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

COURSE HANDOUT

PROGRAM : B.Tech, V-Sem, ME-A section

ACADEMIC YEAR : 2023-24

COURSE NAME & CODE : IC ENGINES AND GAS TURBINES (20ME10)

L-T-P STRUCTURE : 3-1-0

COURSE CREDITS : 3

COURSE INSTRUCTOR : Dr K.DILIP KUMAR

COURSE COORDINATOR : Dr P.VIJAY KUMAR

PRE-REQUISITE: THERMODYNAMICS

COURSE OBJECTIVE:
To provide students an insight of fundamentals and salient features of internal combustion engines and sub-systems, performance analysis, modern automotive engines, electric vehicles, gas turbines and aircraft propulsion systems.

COURSE OUTCOMES (CO):
CO1: Describe the construction and functioning of internal combustion engines fuel supply systems for SI and CI engines, modern automotive engines and electric vehicles **(Understanding Level-2)**
CO2: Comprehend the combustion characteristics of SI engines and CI engines. **(Understanding Level-2)**
CO3: Compute the IC engine performance parameters **(Apply Level-3)**
CO4: Understand the construction and functioning of gas turbines **(Understanding Level-2)**
CO5: Apply gas turbine cycles for aircraft propulsion systems **(Apply Level-3)**

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	2	-	1	3	-	-	-	-	2	3	1	2
CO2	3	-	-	3	1	2	-	-	-	-	-	3	3	1	2
CO3	3	-	3	3	1	1	3	-	2	-	-	2	3	1	2
CO4	3	-	3	1	2	1	-	-	-	-	-	2	3	1	2
CO5	3	3	2	-	-	1	3	1	-	-	-	2	3	1	2

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

BoS APPROVED TEXT BOOKS:

T1 V.Ganesan, Internal Combustion Engines-Tata McGraw-Hill, 4th Edition, 2017

T2 V.Ganesan,Gas Turbines--Tata McGraw-Hill, 3rd Edition, 20017

T3 John B.Heywood, Internal Combustion Engine Fundamentals, Tata McGraw-Hill, 4th Edition 2017

BOS APPROVED REFERENCE BOOKS:

R1 H.N.Gupta, Fundamentals of Internal Combustion engines, PHI 2nd Edition, 2013

R2 HIH Saravanamuttoo, Cohen Rogers, Gas Turbines theory, Pearson, 7th Edition 2019

COURSE DELIVERY PLAN (LESSON PLAN): Section-B

UNIT-I: INTRODUCTION TO IC ENGINES AND CARBURETORS & FUEL INJECTION

S.No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
1.	Introduction to IC Engines, classification, applications of IC Engines	01	04-07-2023		TLM1	CO1	T1/R1	
2.	Basic Engine components and Nomenclature	01	05-07-2023		TLM1	CO1	T1/R1	
3.	Working principle of four stroke SI and CI Engines	02	06-07-2023		TLM2	CO1	T1/R1	
4.	Working principle of two stroke SI and CI Engines	01	08-07-2023		TLM2	CO1	T1/R1	
5.	Tutorial-I	01	11-07-2023		TLM3	CO1	T1/R1	
6.	Comparison of two stroke and four stroke/ SI and CI engines	01	12-07-2023		TLM1	CO1	T1/R1	
7.	Ideal and actual cycles and their analysis	01	13-07-2023		TLM5	CO1	T1/R1	
8.	Valve and Port timing diagrams for four stroke and two stroke SI & CI engines	01	18-07-2023		TLM1/TLM2	CO1	T1/R1	
9.	Port timing diagrams for four stroke and two stroke SI & CI engines	01	19-07-2023		TLM1/TLM2	CO1	T1/R1	
10.	Air-fuel mixture requirements, construction and working of simple carburetor	01	20-07-2023		TLM2	CO2	T1/R1	
11.	Tutorial-2	01	22-07-2023		TLM3	CO1	T1/R1	
12.	Calculation of air-fuel ratio, requirements of fuel injection systems	01	25-07-2023		TLM1	CO1	T1/R1	
13.	Classification of injection systems, working principle of fuel injector	01	26-07-2023		TLM1/TLM2	CO1	T1/R1	
14.	Injection in SI and CI engines	01	27-07-2023		TLM1/TLM2	CO1	T1/R1	
15.	Assignment/Quiz-1	01	29-07-2023		TLM6	CO1	T1/R1	
No. of classes required to complete UNIT-I		15	No. of classes taken:					

UNIT-II: COMBUSTION IN SI AND CI ENGINES

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
16.	Combustion in SI engines-Stages of combustion normal and abnormal combustion	01	01-08-2023		TLM1	CO2	T1/R1	
17.	Effect of detonation Engine variables and other factors affecting knocking and its prevention	01	02-08-2023		TLM1	CO2	T1/R1	
18.	Theory of detonation in SI engines	01	03-08-2023		TLM1	CO2	T1/R1	
19.	Combustion chamber requirements-types of combustion chambers	01	05-08-2023		TLM1, TLM2	CO2	T1/R1	
20.	Octane number and rating of SI engine fuels	01	08-08-2023		TLM1	CO2	T1/R1	
21.	Tutorial-3 Stages of combustion in CI engines ,Variables affecting delay period	01	09-08-2023		TLM3	CO1	T1/R1	
22.	Diesel knock-methods of controlling diesel knock	01	10-08-2023		TLM1	CO2	T1/R1	
23.	CI engine combustion chamber requirements-Types of combustion chambers	01	12-08-2023		TLM1/TLM2	CO2	T1/R1	
24.	Cold starting of CI engines	01	16-08-2023		TLM1/TLM2	CO2	T1/R1	
25.	Tutorial-4 ,Cetane number and rating of CI engine fuels	01	17-08-2023		TLM3	CO1	T1/R1	
No. of classes required to complete UNIT-II		11						

UNIT-III: IC ENGINE PERFORMANCE, MODERN AUTOMOTIVE ENGINES, HYBRID VEHICLES

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
26.	Performance parameters for IC engines	01	19-08-2023		TLM1	CO3	T1/R1	
27.	Engine power and engine efficiency	01	22-08-2023		TLM1	CO3	T1/R1	
28.	Performance characteristics	01	23-08-2023		TLM1	CO3	T1/R1	
29.	Variables effecting Performance characteristics	01	24-08-2023		TLM1	CO3	T1/R1	
30.	Methods of improving engine performance	01	26-08-2023		TLM1, TLM2	CO3	T1/R1	
31.	Heat balance sheet	01	02-09-2023		TLM1	CO3	T1/R1	
32.	Tutorial-5	01	05-09-2023		TLM3	CO3	T1/R1	
33.	Modern automotive engines-introduction	01	06-09-2023		TLM1	CO3	T1/R1	

34.	Changes in fuel injection methods in SI and CI engines	01	07-09-2023		TLM1	CO3	T1/R1	
35.	Common rail direct injection system	01	09-09-2023		TLM1	CO3	T1/R1	
36.	Gasoline direct injection	01	12-09-2023		TLM1	CO3	T1/R1	
37.	Variable valve technology-VVT, DTSi Technology	01	13-09-2023		TLM2	CO3	T1/R1	
38.	Tutorial-6	01	14-09-2023		TLM3	CO3	T1/R1	
39.	Assignment/Quiz-3	01	16-09-2023		TLM6	CO3	T1/R1	
No. of classes required to complete UNIT-III		15			No. of classes taken:			

UNIT-IV: GAS TURBINES, INTERCOOLING, REHEATING, REGENERATION METHODS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
40.	Gas turbines-introduction	01	19-09-2023		TLM1	CO4	T2/R1	
41.	Development of gas turbines	01	20-09-2023		TLM1	CO4	T2/R1	
42.	Classification and application of gas turbines	01	21-09-2023		TLM1	CO4	T2/R1	
43.	Ideal and actual cycles	01	23-09-2023		TLM4	CO4	T2/R1	
44.	Effect of intercooling	01	26-09-2023		TLM1	CO4	T2/R1	
45.	Tutorial-7	01	27-09-2023		TLM3	CO3	T2/R1	
46.	Reheating method	01	28-09-2023		TLM1	CO4	T2/R1	
47.	Regeneration method	01	30-09-2023		TLM1	CO4	T2/R1	
48.	Combined cycles	01	03-10-2023		TLM2, TLM4	CO4	T2/R1	
49.	Combined cycles	01	04-10-2023		TLM2, TLM4	CO4	T2/R1	
50.	Tutorial-8	01	05-10-2023		TLM3	CO4	T2/R1	
51.	Assignment/Quiz-4	01	07-10-2023		TLM6	CO4	T2/R1	
No. of classes required to complete UNIT-IV		12			No. of classes taken:			

UNIT-V: GAS TURBINES FOR AIRCRAFT PROPULSION SYSTEMS

S.No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
52.	Gas turbine cycles for aircraft propulsion	01	10-10-2023		TLM1	CO5	T2/R2	
53.	Intake and propelling nozzle efficiencies	01	11-10-2023		TLM1	CO5	T2/R2	

