theories of failure	1	15-07-2025		TLM1	
10.	Tutorial-1	1	16-07-2025		TLM3	
11.	Stress concentration - Stress concentration factors	1	19-07-2025		TLM1	
12.	Problems on Stress concentration factor	1	21-07-2025		TLM1	
13.	Methods of reducing stress concentration	1	22-07-2025		TLM1	
14.	Notch sensitivity, Fluctuating stresses	1	23-07-2025		TLM1	
15.	Fatigue failure, Endurance limit, S-N diagram	1	26-07-2025		TLM1	
16.	Soderberg and Goodman theories	1	28-07-2025		TLM1	
17.	Tutorial-2	1	29-07-2025		TLM3	
18.	Design for infinite life	1	30-07-2025		TLM1	
No. of classes required to complete UNIT-I : 18					No. of classes taken:	

UNIT-II : DESIGN OF BOLTED AND WELDED JOINTS

S.No.	Topics to be covered	No. of Classes	Tentative Date of	Actual Date of	Teaching Learning	HOD Sign

		Required	Completion	Completion	Methods	Weekly
19.	Threaded fasteners	1	02-08-2025		TLM1, TLM2	
20.	preload of bolts	1	04-08-2025		TLM1	
21.	various stresses induced in the bolts	1	05-08-2025		TLM1	
22.	Torque requirement for bolt tightening	1	06-08-2025		TLM1	
23.	gasketed joints	1	09-08-2025		TLM1	
24.	Tutorial-3	1	11-08-2025		TLM3	
25.	Introduction to welding joints Butt joints-Fillet joints	1	12-08-2025		TLM1	
26.	Strength of butt welds- Strength of parallel fillet welds	1	13-08-2025		TLM1	
27.	Strength of transverse fillet welds Maximum shear stress in parallel fillet welds	1	16-08-2025		TLM1	
28.	Maximum shear stress in transverse fillet welds	1	18-08-2025		TLM1	
29.	Axially loaded unsymmetrical Welded joints	1	19-08-2025		TLM1	
30.	Welded joint subjected to bending moment	1	20-08-2025		TLM1	
31.	Tutorial-4	1	23-08-2025		TLM3	
No. of classes required to complete UNIT-II : 13					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
32.	Introduction to transmission shafts	1	01-09-2025		TLM1	
33.	Shaft design on strength basis	1	02-09-2025		TLM1	
34.	Shafts subjected to combined twisting moment and bending moment	1	03-09-2025		TLM1	
35.	Design of shafts carrying gears & pulleys with flat belts	1	06-09-2025		TLM1	
36.	Problems on shafts	1	08-09-2025		TLM1	

37.	Tutorial-5	1	09-09-2025		TLM3	
38.	Shaft design on torsional rigidity basis	1	10-09-2025		TLM1	
39.	Types of keys Key failures by shear and compression	1	13-09-2025		TLM1	
40.	Design of saddle and sunk keys	1	15-09-2025		TLM1	
41.	Types of couplings	1	16-09-2025		TLM1	
42.	Design of flange couplings	1	17-09-2025		TLM1	
43.	Design of bushed pin couplings	1	20-09-2025		TLM1	
44.	Tutorial-6	1	22-09-2025		TLM3	
No. of classes required to complete UNIT-III : 13					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
45.	Introduction to spur gears	1	23-09-2025		TLM1	
46.	Lewis Equation	1	24-09-2025		TLM1	
47.	Beam strength of gear tooth	1	27-09-2025		TLM1	
48.	Design of spur gears for dynamic loads	1	29-09-2025		TLM1	
49.	Design of spur gears for wear loads	1	30-09-2025		TLM1	
50.	Tutorial-7	1	01-10-2025		TLM3	
51.	Types of springs	1	04-10-2025		TLM1	
52.	Design of helical compression & tension springs	1	06-10-2025		TLM1	
53.	Problems on design of helical springs	1	07-10-2025		TLM1	
54.	Tutorial-8	1	08-10-2025		TLM3	
No. of classes required to complete UNIT-IV : 10					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
55.	Types of Journal bearings	1	11-10-2025		TLM1	
56.	Bearing materials Bearing failures	1	13-10-2025		TLM1, TLM2	
57.	Theory of lubrication	1	14-10-2025		TLM1	
58.	Selection of bearing modulus from design tables, Mc Kee's equation	1	15-10-2025		TLM1	

59.	Heat generation and heat dissipation of bearings	1	18-10-2025		TLM1	
60.	Journal bearing design	1	20-10-2025		TLM1	
61.	Tutorial-9	1	21-10-2025		TLM3	
62.	Static load carrying capacity, Dynamic load carrying capacity	1	22-10-2025		TLM1	
63.	Selection of bearings from manufacturer's catalogue	1	25-10-2025		TLM1	
64.	Load factors, Equivalent bearing load, Selection of bearing life	1	27-10-2025		TLM1	
65.	Design for cyclic loads and speeds	1	28-10-2025		TLM1	
66.	Tutorial-10	1	29-10-2025		TLM3	
No. of classes required to complete UNIT-V : 10					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
67.	Design of Cotter & Knuckle joints	1	01-11-2025		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 (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	30-06-2025	23-08-2025	8 W
Technical Training	25-08-2025	06-09-2025	2 W
I Mid Examinations	08-09-2025	13-09-2025	1 W
II Phase of Instructions	15-09-2025	15-11-2025	9 W
II Mid Examinations	17-11-2025	22-11-2025	1 W
Preparation and Practicals	24-11-2025	29-11-2025	1 W
Semester End Examinations	01-12-2025	13-12-2025	2 W