54.	Simple turbojet cycles	01	12-10-2023		TLM1, TLM2	CO5	T2/R2	
55.	Turboprop engine	01			TLM2	CO5	T2/R2	
56.	Tutorial-8	01	14-10-2023		TLM3	CO3	T2/R2	
57.	Thrust augmentation	01	17-10-2023		TLM1	CO5	T2/R2	
58.	Gas turbine combustion systems	01	18-10-2023		TLM2	CO5	T2/R2	
59.	Combustion chamber designs	01	19-10-2023		TLM3	CO3	T2/R2	
60.	Gas turbine emissions	01	21-10-2023		TLM2	CO5	T2/R2	
61.	Tutorial-9	01	24-10-2023		TLM3	CO3	T2/R2	
62.	Assignment/Quiz-5	01	25-10-2023		TLM6	CO5	T2/R2	
63.	Revision	01	26-10-2023		TLM1	CO5	T2/R2	
64.	Revision	01	28-10-2023		TLM1	CO5	T2/R2	
No. of classes required to complete UNIT-V		13			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	Learning Outcome COs	Text Book followed	HOD Sign Weekly
65.	Supercharging, Turbocharging	01	09-08-2023		TLM2	-	T1/R2	
66.	Modern developments in IC Engines	01	09-09-2023		TLM2	-	T1/R2	
67.	Alternate fuels for IC Engines	01	14-10-2023		TLM2	-	T1/R2	

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

ACADEMIC CALENDAR:

Description	From	To	Weeks
Commencement of Class Work: 04-07-2023			
I Phase of Instructions	04/07/2023	26/08/2023	8
I Mid Examinations	28/08/2023	02/09/2023	
II Phase of Instructions	04/09/2023	28/10/2023	10
II Mid Examinations	30/10/2023	04/11/2023	

Preparation and Practical's	06/11/2023	11/11/2023	1
Semester End Examinations	13/11/2023	27/11/2023	2

EVALUATION PROCESS:

Evaluation Task	COs	Marks
Assignment/Quiz – 1	1	A1=05
Assignment/Quiz – 2	2	A2=05
I-Mid Examination	1,2	B1=15
I-Online Mid Examination	1,2	C1=10
II-Mid Examination	3,4,5	B2=15
II-Online Mid Examination	3,4,5	C2=10
Evaluation of Assignment/Quiz Marks: A=(A1+A2)/2	1,2,3,4,5	**A=05**
Evaluation of Mid Marks: B=75% of Max(B1,B2)+25% of Min(B1,B2)	1,2,3,4,5	**B=15**
Evaluation of Online Mid Marks: C=75% of Max(C1,C2)+25% of Min(C1,C	1,2,3,4,5	**C=10**
Cumulative Internal Examination: A+B+C	**1,2,3,4,5**	**A+B+C=30**
Semester End Examinations: D	**1,2,3,4,5**	**E=70**
Total Marks: A+B+C+D	**1,2,3,4,5**	**100**

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

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

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

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

PROGRAMME OUTCOMES (POs)

Engineering Graduates will be able to:

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

2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources,

and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary-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.

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 or evaluation of performance of various systems relating to transmission of motion and power, conservation of energy and other process equipment.

Dr.K.Dilip Kumar	Dr.P.Vijay Kumar	Dr.P.Vijay Kumar	Dr.S.Pichi Reddy
Course Instructor	Course Coordinator	Module Coordinator	HOD

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L.B. REDDY NAGAR, MYLAVARAM, KRISHNA DIST., A.P.-521 230.
Phone: 08659-222933, Fax: 08659-222931

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Dr. Murahari Kolli
Course Name & Code : Machine Tools and Metrology & 20ME11
L-T-P Structure : 3-0-0 Credits: 3
Program/Sem/Sec : B.Tech/V/A A.Y.: 2023-24
PREREQUISITE: Production Technology
COURSE EDUCATIONAL OBJECTIVES (CEOs): The main objective of this course is to provide an overview of machine tools and various principles of measurements.
COURSE OUTCOMES (COs): At the end of the course, the student will be able to

CO1	Understand the concepts of metal cutting theory (Understanding - L2)
CO2	Differentiate various machining processes (Understanding - L2)
CO3	Comprehend the principles of finishing processes. (Understanding - L2)
CO4	Identify the instruments to measure linear, angular, and surface texture parameters (Understanding - L2)
CO5	Apply limits and fits on machine components and perform alignment tests on machine tools. (Applying - L3)

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

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

TEXTBOOKS:

T1 P.N.Rao, Manufacturing Technology- Volume 2, McGraw Hill Education, 3e
T2 I.C.Gupta, A Text Book of Engineering Metrology, Dhanpat Rai Publications.

REFERENCE BOOKS:

R1 Kalpakjain S, Manufacturing Engineering and Technology, Pearson Education, 4TH edition 2001.
R2 J.P.Kaushish, Manufacturing Processes, PHI, Second Edition, 2010.
R3 M. Mahajan, A text book of Metrology, Dhanpat Rai & Co.
R4 R.K.Jain, Engineering Metrology, Khanna Publishers.3rd edition, 2003.
R5 B.S.Raghvamsi, Workshop Technology, Vol-II (Machine Tools), Dhanapat Rai Publishesr, 2015

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: METAL CUTTING THEORY

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,	1	11.7.2023		TLM2	
2.	Introduction of metal cutting, Machine tools, Metrology	1	12.7.2023		TLM2	
3.	Elements of cutting process	1	13.7.2023		TLM2	
4.	Methods of Metal Cutting: Orthogonal Array Vs Oblique	1	14.7.2023		TLM2	
5.	Geometry of Single Point Cutting Tool	1	15.7.2023		TLM2	
6.	Various types of cutting tools	1	18.7.2023		TLM2	
7.	Mechanism of Chip formation	1	19.7.2023		TLM2	
8.	Types of Chip formation	1	20.7.2023		TLM2	
9.	Chip formation problems	1	21.7.2023		TLM2	
10.	Merchant's Force Diagram	1	22.7.2023		TLM2	
11.	Measurement of cutting forces	1	25.7.2023		TLM2	
12.	Machining parameters calculations	1	26.7.2023		TLM1	
13.	Tool wear life	1	27.7.2023		TLM2	
14.	Machinability	1	28.7.2023		TLM2	
15.	Machining economics.	1	01.8.2023		TLM2	
16.	Tool Life problems	1	02.8.2023		TLM2	
No. of classes required to complete UNIT-I: 16				No. of classes taken:		

UNIT-II: Lathe, Reciprocating machine tools

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
17.	Introduction to Lathe	1	03.8.2023		TLM2	
18.	Principle of working and specifications of lathe	1	04.8.2023		TLM2	
19.	Types of lathes	1	05.8.2023		TLM2	
20.	Lathe accessories- tool holding work holding	1	08.8.2023		TLM2	
21.	Lathe accessories- attachments	1	09.8.2023		TLM2	
22.	Operations on Lathe machine	1	10.8.2023		TLM2	
23.	Taper turning-methods	1	11.8.2023		TLM2	
24.	Reciprocating Machines: SHAPING Principle of working	1	14.8.2023		TLM2	
25.	Parts of Shaper Machine– Specifications,	1	16.8.2023		TLM2	
26.	Size and Specifications of Shaper, classifications,	1	17.8.2023		TLM2	
27.	Operations , tool holding , work holding	1	18.8.2023		TLM2	
28.	SLOTTING Principle of working – Principal parts – Specifications,	1	19.8.2023		TLM2	
29.	classifications	1	22.8.2023		TLM2	
30.	operations	1	23.8.2023		TLM2	
31.	PLANNER Principle of working Principal	1	24.8.2023		TLM2	

	parts – Size and Specifications					
32.	classifications	1	25.8.2023		TLM2	
33.	Operations	1	26.8.2023		TLM2	
No. of classes required to complete UNIT-II: 17				No. of classes taken:		

UNIT-III: Grinding, Milling, Drilling

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.	Introduction of Grinding machines Defiance with cutting and surface finishing , examples	1	05.9.2023		TLM2	
35.	Fundamentals – Theory of grinding, Classification of grinding machine	1	07.9.2023		TLM2	
36.	Non precision grinding machines	1	08.9.2023		TLM2	
37.	Cylindrical grinding machines	1	12.9.2023		TLM2	
38.	Surface grinding machines	1	13.9.2023		TLM2	
39.	Tool and cutter grinding machine	1	14.9.2023		TLM2	
40.	Special types of grinding machines.	1	15.9.2023		TLM2	
41.	MILLING MACHINES: Principle of working – Specifications, Methods of Milling	1	16.9.2023		TLM2	
42.	Classifications of milling machines	1	19.9.2023		TLM2	
43.	Machining operations	1	20.9.2023		TLM2	
44.	Machining tool cutter	1	21.9.2023		TLM2	
45.	Drilling , Introduction	1	22.9.2023		TLM2	
46.	Size and Specifications	1	23.9.2023		TLM2	
47.	Types of Drilling machines	1	26.9.2023		TLM2	
48.	Drilling operations	1	27.9.2023		TLM2	
No. of classes required to complete UNIT-III: 17				No. of classes taken:		
I-Mid Exams :28.09.2023 to 02.09.2023						

UNIT-IV: METROLOGY

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 Metrology	1	29.9.2023		TLM2	
50.	Linear and angular measurements	1	30.9.2023		TLM2	
51.	Standards of measurements - line and end standards	1	03.10.2023		TLM2	
52.	Dial indicators, Micrometers	1	04.10.2023		TLM2	
53.	Basic principle and applications of slip gauges Angle slip gauges	1	05.10.2023		TLM2	
54.	Sine bar and rollers	1	06.10.2023		TLM2	
55.	SURFACE TEXTURE Introduction, Factors effecting surface roughness, reasons for controlling surface texture	1	07.10.2023		TLM2	
56.	Differences between surface roughness and surface waviness	1	10.10.2023		TLM2	
57.	Elements of surface texture - Numerical assessment of surface finish	1	11.10.2023		TLM2	
58.	C.L.A., R.M.S Values, R_a values, and R_z values	1	12.10.2023		TLM2	
59.	ISI symbols for indication of surface finish.	1	13.10.2023		TLM2	

60.	Profile meters	1	17.10.2023		TLM2	
61.	Tomlinson surface meter	1	18.10.2023		TLM2	
No. of classes required to complete UNIT-IV: 12				No. of classes taken:		

UNIT-V: LIMITS AND FITS

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
62.	Introduction	1	19.10.2023		TLM2	
63.	Tolerance limits Normal size	1	20.10.2023		TLM2	
64.	Deviations, Allowance, Fits and their types	1	21.10.2023		TLM2	
65.	Unilateral tolerance system, Bilateral tolerance system	1	24.10.2023		TLM2	
66.	Hole basis systems problems	1	25.10.2023		TLM2	
67.	Shaft basis systems problems	1	26.10.2023		TLM2	
68.	Interchangeability and selective assembly	1	27.10.2023		TLM2	
69.	ALIGNMENT TESTS: Alignment tests on Lathe	1	28.10.2023		TLM1	
No. of classes required to complete UNIT-V: 08				No. of classes taken:		
II-Mid Exams :				30.10.2023 to 04.11.2023		

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 & 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 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
Signature				

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L.B. REDDY NAGAR, MYLAVARAM, KRISHNA DIST., A.P.-521 230.
Phone: 08659-222933, Fax: 08659-222931

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor: Dr.CH Siva Sankara Babu
Course Name & Code **:** Design of Machine Elements-I & 20ME12
L-T-P Structure **: 2-1-0** **Credits:** 3
Program/Sem/Sec : B.Tech/V/A **A.Y.:** 2023-24

PREREQUISITE: Mechanics of Solids

COURSE EDUCATIONAL OBJECTIVES (CEOs): The main objective of this course is to familiarize the steps involved in the design process of various machine elements.

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

CO1	Comprehend the simple stresses in machine parts subjected to static loads. **(Understanding-L2)**
CO2	Analyze the failure criterion of mechanical parts subjected to fatigue loads**. (Analyzing-L4)**
CO3	Evaluate the strengths of welded & threaded joints subjected to various types of loads**. (Applying-L3**)
CO4	Design the shafts for various applications of engineering**. (Applying-L3)**
CO5	Design the various mechanical elements such as keys, cotter, knuckle joints & shaft couplings. **(Applying-L3)**

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

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

BOS APPROVED TEXT BOOKS:

T1. Bhandari V.B, Design of Machine Elements, 3rdEdition, 2ndReprint, Tata McGraw-Hill 2010.
T2. Shigley J.E and Mischke C. R., Mechanical Engineering Design, 6thEdition, Tata McGraw-Hill, 2003.

BOS APPROVED REFERENCE BOOKS:

R1 Norton R.L, "Design of Machinery", ,2ndedition,Tata McGraw-Hill Book Co, 2001.
R2 Orthwein W, "Machine Component Design", 1st edition, Jaico Publishing Co, 1999.
R3. Ugural A.C, "Mechanical Design – An Integral Approach, McGraw-Hill Book Co, 2004.
R4. Spotts M.F., Shoup T.E "Design and Machine Elements" Pearson Education, 2004.

R5. Juvinall R. C., Marshek K.M., "Fundamentals of Machine component Design", – John Wiley & Sons 3rdEdition, 2002.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: **INTRODUCTION, DESIGN FOR STATIC STRENGTH**

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.	Design - Introduction	1	03-07-2023		TLM2	
2.	Machine Design-Introduction& Basic Procedure	1	05-07-2023		TLM2	
3.	Basic requirements of machine elements and Design of Machine Elements	1	06-07-2023		TLM2	
4.	Design analysis-Design synthesis Introduction to Indian standards	1	07-07-2023		TLM2	
5.	Selection of Preferred sizes & Modes of failure – Factor of safety	1	10-07-2023		TLM2	
6.	Stress-strain relationship, Shear stress and shear strain	1	12-07-2023		TLM2	
7.	Stresses due to bending moment	1	13-07-2023		TLM2	
8.	Stresses due to torsional moment	1	14-07-2023		TLM2	
9.	Eccentric axial loading	1	15-07-2023		TLM2	
10.	**Tutorial-I**	1	17-07-2023		TLM3	
11.	Theories of elastic failure – Introduction and principal stresses	1	19-07-2023		TLM2	
12.	Maximum principal stress theory	1	20-07-2023		TLM1	
13.	Maximum Shear stress theory	1	21-07-2023		TLM2	
14.	Distortion energy theory	1	22-07-2023		TLM2	
15.	**Tutorial-II & Quiz-I**	1	24-07-2023		TLM3	
No. of classes required to complete UNIT-I: 15				**No. of classes taken:**		

UNIT-II: DESIGN FOR FATIGUE STRENGTH

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
16.	Stress concentration - Stress concentration factors	1	26-07-2023		TLM2	
17.	Reduction of stress concentration Fluctuating stresses - Fatigue failure	1	27-07-2023		TLM2	
18.	Endurance limit Low cycle and high cycle	1	28-07-2023		TLM2	

	fatigue					
19.	Notch sensitivity	1	31-07-2023		TLM2	
20.	Endurance limit - Approximate estimation	1	02-08-2023		TLM2	
21.	Introduction to reversed stresses	1	03-08-2023		TLM2	
22.	Reversed stresses and Design for infinite life	1	04-08-2023		TLM2	
23.	Soderberg, Goodman lines	1	05-08-2023		TLM2	
24.	**Tutorial-III**	1	07-08-2023		TLM3	
25.	Modified Goodman line	1	09-08-2023		TLM2	
26.	Infinite Life Problems under fluctuating loads	1	10-08-2023		TLM2	
27.	Gerber equation	1	11-08-2023		TLM2	
28.	Fatigue design under combined stresses	1	12-08-2023		TLM2	
29.	**Tutorial-IV & Quiz-II**	1	**14-08-2023**		TLM3	
30.	**Beyond Syllabus:** Joints with combined loads	1	16-08-2023		TLM2	
No. of classes required to complete UNIT-II: 13				**No. of classes taken:**		

UNIT-III: WELDED JOINTS, THREADED JOINTS

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
31.	Introduction to welding joints Butt joints-Fillet joints	1	17-08-2023		TLM2	
32.	Strength of butt welds- Strength of parallel fillet welds	1	18-08-2023		TLM2	
33.	Strength of transverse fillet welds Maximum shear stress in parallel fillet welds	1	19-08-2023		TLM2	
34.	Maximum shear stress in transverse fillet welds	1	21-08-2023		TLM2	
35.	Axially loaded unsymmetrical Welded joints	1	23-08-2023		TLM2	
36.	Welded joint subjected to bending moment	1	24-08-2023		TLM2	
37.	**Beyond Syllabus:** Joints with combined loads	1	25-08-2023		TLM2	
38.	**Tutorial-V**	1	26-08-2023		TLM3	
	I-Mid Exams :28.08.2023 to 02.09.2023					
39.	Threaded joints -Terminology of screw threads	1	04-09-2023		TLM2	
40.	Bolted joints	1	07-09-2023		TLM2	
41.	Eccentrically loaded bolted joints in shear	1	08-09-2023		TLM2	
42.	Problems on Eccentrically loaded bolted joints in shear	1	11-09-2023		TLM3	
43.	Eccentrically loaded bolted joints in shear	1	13-09-2023		TLM2	
44.	Problems on Eccentrically loaded bolted joints in shear	1	14-09-2023		TLM2	
45.	Eccentric load perpendicular to	1	15-09-2023		TLM2	

	axis of bolt					
46.	Problems on Eccentric load perpendicular to axis of bolt	1	16-09-2023		TLM2	
47.	Bolts of uniform strength	1	20-09-2023		TLM2	
48.	**Tutorial-VI & Quiz-III**	1	21-09-2023		TLM3	
No. of classes required to complete UNIT-III: 18				**No. of classes taken:**		