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 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	**IndividualandCollaborativeTeamwork:**Functioneffectivelyasanindividual,and as a member or leader in diverse/multi-disciplinary teams
PO 9	**Communication:** Communicate effectively and inclusively within the engineering communityandsocietyatlarge,suchasbeingabletocomprehendandwriteeffective reportsanddesigndocumentation,makeeffectivepresentationsconsidering cultural, language, and learning differences
PO 10	**Project Management and Finance**: Apply knowledge and understanding of engineeringmanagementprinciplesandeconomicdecision-makingandapplytheseto one's own work, as a member and leader in a team, and to manage projects and in multidisciplinary environments.
PO 11	**Life Long Learning:** Recognize the need for, and have the preparation and ability for i) independent and life-long learning ii) adaptability to new and emerging technologies and iii) critical thinking in the broadest context of technological change. (WK8)

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

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

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Phone: 08659-222933, Fax: 08659-222931

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor: Dr M B S Sreekara Reddy

Course Name & Code	**: INDUSTRIAL ROBOTICS – 23ME16**	**Regulation**: R23
L-T-P Structure	**: 3-0-0**	**Credits:** 3
Program/Sem	: B.Tech V Sem	**A.Y.:** 2025-2026

PREREQUISITE: Engineering Mechanics & Kinematics of Machines

COURSE EDUCATIONAL OBJECTIVES (CEOs): This course aims to equip students with foundational knowledge of industrial robotic systems, including their components, applications, and actuation mechanisms. It covers essential topics such as robot kinematics, programming principles, and control systems. Additionally, students will explore the role of image processing and machine vision in robotic applications.

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

CO1	Comprehend the anatomy of a robot and identify the components, configurations, and industrial applications of robotic systems. **(Understanding – L2)**
CO2	Describe the types, characteristics, and selection criteria of actuators and sensors used in robotic systems. **(Understanding – L2)**
CO3	Analyze and solve problems related to forward and inverse kinematics of robotic manipulators. **(Analyzing – L4)**
CO4	Demonstrate the principles of trajectory planning, learn robot programming, and utilize programming languages for robot control. **(Applying – L3)**
CO5	Describe the principles and applications of image processing and machine vision in robotics. **(Understanding – L2)**

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

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	3	--	--	--	--	1	--	--	--	--	--	1	--	2	3
CO2	3	3	2	--	--	--	--	--	--	--	--	1	--	2	2
CO3	3	3	2	--	--	--	--	--	--	--	--	1	--	2	3
CO4	2	--	--	--	2	2	--	--	--	--	--	1	--	2	1
CO5	1	2	2		2	--	--	--	--	--	--	1	--	1	1
1 - Low 2 –Medium 3 - High															

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

TEXTBOOKS:

1. Saeed B.Niku, Introduction to robotics- analysis, systems &application, Second Edition, Willy India Private Limited, New Delhi,2011.
2. R.K.Mittal and IJ Nagrath, Robotics and Control, Tata McGraw–Hill Publishing company Limited, New Delhi, 2003.

REFERENCE BOOKS:

1. Mikell P.Groover, Mitchell Weiss, Roger N. Nagel and Nicholas G. Odrey,Ashish Dutta, Industrial Robotics, Second Edition McGraw- Hill Education (India) PrivateLimited,2012
2. Robert J.Schilling, Fundamentals of robotics analysis & control, PHI learning privateLimited, New Delhi,4th Edition 2002
3. John.JCriag, Introduction to Robotics-Mechanics and Control, Third Edition, PearsonEducation,Inc., 2008.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN): Section - A

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	HOD Sign Weekly
1	**Introduction to Robotics:** CEOs, Course Outcomes, POs and PSOs	1	30-06-2025		TLM 2	
2	Automation and Robotics, CAD/CAM and Robotics	1	01-07-2025		TLM 2	
3	Classification by coordinate system.	1	02-07-2025		TLM 2	
4	Classification by control system.	1	04-07-2025		TLM 2	
5	Robot anatomy, work volume,	1	07-07-2025		TLM 2	
6	Robot components, number of degrees of freedom	1	08-07-2025		TLM 2	
7	Robot drive systems	1	09-07-2025		TLM 2	
8	Present and future applications	1	11-07-2025		TLM 2	
9	End effectors: Classification	1	14-07-2025		TLM 1	
10	End effectors explanation	1	15-07-2025		TLM 1	
11	Requirements and challenges of end effectors	1	16-07-2025		TLM 1	
12	Determination of the end effectors.	1	18-07-2025		TLM 1	
No. of classes required to complete UNIT-I: 12				**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	HOD Sign Weekly
13	Actuators: Introduction	1	21-07-2025		TLM 1	
14	Characteristics of actuators		22-07-2025		TLM 1	
15	Pneumatic actuators	1	23-07-2025		TLM 2	
16	Hydraulic actuators	1	25-07-2025		TLM 2	