UNIT-IV: SHAFTS

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 transmission shafts	1	22-09-2023		TLM2	
50.	Shaft design on strength basis		23-09-2023			
51.	Shaft design on strength basis	1	25-09-2023		TLM2	
52.	Shaft design on torsional rigidity basis	1	27-09-2023		TLM2	
53.	**Tutorial-VII**	1	28-09-2023		TLM3	
54.	ASME code for shaft design	1	29-09-2023		TLM2	
55.	Design of hollow shaft on strength and torsional rigidity basis	1	30-09-2023		TLM2	
56.	Design of hollow shaft on strength and torsional rigidity basis	1	04-10-2023		TLM2	
57.	Problems on shafts	1	05-10-2023		TLM2	
58.	Problems on shafts	1	06-10-2023		TLM2	
59.	Problems on shafts	1	07-10-2023		TLM2	
60.	**Tutorial-VIII & Quiz-IV**	1	**09-10-2023**		TLM2	
No. of classes required to complete UNIT-IV: 12				**No. of classes taken:**		

UNIT-V: KEYS, COTTER AND KNUCKLE JOINTS, SHAFT 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
61.	Design of square and flat keys-types	1	11-10-2023		TLM2	
62.	Design of Socket and Spigot cotter joint	1	12-10-2023		TLM2	
63.	Design of Socket and Spigot cotter joint	1	13-10-2023		TLM2	
64.	Problem on Design of Socket and Spigot cotter joint	1	16-10-2023		TLM2	
65.	Problem on Design of Socket and Spigot cotter joint	1	18-10-2023			
66.	Design of Cotter joints	1	19-10-2023		TLM2	
67.	Design of Knuckle joint-Failures	1	20-10-2023		TLM1	
68.	Problems onKnuckle joint	1	21-10-2023			
69.	**Tutorial-IX**	1	24-10-2023		TLM3	
70.	Flange coupling-Muff coupling	1	25-10-2023		TLM1	
71.	Clamp coupling	1	26-10-2023		TLM2	
72.	Bushed pin flexible coupling	1	27-10-2023		TLM2	

73.	Quiz-V /**Tutorial-X**	1	28-10-2023		TLM3	
No. of classes required to complete UNIT-V: 13				**No. of classes taken:**		
II-Mid Exams :				**30.10.2023 to 04.11.2023**		

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 & 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 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.

Signature				
Name of the Faculty	**Dr.Ch. Siva Sakara Babu**	**Dr. B. Sudheer Kumar**	**Dr. B. Sudheer Kumar**	**Dr. S.Pichi Reddy**
Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**

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DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART - A

PROGRAM	**: B.Tech. - V-Sem. - Mechanical Engineering – B Section**
ACADEMIC YEAR	**:** 2022-23
COURSE NAME & CODE	**: ROBOTICS – 20ME14**
L-T-P STRUCTURE	**:** 3-0-0
COURSE CREDITS	**:** 3
COURSE INSTRUCTOR	**: Dr M B S S Reddy, Associate Professor**
COURSE COORDINATOR	**: J.Subba Reddy, Associate Professor**
PER-REQUISITE	**:** Engineering Mechanics & Kinematics of Machines

COURSE EDUCATIONAL OBJECTIVES:

The main objective of this course is to cultivate the interest and ability to develop robotic systems for social and industrial development.

COURSE OUTCOMES:

After completion of the course student will be able to:

CO1: Understand the basics of robots, end effectors and its applications.

CO2: Familiarize the working of actuators and sensors for robotic application.

CO3: Formulate D-H matrices for different kinematics problems.

CO4: Model the dynamic behavior of robot.

CO5: Analyze the trajectory of robotic motion.

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

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

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

BOS APPROVED TEXT BOOKS:

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

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

BOS APPROVED REFERENCE BOOKS:

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

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

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

COURSE DELIVERY PLAN (LESSON PLAN): ROBOTICS (20ME14)

PART - B

UNIT-I: INTRODUCTION TO ROBOTICS, ANATOMY, ROBOT END EFFECTORS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
1.	**Introduction to Robotics**	1	19-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
2.	CEOs, Course Outcomes, POs and PSOs	1	20-07-2022		**TLM2**	-	-	
3.	Basic concepts – Robot anatomy	1	21-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
4.	Components of robots, **Tutorial**	1	22-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
5.	Robot motions	1	23-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
6.	Number of D.O.F – Work volume	1	26-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
7.	Robot applications in Material transfer and machine loading / unloading applications	1	27-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
8.	Robot applications in Processing operations – Assembly and inspection – Future applications	1	28-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
9.	**Robot End Effectors –** Introduction, **Tutorial**	1	29-07-2022		**TLM3**	CO1	T1, T2, R1, R2	
10.	Types of end effectors – Mechanical grippers	1	30-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
11.	Vacuum cups, magnetic grippers, adhesive gripers and others	1	02-08-2022		**TLM2**	CO1	T1, T2, R1, R2	
12.	Robot / End effectors interface	1	03-08-2022		**TLM2**	CO1	T1, T2, R1, R2	
13.	Considerations in gripper selection and design	1	04-08-2022		**TLM2**	CO1	T1, T2, R1, R2	
14.	Case Studies, Numericals, **Tutorial**	1	05-08-2022		**TLM2**	CO1	T1, T2, R1, R2	
15.	Numericals	1	06-08-2022		**TLM3**	CO1	T1, T2, R1, R2	
No. of classes required to complete UNIT-I:		**15**			**No. of classes taken:**			

UNIT-II: ROBOT ACTUATORS AND SENSORS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
16.	Introduction to Actuators	1	10-08-2022		**TLM2**	CO2	T1,R1	
17.	Characteristics of Actuating System	1	11-08-2022		**TLM2**	CO2	T1,R1	
18.	Pneumatic Actuators	1	12-08-2022		**TLM2**	CO2	T1,R1	
19.	Hydraulic Actuators, **Tutorial**	1	13-08-2022		**TLM2**	CO2	T1,R1	
20.	Electric Motors	1	16-08-2022		**TLM2**	CO2	T1,R1	
21.	Introduction to Sensors	1	17-08-2022		**TLM3**	CO2	T1,R1	
22.	Sensor characteristics	1	18-08-2022		**TLM1**	CO2	T1,R1	
23.	Position sensors: Potentiometers, LVDT	1	20-08-2022		**TLM1**	CO2	T1,R1	
24.	Resolvers, Encoders, **Tutorial**	1	23-08-2022		**TLM1**	CO2	T1,R1	
25.	Magnetostrictive Displacement Transducers (MDT)	1	24-08-2022		**TLM1**	CO2	T1,R1	
26.	Velocity Sensors: Encoders	1	25-08-2022		**TLM1**	CO2	T1,R1	
27.	Tachometers	1	26-08-2022		**TLM1**	CO2	T1,R1	
28.	Industrial Applications, **Tutorial**	1	27-08-2022		**TLM2**	CO2	T1,R1	
29.	Case Studies	1	30-08-2022		**TLM2**	CO2	T1,R1	
No. of classes required to complete UNIT-II		**14**		**No. of classes taken:**				

UNIT-III: MANIPULATOR KINEMATICS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
30.	Introduction to Manipulator Kinematics	1	01-09-2022		**TLM2**	CO3	T1,R1	
31.	Coordinate Frames	1	02-09-2022		**TLM2**	CO3	T1,R1	
32.	Description of Objects in space	1	03-09-2022		**TLM2**	CO3	T1,R1	
33.	Transformation of vectors, **Tutorial**	1	01-09-2022		**TLM2**	CO3	T1,R1	
34.	Numericals	1	06-09-2022		**TLM1**	CO3	T1,R1	
35.	Inverting a Homogeneous Transform	1	07-09-2022		**TLM3**	CO3	T1,R1	
36.	Numericals	1	08-09-2022		**TLM2**	CO3	T1,R1	
37.	Fundamental Rotation Matrices	1	09-09-2022		**TLM2**	CO3	T1,R1	
38.	Numericals, **Tutorial**	1	10-09-2022		**TLM2**	CO3	T1,R1	
39.	D-H representation	1	11-10-2022		**TLM2**	CO3	T1,R1	
40.	Problems on Forward Kinematics	1	12-10-2022		**TLM2**	CO3	T1,R1	
41.	Numericals	1	13-10-2022		**TLM2**	CO3	T1,R1	
42.	Numericals	1	14-10-2022		**TLM2**	CO3	T1,R1	
43.	Numericals, **Tutorial**	1	15-10-2022		**TLM2**	CO3	T1,R1	
44.	Numericals	1	18-10-2022		**TLM2**	CO3	T1,R1	
No. of classes required to complete UNIT-III		**15**			**No. of classes taken:**			

UNIT-IV: ROBOT DYNAMICS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
45.	Introduction to Dynamics of Robots	1	19-10-2022		**TLM2**	CO4	T1,R1	
46.	Differential transformations	1	20-10-2022		**TLM2**	CO4	T1,R1	
47.	Numericals	1	21-10-2022		**TLM2**	CO4	T1,R1	
48.	Numericals, **Tutorial**	1	13-10-2022		**TLM2**	CO4	T1,R1	
49.	Numericals	1	22-10-2022		**TLM2**	CO4	T1,R1	
50.	Numericals	1	25-10-2022		**TLM2**	CO4	T1,R1	
51.	Jacobian Matrix	1	26-10-2022		**TLM2**	CO4	T1,R1	
52.	Numericals	1	27-10-2022		**TLM1**	CO4	T1,R1	
53.	Numericals, **Tutorial**	1	28-10-2022		**TLM2**	CO4	T1,R1	
54.	Numericals	1	29-10-2022		**TLM1**	CO4	T1,R1	
55.	Lagrange Euler formulation	1	01-11-2022		**TLM2**	CO4	T1,R1	
56.	Numericals	1	02-11-2022		**TLM2**	CO4	T1,R1	
57.	Numericals	1	03-11-2022		**TLM1**	CO4	T1,R1	
58.	Numericals, **Tutorial**	1	04-11-2022		**TLM2**	CO4	T1,R1	
59.	Numericals	1	05-11-2022		**TLM1**	CO4	T1,R1	
No. of classes required to complete UNIT-IV		**15**			**No. of classes taken:**			

UNIT-V: TRAJECTORY PLANNING

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
60.	Introduction to Trajectory Planning	1	08-11-2022		**TLM2**	CO5	T1,R1	
61.	Considerations on Trajectory Planning	1	09-11-2022		**TLM2**	CO5	T1,R1	
62.	Joint Interpolated Trajectory	1	10-11-2022		**TLM2**	CO5	T1,R1	
63.	Numericals	1	11-11-2022		**TLM2**	CO5	T1,R1	
64.	Numericals, **Tutorial**	1	12-11-2022		**TLM3**	CO5	T1,R1	
65.	Numericals	1	15-11-2022		**TLM2**	CO5	T1,R1	
66.	Numericals	1	16-11-2022		**TLM2**	CO5	T1,R1	
67.	Cartesian Path Trajectory	1	17-11-2022		**TLM2**	CO5	T1,R1	
68.	Numericals, **Tutorial**	1	18-11-2022		**TLM2**	CO5	T1,R1	
69.	Numericals	1	19-11-2022		**TLM2**	CO5	T1,R1	
70.	Numericals	1	22-11-2022		**TLM2**	CO5	T1,R1	
71.	Numericals, **Tutorial**	1	23-11-2022		**TLM2**	CO5	T1,R1	
72.	Numericals	1	24-11-2022		**TLM2**	CO5	T1,R1	
73.	**Robot Programming**	1	25-11-2022		**TLM2**	CO5	T1,R1	
74.	**Robot Programming**	1	26-11-2022		**TLM2**	CO5	T1,R1	
No. of classes required to complete UNIT-V		**15**			**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/Assignment/Quiz

ACADEMIC CALENDER:

Commencement of Class work		**18-07-2022**	
I Phase of Instructions	18-07-2022	10-09-2022	8 Weeks
Technical Training / Value added Courses	12-09-2022	24-09-2022	2 Weeks
I Mid Examinations	26-09-2022	01-10-2022	1 Week
II Phase of Instructions	03-10-2022	26-11-2022	8 Weeks
II Mid Examinations	28-11-2022	03-12-2022	1 Week
Preparation and Practicals	05-12-2022	10-12-2022	1 Week
Semester End Examinations	12-12-2022	24-12-2022	2 Weeks

PART – C

EVALUATION PROCESS:

Evaluation Task	**COs**	**Marks**
Assignment/Quiz – 1 2	1	A1=05
Assignment/Quiz – 2	2	A2=05
I-Mid Examination	1,2, 3 (half)	B1=15
I-Online Mid Examination	1,2, 3 (half)	C1=10
Assignment/Quiz – 3	3	A3=05
Assignment/Quiz – 4	4	A4=05
Assignment/Quiz – 5	5	A5=05
II-Mid Examination	3 (half),4,5	B2=15
II-Online Mid Examination	3 (half),4,5	C2=10
Evaluation of Assignment/Quiz Marks: A=(A1+A2+A3+A4+A5)/5	1,2,3,4,5	**A=05**
Evaluation of Mid Marks: B=75% of Max(B1, B2)+25% of Min(B1,B2)	1,2,3,4,5	**B=15**
Evaluation of Online Mid Marks: C=75% of Max(C1, C2)+25% of Min(C1,C2)	1,2,3,4,5	**C=10**
Cumulative Internal Examination: A+B+C	**1,2,3,4,5**	**A+B+C=30**
Semester End Examinations: D	**1,2,3,4,5**	**D=70**
Total Marks: A+B+C+D	**1,2,3,4,5**	**100**

PART – D

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

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

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

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

PROGRAMME OUTCOMES (POs):

Engineering Graduates will be able to:

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

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):
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.

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

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(AUTONOMOUS)
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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 ELECTRICAL AND ELECTRONICS ENGINEERING

PART-A

Name of Course Instructor: Mr P.Rathnakar Kumar
Course Name & Code : Electric Vehicles-20EE84
L-T-P Structure : 3-0-0 **Credits:** 3
Program/Sem/Sec : B.Tech., V-Sem., MECH –A section **A.Y :** 2023-24

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															
CO2															
CO3															
CO4															
CO5															
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	3/07/23		TLM1	
2.	Components	1	4/07/23		TLM1	
3.	Vehicle Mechanics	1	5/07/23		TLM1	
4.	Roadway Fundamentals	1	10/07/23		TLM1	
5.	Roadway Fundamentals	1	11/07/23		TLM1	
6.	Vehicle Kinetics	1	12/07/23		TLM1	
7.	Dynamics of vehicle motion	1	15/07/23		TLM1	
8.	Dynamics of vehicle motion	1	4/07/23		TLM1	
9.	Propulsion system design.	1	17/07/23		TLM1	
10.	Propulsion system design.	1	18/07/23		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	19/07/23		TLM1	
12	Parameters	1	22/07/23		TLM1	
13	Capacity	1	24/07/23		TLM1	
14	Discharge Rate	1	25/07/23		TLM1	
15	Sate of charge	1	26/07/23		TLM1	
16	State of Discharge	2	31/07/23		TLM1	
17	Depth od Discharge		1/08/23		TLM1	
18	Technical Characteristics	1	02/08/23		TLM1	
19	Battery pack Design	1	05/08/23		TLM2	
20	Battery pack Design	1	07/08/23		TLM3	
21	Properties of Batteries	1	08/08/23		TLM3	
No. of classes required to complete UNIT-II		11				

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	09/08/23		TLM1	
23	Motor & Engine rating, requirements	1	14/08/23		TLM1	
25	DC machines	1	16/08/23		TLM1	
26.	DC machines	1	19/08/23		TLM1	
27.	Three phase A.C. Machines	1	09/08/23		TLM1	
29.	Three phase A.C. Machines	1	21/08/23		TLM1	
30.	Induction Machines	1	22/08/23		TLM1	
31	Permanent magnet machines	1	23/08/23		TLM1	
32	Permanent magnet machines	1	26/08/23		TLM1	
33.	Switched reluctance machines	1	04/09/23		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	04/09/23		TLM1	
35	Transmission Configuration	1	05/09/23		TLM1	
36	Components	1	06/09/23		TLM1	
37	gears	1	11/09/23		TLM1	
38	differential	1	12/09/23		TLM1	
39	clutch	1	13/09/23		TLM1	
40	brakes	1	16/09/23		TLM2	
41	Regenerative braking	1	18/09/23		TLM1	
42	Regenerative braking	1	20/09/23		TLM1	
43	Motor sizing	1	23/09/23		TLM1	
44	Motor sizing	1	25/09/23		TLM3	

No. of classes required to complete UNIT-IV	11				

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	26/09/23		TLM1	
46	Series	1	27/09/23		TLM1	
47	Parallel and series	1	30/09/23		TLM1	
48	Parallel configuration	1	03/10/23		TLM1	
49	Design	1	04/10/23		TLM1	
50	Drive train	1	07/10/23		TLM2	
51	Sizing of components	1	09/10/23		TLM2	
52	Revision U1	1	11/10/23		TLM2	
53	Revision U2	1	16/10/23		TLM2	
54	Revision U3	1	17/10/23		TLM2	
55	Revision U4	1	18/10/23		TLM2	
56	Revision U5	1	25/10/23		TLM2	
No. of classes required to complete UNIT-V		13				

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	28/10/23		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
Signature				

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L.B.Reddy Nagar, Mylavaram-521230, Krishna Dist, Andhra Pradesh, India

COURSE HANDOUT

PROGRAM : B.Tech, V-Sem, ME-B section

ACADEMIC YEAR : 2023-24

COURSE NAME & CODE : IC ENGINES AND GAS TURBINES (20ME10)

L-T-P STRUCTURE : 3-1-0

COURSE CREDITS : 3

COURSE INSTRUCTOR : Dr P.VIJAY KUMAR

COURSE COORDINATOR : Dr P.VIJAY KUMAR

PRE-REQUISITE: THERMODYNAMICS

COURSE OBJECTIVE:
To provide students an insight of fundamentals and salient features of internal combustion engines and sub-systems, performance analysis, modern automotive engines, electric vehicles, gas turbines and aircraft propulsion systems.