17	Electric& stepper motors	1	28-07-2025		TLM 1	
18	Comparison of Electric, Hydraulic and Pneumatic types of actuation devices.	1	29-07-2025		TLM 2	
19	Feedback components: Types	1	30-07-2025		TLM 2	
20	Position sensors– potentiometers, resolvers	1	04-08-2025		TLM 2	
21	Encoders	1	05-08-2025		TLM 2	
22	Velocity sensors.	1	06-08-2025		TLM 2	
23	Revision of Unit II	1	08-08-2025		TLM 2	
No. of classes required to complete UNIT-II: 11				**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	HOD Sign Weekly
23	Introduction to Manipulator Kinematics	1	11-08-2025		TLM 1	
24	Coordinate Frames, Description of Objects in space	1	12-08-2025		TLM 1	
25	Transformation of vectors	1	13-08-2025		TLM 1	
26	Homogeneous transformation	1	18-08-2025		TLM 1	
27	Inverting a Homogeneous Transform	1	19-08-2025		TLM 1	
28	Problems	1	20-08-2025		TLM 3	
29	Fundamental Transformations	1	22-08-2025		TLM 1	
30	Problems on rotations and translations	1	01-09-2025		TLM 3	
31	D-H representation	1	02-09-2025		TLM 1	
32	Problems on Forward Kinematics	1	03-09-2025		TLM 1	
33	Problems on Forward Kinematics	1	05-09-2025		TLM 3	
34	Inverse Kinematics	1	08-09-2025		TLM 1	
35	Problems on Inverse Kinematics	1	09-09-2025		TLM 3	
No. of classes required to complete UNIT-III: 12				**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	HOD Sign Weekly
36	Introduction to Trajectory Planning	1	10-09-2025		TLM 1	
37	Considerations on Trajectory Planning	1	12-09-2025		TLM 1	
38	Joint Interpolated Trajectory	1	15-09-2025		TLM 1	
39	Problems on Joint interpolated trajectory	1	16-09-2025		TLM 1	
40	Problems on Joint interpolated trajectory	1	17-09-2025		TLM 3	
41	Cartesian Path Trajectory	1	19-09-2025		TLM 1	
42	Problems	1	22-09-2025		TLM 1	
43	Problems		23-09-2025		TLM 3	
44	Robot programming	1	24-09-2025		TLM 1	
45	Languages	1	26-09-2025		TLM 1	
46	Software packages	1	06-10-2025		TLM 1	
47	Description of paths with a robot programming language.	1	07-10-2025		TLM 1	
48	Revision of Unit IV	1	08-10-2025		TLM 2	
No. of classes required to complete UNIT-IV: 13				**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	HOD Sign Weekly
49	Introduction to Machine Vision	1	10-10-2025		TLM 2	
50	Machine vision in Robotics	1	13-10-2025		TLM 2	
51	Sensing	1	14-10-2025		TLM 2	
52	Digitizing	1	15-10-2025		TLM 2	
53	Sensing and Digitizing function in Machine Vision	1	17-10-2025		TLM 2	
54	Training Vision System	1	20-10-2025		TLM 2	
55	Training Vision System	1	22-10-2025		TLM 2	
56	Robotic Applications	1	24-10-2025		TLM 2	
57	Robotic Applications	1	27-10-2025		TLM 2	
58	Revision of Unit V	1	28-10-2025		TLM 2	

No. of classes required to complete UNIT-V: 10	No. of classes taken:

CONTENT BEYOND SYLLABUS

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
59	Differential Transformations	1	29-10-2025		TLM2	
60	Jacobian	1	31-10-2025		TLM2	

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

Academic Calander: 2025-25

Description	From	To	Weeks
B. Tech III semester			
Commencement of class work	30-06-2025		
I phase of Instructions	30-06-2025	23-08-2025	8 weeks
I Mid examinations	25-08-2025	30-08-2025	1 week
II phase of Instructions	01-09-2025	01-11-2025	9 weeks
II Mid examinations	03-11-2025	08-11-2025	1 week
Preparation and practical's	10-11-2025	15-11-2025	1 week
Semester end examinations	17-11-2025	29-11-2025	2 weeks

PART-C

EVALUATION PROCESS (R23 Regulation):

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

Semester End Examination (SEE)	70
Total Marks = CIE + SEE	100

PART-D

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

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

PROGRAMME OUTCOMES (POs):

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

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

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

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Phone: 08659-222933, Fax: 08659-222931