COURSE OUTCOMES (CO):
CO1: Describe the construction and functioning of internal combustion engines fuel supply systems for SI and CI engines, modern automotive engines and electric vehicles **(Understanding Level-2)**
CO2: Comprehend the combustion characteristics of SI engines and CI engines. **(Understanding Level-2)**
CO3: Compute the IC engine performance parameters **(Apply Level-3)**
CO4: Understand the construction and functioning of gas turbines **(Understanding Level-2)**
CO5: Apply gas turbine cycles for aircraft propulsion systems **(Apply Level-3)**

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	2	-	1	3	-	-	-	-	2	3	1	2
CO2	3	-	-	3	1	2	-	-	-	-	-	3	3	1	2
CO3	3	-	3	3	1	1	3	-	2	-	-	2	3	1	2
CO4	3	-	3	1	2	1	-	-	-	-	-	2	3	1	2
CO5	3	3	2	-	-	1	3	1	-	-	-	2	3	1	2

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

BoS APPROVED TEXT BOOKS:

T1 V.Ganesan, Internal Combustion Engines-Tata McGraw-Hill, 4th Edition, 2017

T2 V.Ganesan,Gas Turbines--Tata McGraw-Hill, 3rd Edition, 20017

T3 John B.Heywood, Internal Combustion Engine Fundamentals, Tata McGraw-Hill, 4th Edition 2017

BOS APPROVED REFERENCE BOOKS:

R1 H.N.Gupta, Fundamentals of Internal Combustion engines, PHI 2nd Edition, 2013

R2 HIH Saravanamuttoo, Cohen Rogers, Gas Turbines theory, Pearson, 7th Edition 2019

COURSE DELIVERY PLAN (LESSON PLAN): Section-B

UNIT-I: INTRODUCTION TO IC ENGINES AND CARBURETORS & FUEL INJECTION

S.No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
1.	Introduction to IC Engines, classification, applications of IC Engines	01	04-07-2023		TLM1	CO1	T1/R1	
2.	Basic Engine components and Nomenclature	01	05-07-2023		TLM1	CO1	T1/R1	
3.	Working principle of four stroke SI and CI Engines	02	07-07-2023		TLM2	CO1	T1/R1	
4.	Working principle of two stroke SI and CI Engines	01	10-07-2023		TLM2	CO1	T1/R1	
5.	Tutorial-I	01	11-07-2023		TLM3	CO1	T1/R1	
6.	Comparison of two stroke and four stroke/ SI and CI engines	01	12-07-2023		TLM1	CO1	T1/R1	
7.	Ideal and actual cycles and their analysis	01	14-07-2023		TLM5	CO1	T1/R1	
8.	Valve and Port timing diagrams for four stroke and two stroke SI & CI engines	01	15-07-2023		TLM1/TLM2	CO1	T1/R1	
9.	Port timing diagrams for four stroke and two stroke SI & CI engines	01	17-07-2023		TLM1/TLM2	CO1	T1/R1	
10.	Air-fuel mixture requirements, construction and working of simple carburetor	01	18-07-2023		TLM2	CO2	T1/R1	
11.	Tutorial-2	01	19-07-2023		TLM3	CO1	T1/R1	
12.	Calculation of air-fuel ratio, requirements of fuel injection systems	01	21-07-2023		TLM1	CO1	T1/R1	
13.	Classification of injection systems, working principle of fuel injector	01	22-07-2023		TLM1/TLM2	CO1	T1/R1	
14.	Injection in SI and CI engines	01	26-07-2023		TLM1/TLM2	CO1	T1/R1	
15.	Assignment/Quiz-1	01	28-07-2023		TLM6	CO1	T1/R1	
No. of classes required to complete UNIT-I		15	No. of classes taken:					

UNIT-II: COMBUSTION IN SI AND CI ENGINES

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
16.	Combustion in SI engines-Stages of combustion	01	01-08-2023		TLM1	CO2	T1/R1	
17.	normal and abnormal combustion	01	02-08-2023		TLM1	CO2	T1/R1	
18.	Effect of detonation	01	04-08-2023		TLM1	CO2	T1/R1	
19.	Engine variables and other factors affecting knocking and its prevention	01	05-08-2023		TLM1	CO2	T1/R1	
20.	Theory of detonation in SI engines	01	07-08-2023		TLM1	CO2	T1/R1	
21.	Combustion chamber requirements-types of combustion chambers	01	08-08-2023		TLM1, TLM2	CO2	T1/R1	
22.	Octane number and rating of SI engine fuels	01	09-08-2023		TLM1	CO2	T1/R1	
23.	Tutorial-3	01	11-08-2023		TLM3	CO1	T1/R1	
24.	Stages of combustion in CI engines	01	12-08-2023		TLM1/TLM2	CO2	T1/R1	
25.	Variables affecting delay period	01	14-08-2023		TLM1	CO2	T1/R1	
26.	Diesel knock-methods of controlling diesel knock	01	16-08-2023		TLM1	CO2	T1/R1	
27.	CI engine combustion chamber requirements-Types of combustion chambers	01	18-08-2023		TLM1/TLM2	CO2	T1/R1	
28.	Cold starting of CI engines	01	19-08-2023		TLM1/TLM2	CO2	T1/R1	
29.	Tutorial-4	01	21-08-2023		TLM3	CO1	T1/R1	
30.	Cetane number and rating of CI engine fuels	01	22-08-2023		TLM1	CO2	T1/R1	
31.	Assignment/Quiz-2	01	23-08-2023		TLM6	CO1	T1/R1	
No. of classes required to complete UNIT-II		16						

UNIT-III: IC ENGINE PERFORMANCE, MODERN AUTOMOTIVE ENGINES, HYBRID VEHICLES

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
32.	Performance parameters for IC engines	01	25-08-2023		TLM1	CO3	T1/R1	
33.	Engine power and engine efficiency	01	26-08-2023		TLM1	CO3	T1/R1	
34.	Performance characteristics	01	04-09-2023		TLM1	CO3	T1/R1	
35.	Variables effecting Performance	01	05-09-2023		TLM1	CO3	T1/R1	

	characteristics							
36.	Methods of improving engine performance	01	06-09-2023		TLM1, TLM2	CO3	T1/R1	
37.	Heat balance sheet	01	08-09-2023		TLM1	CO3	T1/R1	
38.	Tutorial-5	01	09-09-2023		TLM3	CO3	T1/R1	
39.	Modern automotive engines-introduction	01	11-09-2023		TLM1	CO3	T1/R1	
40.	Changes in fuel injection methods in SI and CI engines	01	12-09-2023		TLM1	CO3	T1/R1	
41.	Common rail direct injection system	01	13-09-2023		TLM1	CO3	T1/R1	
42.	Gasoline direct injection	01	15-09-2023		TLM1	CO3	T1/R1	
43.	Variable valve technology-VVT	01	16-09-2023		TLM2	CO3	T1/R1	
44.	DTSi Technology	01	18-09-2023		TLM2	CO3	T1/R1	
45.	Tutorial-6	01	19-09-2023		TLM3	CO3	T1/R1	
46.	Assignment/Quiz-3	01	20-09-2023		TLM6	CO3	T1/R1	
No. of classes required to complete UNIT-III		15			No. of classes taken:			

UNIT-IV: GAS TURBINES, INTERCOOLING, REHEATING, REGENERATION METHODS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
47.	Gas turbines-introduction	01	22-09-2023		TLM1	CO4	T2/R1	
48.	Development of gas turbines	01	23-09-2023		TLM1	CO4	T2/R1	
49.	Classification and application of gas turbines	01	25-09-2023		TLM1	CO4	T2/R1	
50.	Ideal and actual cycles	01	26-09-2023		TLM4	CO4	T2/R1	
51.	Effect of intercooling	01	27-09-2023		TLM1	CO4	T2/R1	
52.	Tutorial-7	01	29-09-2023		TLM3	CO3	T2/R1	
53.	Reheating method	01	30-09-2023		TLM1	CO4	T2/R1	
54.	Regeneration method	01	03-10-2023		TLM1	CO4	T2/R1	
55.	Combined cycles	01	04-10-2023		TLM2, TLM4	CO4	T2/R1	
56.	Combined cycles	01	06-10-2023		TLM2, TLM4	CO4	T2/R1	
57.	Tutorial-8	01	07-10-2023		TLM3	CO4	T2/R1	
58.	Assignment/Quiz-4	01	09-10-2023		TLM6	CO4	T2/R1	
No. of classes required to complete UNIT-IV		12			No. of classes taken:			

UNIT-V: GAS TURBINES FOR AIRCRAFT PROPULSION SYSTEMS

S.No	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
59.	Gas turbine cycles for aircraft propulsion	01	10-10-2023		TLM1	CO5	T2/R2	
60.	Intake and propelling nozzle efficiencies	01	11-10-2023		TLM1	CO5	T2/R2	
61.	Simple turbojet cycles	01	13-10-2023		TLM1, TLM2	CO5	T2/R2	
62.	Turboprop engine	01	14-10-2023		TLM2	CO5	T2/R2	
63.	Tutorial-8	01	16-10-2023		TLM3	CO3	T2/R2	
64.	Thrust augmentation	01	17-10-2023		TLM1	CO5	T2/R2	
65.	Gas turbine combustion systems	01	18-10-2023		TLM2	CO5	T2/R2	
66.	Combustion chamber designs	01	20-10-2023		TLM3	CO3	T2/R2	
67.	Gas turbine emissions	01	21-10-2023		TLM2	CO5	T2/R2	
68.	Tutorial-9	01	23-10-2023		TLM3	CO3	T2/R2	
69.	Assignment/Quiz-5	01	24-10-2023		TLM6	CO5	T2/R2	
70.	Revision	01	25-10-2023		TLM1	CO5	T2/R2	
71.	Revision	01	27-10-2023		TLM1	CO5	T2/R2	
72.	Revision	01	28-10-2023		TLM1	CO5	T2/R2	
No. of classes required to complete UNIT-V		14			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	Learning Outcome COs	Text Book followed	HOD Sign Weekly
73.	Supercharging, Turbocharging	01	09-08-2023		TLM2	-	T1/R2	
74.	Modern developments in IC Engines	01	09-09-2023		TLM2	-	T1/R2	
75.	Alternate fuels for IC Engines	01	14-10-2023		TLM2	-	T1/R2	

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

ACADEMIC CALENDAR:

Description	From	To	Weeks
Commencement of Class Work: 04-07-2023			
I Phase of Instructions	04/07/2023	26/08/2023	8
I Mid Examinations	28/08/2023	02/09/2023	
II Phase of Instructions	04/09/2023	28/10/2023	10
II Mid Examinations	30/10/2023	04/11/2023	
Preparation and Practical's	06/11/2023	11/11/2023	1
Semester End Examinations	13/11/2023	27/11/2023	2

EVALUATION PROCESS:

Evaluation Task	COs	Marks
Assignment/Quiz – 1	1	A1=05
Assignment/Quiz – 2	2	A2=05
I-Mid Examination	1,2	B1=15
I-Online Mid Examination	1,2	C1=10
II-Mid Examination	3,4,5	B2=15
II-Online Mid Examination	3,4,5	C2=10
Evaluation of Assignment/Quiz Marks: A=(A1+A2)/2	1,2,3,4,5	**A=05**
Evaluation of Mid Marks: B=75% of Max(B1,B2)+25% of Min(B1,B2)	1,2,3,4,5	**B=15**
Evaluation of Online Mid Marks: C=75% of Max(C1,C2)+25% of Min(C1,C	1,2,3,4,5	**C=10**
Cumulative Internal Examination: A+B+C	**1,2,3,4,5**	**A+B+C=30**
Semester End Examinations: D	**1,2,3,4,5**	**E=70**
Total Marks: A+B+C+D	**1,2,3,4,5**	**100**

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs)

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

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

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

PROGRAMME OUTCOMES (POs)

Engineering Graduates will be able to:

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

2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.
6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multi-disciplinary-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.

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 or evaluation of performance of various systems relating to transmission of motion and power, conservation of energy and other process equipment.

Dr.P.Vijay Kumar	Dr.P.Vijay Kumar	Dr.P.Vijay Kumar	Dr.S.Pichi Reddy
Course Instructor	Course Coordinator	Module Coordinator	HOD

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

COURSE HANDOUT

PART-A

Name of Course Instructor: S. Srinivasa Reddy
Course Name & Code **:** Machine Tools and Metrology & 20ME11
L-T-P Structure **: 3-0-0** **Credits:** 3
Program/Sem/Sec : B.Tech/V/B **A.Y.:** 2023-24

PREREQUISITE: Production Technology
COURSE EDUCATIONAL OBJECTIVES (CEOs): The main objective of this course is to provide an overview of machine tools and various principles of measurements.
COURSE OUTCOMES (COs): At the end of the course, the student will be able to

CO1	Understand the concepts of metal cutting theory (**Understanding - L2**)
CO2	Differentiate various machining processes **(Understanding - L2)**
CO3	Comprehend the principles of finishing processes. **(Understanding - L2)**
CO4	Identify the instruments to measure linear, angular, and surface texture parameters (**Understanding - L2**)
CO5	Apply limits and fits on machine components and perform alignment tests on machine tools. (**Applying - L3**)

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

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

TEXTBOOKS:

T1 P.N.Rao, Manufacturing Technology- Volume 2, McGraw Hill Education, 3e
T2 I.C.Gupta, A Text Book of Engineering Metrology, Dhanpat Rai Publications.

REFERENCE BOOKS:

R1 Kalpakjain S, Manufacturing Engineering and Technology, Pearson Education, 4TH edition 2001.
R2 J.P.Kaushish, Manufacturing Processes, PHI, Second Edition, 2010.
R3 M. Mahajan, A text book of Metrology, Dhanpat Rai & Co.
R4 R.K.Jain, Engineering Metrology, Khanna Publishers.3rd edition, 2003.
R5 B.S.Raghvamsi, Workshop Technology, Vol-II (Machine Tools), Dhanapat Rai Publishesr, 2015

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: METAL CUTTING THEORY

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,	1	4-7-23		TLM2	
2.	Introduction of metal cutting, Machine tools, Metrology	1	5-7-23		TLM2	
3.	Elements of cutting process	1	6-7-23		TLM2	
4.	Methods of Metal Cutting: Orthogonal Array Vs Oblique	1	7-7-23		TLM2	
5.	Geometry of Single Point Cutting Tool	1	11-7-23		TLM2	
6.	Various types of cutting tools, Mechanism of Chip formation	1	12-7-23		TLM2	
7.	Types of Chip formation, Chip formation problems	1	13-7-23		TLM2	
8.	Merchant's Force Diagram, Measurement of cutting forces	1	14-7-23		TLM2	
9.	Machining parameters calculations, Tool wear life, Tool Life problems	1	15-7-23		TLM2	
10.	Mach inability, Machining economics.	1	18-7-23		TLM2	
11.	Quiz and Revision	1	19-7-23		TLM2	
No. of classes required to complete UNIT-I: 11				**No. of classes taken:**		

UNIT-II: Lathe, Reciprocating machine tools

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
12.	Introduction to Lathe	1	20-7-23		TLM2	
13.	Principle of working and specifications of lathe	1	21-7-23		TLM2	
14.	Types of lathes	1	22-7-23		TLM2	
15.	Lathe accessories- tool holding	1	25-7-23		TLM2	
16.	Lathe accessories-work holding	1	26-7-23		TLM2	
17.	Lathe accessories- attachments	1	27-7-23		TLM2	
18.	Operations on Lathe machine	1	28-7-23		TLM2	
19.	Lathe accessories-supporting devices	1	1-8-23		TLM2	
20.	Taper turning-methods	1	2-8-23		TLM2	
21.	Reciprocating Machines: **SHAPING** Principle of working	1	3-8-23		TLM2	

22.	Parts of Shaper Machine– Specifications,	1	4-8-23		TLM2	
23.	**Size and Specifications of Shaper,**	1	5-8-23		TLM2	
24.	classifications,	1	8-8-23		TLM2	
25.	Operations , tool holding , work holding	1	9-8-23		TLM2	
26.	**SLOTTING** Principle of working – Principal parts – Specifications,	1	10-8-23		TLM2	
27.	classifications	1	11-8-23		TLM2	
28.	operations	1	12-8-23		TLM2	
29.	**PLANNER** Principle of working Principal parts –	1	16-8-23		TLM2	
30.	Size and Specifications	1	17-8-23		TLM2	
31.	Classifications, Operations	1	18-8-23		TLM2	
32.	Quiz and Revision	1	19-8-23		TLM2	
No. of classes required to complete UNIT-II: 21				**No. of classes taken:**		

UNIT-III: Grinding, Milling, Drilling

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
33.	**Introduction of Grinding machines Fundamentals - theory of Grinding**	1	22-8-23		TLM2	
34.	Fundamentals – Theory of grinding	1	23-8-23		TLM2	
35.	Classification of grinding machine	1	24-8-23		TLM2	
36.	Non precision grinding machines	1	25-8-23		TLM2	
37.	Cylindrical grinding machines	1	26-8-23		TLM2	
38.	Surface grinding machines	1	4-9-23		TLM2	
39.	Tool and cutter grinding machine	1	5-9-23		TLM2	
40.	Special types of grinding machines.	1	7-9-23		TLM2	
41.	**MILLING MACHINES**: Principle of working –	1	8-9-23		TLM2	
42.	Specifications, Methods of Milling	1	12-9-23		TLM2	
43.	Classifications of milling machines	1	13-9-23		TLM2	
44.	Machining operations	1	14-9-23		TLM2	
45.	Machining operations	1	15-9-23		TLM2	
46.	**Drilling** , Introduction	1	16-9-23		TLM2	