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:** 2025-26

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	02-07-2025		TLM1	
2.	Components	1	04-07-2025		TLM1	
3.	Vehicle Mechanics	1	05-07-2025		TLM1	
4.	Roadway Fundamentals	1	09-07-2025		TLM1	
5.	Roadway Fundamentals	1	11-07-2025		TLM1	
6.	Vehicle Kinetics	1	16-07-2025		TLM1	
7.	Dynamics of vehicle motion	1	18-07-2025		TLM1	
8.	Dynamics of vehicle motion	1	19-07-2025		TLM1	
9.	Propulsion system design.	1	23-07-2025		TLM1	
10.	Propulsion system design.	1	25-07-2025		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	26-07-2025		TLM1	
12	Parameters	1	30-07-2025		TLM1	
13	Capacity	1	01-08-2025		TLM1	
14	Discharge Rate	1	02-08-2025		TLM1	
15	Sate of charge	1	06-08-2025		TLM1	
16	State of Discharge	1	08-08-2025		TLM1	
17	Depth od Discharge				TLM1	
18	Technical Characteristics	1	13-08-2025		TLM1	
19	Battery pack Design	1	16-08-2025		TLM2	
20	Battery pack Design	1	20-08-2025		TLM2	
21	Properties of Batteries	1	20-08-2025		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	22-08-2025		TLM1	

23	Motor & Engine rating, requirements	1	23-08-2025		TLM1	
25	DC machines	1	03-09-2025		TLM1	
26.	DC machines	1	06-09-2025		TLM1	
27.	Three phase A.C. Machines	1	10-09-2025		TLM1	
29.	Three phase A.C. Machines	1	12-09-2025		TLM1	
30.	Induction Machines	1	17-09-2025		TLM1	
31	Permanent magnet machines	1	19-09-2025		TLM1	
32	Permanent magnet machines	1	20-09-2025		TLM1	
33.	Switched reluctance machines	1	24-09-2025		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
34	Transmission Configuration	1	26-09-2025		TLM1	
36	Components	1	27-09-2025		TLM1	
37	gears	1	03-10-2025		TLM1	
38	differential	1	04-10-2025		TLM1	
39	clutch	1	08-10-2025		TLM1	
40	brakes	1	10-10-2025		TLM2	
41	Regenerative braking	1	15-10-2025		TLM1	
43	Motor sizing	1	17-10-2025		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
45	Types	1	18-10-2025		TLM1	
46	Series	1	22-10-2025		TLM1	
47	Parallel and series	1	24-10-2025		TLM1	
48	Parallel configuration	1	25-10-2025		TLM1	
49	Design	1	29-10-2025		TLM1	
50	Drive train	1	31-10-2025		TLM2	
51	Sizing of components	1	01-11-2025		TLM2	
57	Revision unit-V	1	01-11-2025		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	29-10-2025		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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DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code : **23ME58** **Thermal Engineering Lab**
Lab/Practical's : **3 hrs/ Week** **Continuous Internal Assessment** : **30**
A.Y. : **2025-26** **Semester End Examination** : **70**
Class & Semester : **B. Tech – V Sem**
Instructors : **Dr. P. RAVINDRA KUMAR /Mr. K.SAI BABU**

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	1	3	-	-	-	2	1	1	-	3	-	-
CO2	3	2	1	3	-	-	-	2	2	2	-	3	-	3
CO3	3	2	1	3	-	-	-	2	2	2	-	3	-	-
CO4	2	3	1	2	-	-	-	2	1	1	-	2	-	-

Title	Course Instructor/ Coordinator	Module Coordinator	Head of the Department
Name of the Faculty	Dr. P. Ravindra Kumar	Dr. P. Vijay Kumar	Dr. M.B.S.S Reddy
Signature			

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DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code	**: 23ME58**	**Lab**	**:TE LAB**
Lab/Practical's	**: 3 hrs/ Week**	**Continuous Internal Assessment**	**: 30**
A.Y.	**: 2025-26**	**Semester End Examination**	**: 70**
Class & Semester	**: B. Tech – V Sem**		
Instructors	**: Dr. P. RAVINDRA KUMAR /Mr. K.SAI BABU**		

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

Title	Course Instructor/ Coordinator	Module Coordinator	Head of the Department
Name of the Faculty	Dr. P. Ravindra Kumar	Dr. P. Vijay Kumar	Dr. M.B.S.S Reddy
Signature			

Knowledge and Attitude Profile (WK)

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

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

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

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

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

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

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

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

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

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, & 24765A0301-308 = 70

Thursday : Batch B1 :23761A0301 to 337 = 35
Monday : Batch B2 :23761A0338 to 24765A0308 = 35

Sub Batches of B1:

S. No	Batch	Registered Nos	Total
1	$B1_1$	23761A0301-307	07
2	$B1_2$	23761A0308-315	07
3	$B1_3$	23761A0316-323	07
4	$B1_4$	23761A0324-330	07
5	$B1_5$	23761A0331-337	07
Total			35

Sub Batches of B2:

S. No	Batch	Registered Nos	Total
1	$B2_1$	23761A0338-344	07
2	$B2_2$	23761A0345-351	07
3	$B2_3$	23761A0352-358	07
4	$B2_4$	23761A0359-24765A0301	07
5	$B2_5$	24765A0302-24765A0308	07
Total			35

Title	Course Instructor/ Coordinator	Module Coordinator	Head of the Department
Name of the Faculty	Dr. P. Ravindra Kumar	Dr. P. Vijay Kumar	Dr. M.B.S.S Reddy
Signature			

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.
Phone: 08659-222933, Fax: 08659-222931

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. P. RAVINDRA KUMAR /Mr. K.SAI BABU

S. No	Date		Batch (Thursday)			
		$B1_1$	$B1_2$	$B1_3$	$B1_4$	$B1_5$
1	03/07/2025	**Demonstration of TE Lab, COs, POs, PSOs, Cycle -I**				
2	10/07/2025	TE – 1	TE – 2	TE – 3	TE – 4	TE – 5
3	17/07/2025	TE – 2	TE – 3	TE – 4	TE – 5	TE – 1
4	24/07/2025	TE – 3	TE – 4	TE – 5	TE – 1	TE – 2
5	31/07/2025	TE – 4	TE – 5	TE – 1	TE – 2	TE – 3
6	07/08/2025	TE – 5	TE – 1	TE – 2	TE – 3	TE – 4
7	14/08/2025	Repetition/Revision/Viva -Voce				
8	21/08/2025	Repetition/Revision/Viva-Voce				
25/08/2025-30/08/2025		**I Mid Examinations**				
S. No	**Date**	**$B1_6$**	**$B1_7$**	**$B1_8$**	**$B1_9$**	**$B1_{10}$**
9	04/09/2025	**Demonstration of TE Lab - Cycle II**				
10	11/09/2025	TE – 6	TE – 7	TE– 8	TE – 9	TE- 10
11	18/09/2025	TE – 7	TE – 8	TE –9	TE – 10	TE – 6
12	25/09/2025	TE – 8	TE –9	TE – 10	TE – 6	TE –7
13	09/10/2025	TE – 9	TE – 10	TE – 6	TE –7	TE – 8
14	16/10/2025	TE – 10	TE – 6	TE– 7	TE– 8	TE – 9
15	23/10/2025	Repetition/Revision/Viva-Voce				
16	30/10/2025	**Internal Examination**				
03/11/2025-08/11/2025		**II Mid Examinations**				

Title	**Course Instructor/ Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**Dr. P. Ravindra Kumar**	**Dr. P. Vijay Kumar**	**Dr. M.B.S.S Reddy**
Signature			

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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. P. RAVINDRA KUMAR /Mr. K.SAI BABU

S. No	Date		Batch (Monday)			
		$B2_1$	**$B2_2$**	**$B2_3$**	**$B2_4$**	**$B2_5$**
1	30/06/2025		**Demonstration of TE Lab, COs, POs, PSOs, Cycle -I**			
2	07/07/2025	TE – 1	TE – 2	TE – 3	TE – 4	TE – 5
3	14/07/2025	TE – 2	TE – 3	TE – 4	TE – 5	TE – 1
4	21/07/2025	TE – 3	TE – 4	TE – 5	TE – 1	TE – 2
5	28/07/2025	TE – 4	TE – 5	TE – 1	TE – 2	TE – 3
6	04/08/2025	TE – 5	TE – 1	TE – 2	TE – 3	TE – 4
7	11/08/2025	Repetition/Revision/Viva -Voce				
8	18/08/2025	Repetition/Revision/Viva-Voce				
25/08/2025-30/08-2025		**I Mid Examinations**				
S. No	**Date**	**$B2_6$**	**$B2_7$**	**$B2_8$**	**$B2_9$**	**$B2_{10}$**
	01/09/2025	**Demonstration of TE Lab - Cycle II**				
7	08/09/2025	TE – 6	TE – 7	TE– 8	TE – 9	TE- 10
8	15/09/2025	TE – 7	TE – 8	TE –9	TE – 10	TE – 6
9	22/09/2025	TE – 8	TE –9	TE – 10	TE – 6	TE –7
10	06/10/2025	TE – 9	TE – 10	TE – 6	TE –7	TE – 8
11	13/10/2025	TE – 10	TE – 6	TE– 7	TE– 8	TE – 9
12	20/10/2025	Repetition/Revision/Viva -Voce				
13	27/10/2025	**Internal Examination**				
03/11/2025-08/11/2025		**II Mid Examinations**				

Title	**Course Instructor/ Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**Dr. P. Ravindra Kumar**	**Dr. P. Vijay Kumar**	**Dr. M.B.S.S Reddy**
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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. P. RAVINDRA KUMAR /Mr. K.SAI BABU**

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. P. Ravindra Kumar**	**Dr. P. Vijay Kumar**	**Dr. M.B.S.S Reddy**
Signature			

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
DEPARTMENT OF MECHANICAL ENGINEERING
(Autonomous & Affiliated to JNTUK, Kakinada & Approved by AICTE, New Delhi, NAAC Accredited with 'A' grade, accredited by NBA Tier-I, Certified by ISO 9001:2015)
L B Reddy Nagar, Mylavaram-521 230, Krishna District, Andhra Pradesh.

COURSE HANDOUT

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

ACADEMIC YEAR : 2025-2026

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

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

COURSE CREDITS : 1.5

COURSE INSTRUCTOR : Dr.Ch.Siva Sankara Babu/Mr.K.Venkateswara Reddy

COURSE COORDINATOR : Mr.K.V. Viswanadh

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 (23761A0301 to 23761A0337)

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	30-06-2025		TLM8	-	
2.	Experiment-1	3	07-07-2025		TLM8	R1	
3.	Experiment-2	3	14-07-2025		TLM8	R1	
4.	Experiment-3	3	21-07-2025		TLM8	R1	
5.	Experiment-4	3	28-07-2025		TLM8	R1	
6.	Experiment-5	3	04-08-2025		TLM8	R1	
7.	Demonstration	3	11-08-2025		TLM8	-	
8.	**I MID EXAMINATION (25-08-2025 TO 30-08-2025)**						
9.	Experiment-6	3	18-08-2025		TLM8	R1	
10.	Experiment-7	3	01-09-2025		TLM8	R1	
11.	Experiment-8	3	08-09-2025		TLM8	R1	
12.	Experiment-9	3	15-09-2025		TLM8	R1	
13.	Experiment-10	3	22-09-2025		TLM8	R1	
14.	Repetition	3	06-10-2025		TLM8	R1	
15.	Lab Internal	3	27-10-2025		-	-	

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.	Balancing of reciprocating masses & Gyroscope	3	13-10-2025		TLM8	-	

Batch: A2 (23761A0338 to 23761A0364 &24765A0301 to 24765A0308)

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	03-07-2025		TLM8	-	
2.	Experiment-1	3	10-07-2025		TLM8	R1	
3.	Experiment-2	3	17-07-2025		TLM8	R1	
4.	Experiment-3	3	24-07-2025		TLM8	R1	
5.	Experiment-4	3	31-07-2025		TLM8	R1	
6.	Experiment-5	3	07-08-2025		TLM8	R1	
7.	Demonstration	3	14-08-2025		TLM8	-	
8.	**I MID EXAMINATION (25-08-2025 TO 30-08-2025)**						
9.	Experiment-6	3	21-08-2025		TLM8	R1	
10.	Experiment-7	3	04-09-2025		TLM8	R1	
11.	Experiment-8	3	11-09-2025		TLM8	R1	
12.	Experiment-9	3	18-09-2025		TLM8	R1	

13.	Experiment-10	3	25-09-2025		TLM8	R1	
14.	Repetition	3	09-10-2025, 16-10-2025		TLM8	-	
15.	Lab Internal	3	30-10-2025		-	-	

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.	Balancing of reciprocating masses & Gyroscope	3	23-10-2025		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	30/06/2025	23/08/2025	8
I Mid Examinations	25/08/2025	30/08/2025	1
II Phase of Instructions	01/09/2025	01/11/2025	9
II Mid Examinations	03/11/2025	08/11/2025	1
Preparation and Practicals	10/11/2025	15/11/2025	1
Semester End Examinations	17/11/2025	29/11/2025	2

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	23761A0301-307	07
A1B	23761A0308-315	07
A1C	23761A0316-323	07
A1D	23761A0324-330	07
A1E	23761A0331-337	07

Batch No.	Reg. No. of Students	Number of Students
A2A	20761A0338-344	07
A2B	20761A0345-351	07
A2C	20761A0352-358	07
A2D	20761A0359-364, 24765A0301	07
A2E	24765A0302-308	07

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	Study the cam jump phenomenon of various cams and followers.	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 damped and undamped forced vibrations of beams.	CO4
TOM7	Determination of natural frequency of torsional vibrations of a single rotor system.	CO4
TOM8	Determination of natural frequency of the spring-mass damped and undamped systems.	CO4
TOM9	Balance the given rotor system dynamically with the aid of the force polygon and the couple polygon.	CO3
TOM10	Verification of Dunkerley's formula for transverse vibrations of beams with different end conditions.	CO4

NOTIFICATION OF CYCLE

Cycle	Exp.No.	Name of the Experiment	Related CO
Cycle-1	TOM1	Study the cam jump phenomenon of various cams and followers.	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 damped and undamped forced vibrations of beams.	CO4
	TOM7	Determination of natural frequency of torsional vibrations of a single rotor system.	CO4
	TOM8	Determination of natural frequency of the spring-mass damped and undamped systems.	CO4
	TOM9	Balance the given rotor system dynamically with the aid of the force polygon and the couple polygon.	CO3
	TOM10	Verification of Dunkerley's formula for transverse vibrations of beams with different end conditions.	CO4

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.Ch.Siva Sankara Babu	**Mr.K.V.Viswanadh**	**Dr.B.Sudheer Kumar**	**Dr.M.B.S.Sreekara Reddy**

Mr.K.Venkateswara Reddy			
Course Instructor(s)	**Course Coordinator**	**Module Coordinator**	**HOD**

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DEPARTMENT OF MECHANICAL ENGINEERING

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

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 callipers, micrometres, 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)															

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

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DEPARTMENT OF MECHANICAL ENGINEERING

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

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 resourceuse, environmentalimpacts,whole-lifecost,re- use of resources, net zero carbon, and similar concepts, that supports engineering design and operations in a practice area.

WK6: Knowledgeofengineeringpractice(technology)inthepracticeareasintheengineering discipline.

WK7: Knowledge of the role of engineering insociety and identified issues in engineering practiceinthediscipline,suchastheprofessionalresponsibilityofanengineertopublic safety and sustainable development.

WK8: Engagementwithselectedknowledgeinthecurrentresearchliteratureofthediscipline, 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,andnormsofengineeringpractice.Awarenessoftheneedfordiversity by reason of ethnicity, gender, age, physical ability etc. with mutual understanding andrespect,

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&interpretationofdatatoprovidevalidconclusions. (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 withreferencetoeconomy,health,safety,legalframework,cultureandenvironment. (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	**IndividualandCollaborativeTeamwork:**Functioneffectivelyasanindividual,and as a member or leader in diverse/multi-disciplinary teams
PO 9	**Communication:** Communicate effectively and inclusively within the engineering communityandsocietyatlarge,suchasbeingabletocomprehendandwriteeffective reportsanddesigndocumentation,makeeffectivepresentationsconsidering 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	**LongLearning:**Recognizetheneedfor,andhavethepreparationandabilityfor i)independentandlife-longlearningii)adaptabilitytonewandemergingtechnologies 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.

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

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.
Phone: 08659-222933, Fax: 08659-222931

DEPARTMENT OF MECHANICAL ENGINEERING

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

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**

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DEPARTMENT OF MECHANICAL ENGINEERING

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

Batches (Section – A)

S. No	Batches	Regd. Nos	Total No. of Students
1	B. Tech – V Sem - A/S	23761A0301-12, 314-321, 323- 337 23761A0338-364, 24765A0301-308	70
2	Batch B1	23761A0301-12, 314-321, 323- 337	35
3	Batch B2	23761A0338-364, 24765A0301-308	35

Sub Batch of A1: Machine Tools

S. No	Batch	Registered Nos	Total
1		23761A0301-3	04
2		23761A0304-6	03
3		23761A0307-9	03
4		23761A0310-12	03
5		23761A0314-16	03
6		23761A0317-18	02
Total (Cycle 1) Lathe machines			17

S. No	Batch	Registered Nos	Total
7		23761A0319-21	03
8		23761A0323-25	03
9		23761A0326-28	03
10		23761A0329-321	03
11		23761A0322-224	03
12		23761A0335-37	03
Total (C12) Special Machines			18

Sub Batches of A2: Metrology

S. No	Batch	Registered Nos	Total
1		23761A0338-340	03
2		23761A0341-343	03
3		23761A0344-346	03
4		23761A0347-349	03
5		23761A0350-352	03
6		23761A0353-355	03
Total (C21)			17

S. No	Batch	Registered Nos	Total
7		23761A0356-358	03
8		23761A0359-361	03
9		23761A0362-364	03
10		24765A0301-303	03
11		24765A0304-306	03
12		24765A0307-308	02
Total (C22)			18

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DEPARTMENT OF MECHANICAL ENGINEERING

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

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 instrumentby Taly Surf.

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DEPARTMENT OF MECHANICAL ENGINEERING

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

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

S.No	Batches	Regd.No's	Total No. of Students
1	B. Tech –A/S	23761A0301-12, 314-321, 323- 337 23761A0338-364, 24765A0301-308	70
2	Batch B1	23761A0301-12, 314-321, 323- 337	35
3	Batch B2	23761A0338-364, 24765A0301-308	35

Date	Experiment (Batch)					
	Ex - 1	**Ex – 2**	**Ex – 3**	**Ex – 4**	**Ex – 5**	**Ex – 6**
05.07.2025	**Demonstration of all experiments, CEOs and COs of the Laboratory (Ex – 01 to 06)**					
MACHINE TOOLS LAB						
19.07.2025	B111	B112	B113	B114	B115	B116
26.07.2025	B116	B111	B112	B113	B114	B115
02.08.2025	B115	B116	B111	B112	B113	B114
16.08.2025	B114	B115	B116	B111	B112	B113
23.08.2025	B113	B114	B115	B116	B111	B112
06.09.2025	B112	B113	B114	B115	B116	B111
I Mid Examinations 25.08.2025 to 30.08.2025						
	Ex - 1	**Ex – 2**	**Ex – 3**	**Ex – 4**	**Ex – 5**	**Ex – 6**
20.09.2025	B121	B122	B123	B124	B125	B126
27.09.2025	B126	B121	B122	B123	B124	B125
04.10.2025	B125	B126	B121	B122	B123	B124
18.10.2025	B124	B125	B126	B121	B122	B123
25.10.2025	B123	B124	B125	B126	B121	B122
01.11.2025	B122	B123	B124	B125	B126	B121
II Mid Examinations 03.11.2025 to 08.11.2025						

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

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DEPARTMENT OF MECHANICAL ENGINEERING

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

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

S.No	Batches	Regd.No's	Total No. of Students
1	B. Tech –A/S	23761A0301-12, 314-321, 323- 337 23761A0338-364, 24765A0301-308	70
2	Batch B1	23761A0301-12, 314-321, 323- 337	35
3	Batch B2	23761A0338-364, 24765A0301-308	35

Date	Experiment (Batch)					
	Ex - 1	**Ex – 2**	**Ex – 3**	**Ex – 4**	**Ex – 5**	**Ex – 6**
05.07.2025	**Demonstration of all experiments, CEOs and COs of the Laboratory (Ex – 01 to 06)**					
MACHINE TOOLS LAB						
19.07.2025	B121	B122	B123	B124	B125	B126
26.07.2025	B126	B121	B122	B123	B124	B125
02.08.2025	B125	B126	B121	B122	B123	B124
16.08.2025	B124	B125	B126	B121	B122	B123
23.08.2025	B123	B124	B125	B126	B121	B122
06.09.2025	B122	B123	B124	B125	B126	B121
I Mid Examinations 25.08.2025 to 30.08.2025						
	Ex - 1	**Ex – 2**	**Ex – 3**	**Ex – 4**	**Ex – 5**	**Ex – 6**
20.09.2025	B111	B112	B113	B114	B115	B116
27.09.2025	B116	B111	B112	B113	B114	B115
04.10.2025	B115	B116	B111	B112	B113	B114
18.10.2025	B114	B115	B116	B111	B112	B113
25.10.2025	B113	B114	B115	B116	B111	B112
01.11.2025	B112	B113	B114	B115	B116	B111
II Mid Examinations 03.11.2025 to 08.11.2025						

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 NIRF-2022 (Positioned in the Band of 251-300 in the Engineering Category)NIRF-2023 (Positioned in the Band of 101-150 in the Innovation Category)
NBA Accredited under Tier-I (ECE, EEE, CSE, IT, ME, CIV, ASE)
Recognized as Scientific Industrial Research Organization(SIRO) by DSIR
Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada
L.B.Reddy Nagar, Mylavaram-521230, N.T.R Dist., Andhra Pradesh, India.

Department of Mechanical Engineering

COURSE HANDOUT

PART-A:

Program : B.Tech. V-Sem., Mechanical Engineering
Academic Year : 2025-26
Course Name & Code : Tinkering Lab – 23EM01
L-T-P-Cr : 0-0-3-1.5
Course Instructure : Mr.P. Venkateswara Rao, Dr.A. Nageswara Rao, Mr.V.Sankararao

Course Objectives:

1. 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
2. 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.	L3
CO 2	Inculcate innovative and entrepreneurial mind-set through Design thinking and Hands-on Learning.	L3
CO 3	Develop basic knowledge in electrical and mechanical engineering principles.	L3
CO 4	Develop skills of using hand tools to construct a prototype of an engineering design.	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															
CO 2															
CO 3															
CO 4															

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**	01-07-2025		TLM4	
2.	Make your own parallel and series circuits using breadboard for any application of your choice.	2	08-07-2025		TLM4	
3.	Demonstrate a traffic light circuit using breadboard.	2	15-07-2025		TLM4	
4.	Build and demonstrate automatic Street Light using LDR.	2	22-07-2025		TLM4	
5.	Simulate the Arduino LED blinking activity in Tinkercad.	2	29-07-2025		TLM4	
6.	Build and demonstrate an Arduino LED blinking activity using Arduino IDE.	2	05-08-2025		TLM4	
7.	Interfacing IR Sensor and Servo Motor with Arduino.	2	12-08-2025		TLM4	
8.	Blink LED using ESP32	2	19-08-2025		TLM4	
9.	LDR Interfacing with ESP32.	2	02-09-2025		TLM4	
10.	Control an LED using Mobile App.	2	09-09-2025		TLM4	
11.	Design and 3D print a Walking Robot	2	16-09-2025		TLM4	
12.	Design and 3D Print a Rocket.	2	23-09-2025		TLM4	
13.	Build a live soil moisture monitoring project, and monitor soil moisture levels of a remote plan in your computer dashboard.	2	07-10-2025		TLM4	
14.	Demonstrate all the steps in design thinking to redesign a motor bike.	2	14-10-2025		TLM4	
15.	Internal Lab Exam	2	28-10-2025			
No. of classes required:30				**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:	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9:	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10:	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11:	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12:	**Life-long learning**: Recognize the need for and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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.P. Venkateswara Rao Dr.A.Nageswara Rao Mr.V. sankara Rao			Dr. G. Srinivasulu