47.	Size and Specifications	1	19-9-23		TLM2	
48.	Types of Drilling machines, Drilling operations	1	20-9-23		TLM2	
49.	Quiz and Revision	1	21-9-23		TLM2	
No. of classes required to complete UNIT-III: 17				**No. of classes taken:**		
I-Mid Exams : 26-8-23 to 2-9-23						

UNIT-IV: METROLOGY

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
50.	Introduction to Metrology	1	22-9-23		TLM2	
51.	Linear and angular measurements	1	23-9-23		TLM2	
52.	Standards of measurements - line and end standards	1	26-9-23		TLM2	
53.	Dial indicators, Micrometers	1	27-9-23		TLM2	
54.	Basic principle and applications of slip gauges Angle slip gauges	1	29-9-23		TLM2	
55.	Sine bar and rollers	1	30-9-23		TLM2	
56.	**SURFACE TEXTURE** Introduction, Factors effecting surface roughness	1	3-10-23		TLM2	
57.	reasons for controlling surface texture	1	4-10-23		TLM2	
58.	Differences between surface roughness and surface waviness	1	5-10-23		TLM2	
59.	Elements of surface texture - Numerical assessment of surface finish	1	6-10-23		TLM2	
60.	C.L.A., R.M.S Values	1	7-10-23		TLM2	
61.	R_a values, and R_z values	1	10-10-23		TLM2	
62.	ISI symbols for indication of surface finish.	1	11-10-23		TLM2	
63.	Profile meters	1	12-10-23		TLM2	
64.	Tomlinson surface meter	1	13-10-23		TLM2	
65.	Quiz and Revision	1	17-10-23		TLM2	
No. of classes required to complete UNIT-IV: 15				**No. of classes taken:**		

UNIT-V: LIMITS AND FITS

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
66.	Introduction	1	18-10-23		TLM2	
67.	Tolerance limits Normal size	1	19-10-23		TLM2	

68.	Deviations, Allowance, Fits and their types	1	20-10-23		TLM2	
69.	Unilateral tolerance system, Bilateral tolerance system	1	24-10-23		TLM2	
70.	Hole basis systems, Shaft basis systems	1	25-10-23		TLM2	
71.	Hole basis systems problems, Shaft basis systems problems	1	26-10-23		TLM2	
72.	Interchangeability and selective assembly, alignment test	1	27-10-23		TLM2	
73.	Quiz and Revision	1	28-10-23		TLM1	
No. of classes required to complete UNIT-V: 8				**No. of classes taken:**		
II-Mid Exams : 30-10-23 to 4-11-23						

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

Academic Calendar

Description	From	To	weeks
I phase of Instructions	3-7-23	26-8-23	8w
I Mid Examinations	**28-8-23**	**2-9-23**	**1W**
II phase of Instructions	4-9-23	28-10-23	8W
II Mid Examinations	**30-10-23**	**4-11-23**	**1W**
Preparation and Practical's	6-11-23	11-11-23	2W

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 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	**S. Srinivasa Reddy**	**Dr. K. Murahari**	**Dr.MBS Srikar reddy**	**Dr. S.Pichi Reddy**
Signature				

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L.B. REDDY NAGAR, MYLAVARAM, KRISHNA DIST., A.P.-521 230.
Phone: 08659-222933, Fax: 08659-222931

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor: Dr.B.Sudheer Kumar
Course Name & Code **:** Design of Machine Elements-I & 20ME12
L-T-P Structure **: 2-1-0** **Credits:** 3
Program/Sem/Sec : B.Tech/V/B **A.Y.:** 2023-24

PREREQUISITE: Mechanics of Solids

COURSE EDUCATIONAL OBJECTIVES (CEOs): The main objective of this course is to familiarize the steps involved in the design process of various machine elements.

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

CO1	Comprehend the simple stresses in machine parts subjected to static loads. **(Understanding-L2)**
CO2	Analyze the failure criterion of mechanical parts subjected to fatigue loads**. (Analyzing-L4)**
CO3	Evaluate the strengths of welded & threaded joints subjected to various types of loads**. (Applying-L3**)
CO4	Design the shafts for various applications of engineering**. (Applying-L3)**
CO5	Design the various mechanical elements such as keys, cotter, knuckle joints & shaft couplings. **(Applying-L3)**

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

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

BOS APPROVED TEXT BOOKS:

T1. Bhandari V.B, Design of Machine Elements, 3rdEdition, 2ndReprint, Tata McGraw-Hill 2010.

T2. Shigley J.E and Mischke C. R., Mechanical Engineering Design, 6thEdition, Tata McGraw-Hill, 2003.

BOS APPROVED REFERENCE BOOKS:

R1 Norton R.L, "Design of Machinery", ,2ndedition,Tata McGraw-Hill Book Co, 2001.

R2 Orthwein W, "Machine Component Design", 1st edition, Jaico Publishing Co, 1999.

R3. Ugural A.C, "Mechanical Design – An Integral Approach, McGraw-Hill Book Co, 2004.

R4. Spotts M.F., Shoup T.E "Design and Machine Elements" Pearson Education, 2004.

R5. Juvinall R. C., Marshek K.M., "Fundamentals of Machine component Design", – John Wiley & Sons 3rdEdition, 2002.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: **INTRODUCTION, DESIGN FOR STATIC STRENGTH**

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	Design - Introduction	1	03-07-2023		TLM2	
2.	Machine Design-Introduction& Basic Procedure	1	04-07-2023		TLM2	
3.	Basic requirements of machine elements and Design of Machine Elements	1	04-07-2023		TLM2	
4.	Design analysis-Design synthesis Introduction to Indian standards	1	05-07-2023		TLM2	
5.	Selection of Preferred sizes & Modes of failure – Factor of safety	1	06-07-2023		TLM2	
6.	Stress-strain relationship, Shear stress and shear strain	1	10-07-2023		TLM2	
7.	Stresses due to bending moment	1	11-07-2023		TLM2	
8.	Stresses due to torsional moment	1	11-07-2023		TLM2	
9.	Eccentric axial loading	1	12-07-2023		TLM2	
10.	**Tutorial-I**	1	13-07-2023		TLM2	
11.	Theories of elastic failure – Introduction and principal stresses	1	17-07-2023		TLM2	
12.	Maximum principal stress theory	1	18-07-2023		TLM1	
13.	Maximum Shear stress theory	1	18-07-2023		TLM2	
14.	Distortion energy theory	1	19-07-2023		TLM2	
15.	**Tutorial-II & Quiz-I**	1	20-07-2023		TLM2	
No. of classes required to complete UNIT-I:				No. of classes taken:		

UNIT-II: DESIGN FOR FATIGUE STRENGTH

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
16.	Stress concentration - Stress concentration factors	1	24-07-2023		TLM2	
17.	Reduction of stress concentration Fluctuating stresses - Fatigue failure	1	25-07-2023		TLM2	

18.		1	25-07-2023		TLM2	
19.	Endurance limit Low cycle and high cycle fatigue	1	26-07-2023		TLM2	
20.	Notch sensitivity	1	27-07-2023		TLM2	
21.	Endurance limit - Approximate estimation	1	31-07-2023		TLM2	
22.	Introduction to reversed stresses	1	01-08-2023		TLM2	
23.	Reversed stresses and Design for infinite life	1	01-08-2023		TLM2	
24.	**Tutorial-III**	1	02-08-2023		TLM2	
25.	Soderberg, Goodman lines	1	03-08-2023		TLM2	
26.	Modified Goodman line	1	07-08-2023		TLM2	
27.	Infinite Life Problems under fluctuating loads	1	08-08-2023		TLM2	
28.	Infinite Life Problems under fluctuating loads	1	08-08-2023		TLM2	
29.	Gerber equation and Fatigue design under combined stresses	1	09-08-2023		TLM2	
30.	**Tutorial-IV & Quiz-II**	1	10-08-2023		TLM2	
No. of classes required to complete UNIT-II:				No. of classes taken:		

UNIT-III: WELDED JOINTS, THREADED JOINTS

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
31.	Introduction to welding joints Butt joints-Fillet joints	1	14-08-2023		TLM2	
32.	Strength of butt welds- Strength of parallel fillet welds	1	16-08-2023		TLM2	
33.	Strength of transverse fillet welds Maximum shear stress in parallel fillet welds	1	17-08-2023		TLM2	
34.	Maximum shear stress in transverse fillet welds	1	21-08-2023		TLM2	
35.	Axially loaded un symmetrical Welded joints	1	22-08-2023		TLM2	
36.	Welded joint subjected to bending moment	1	22-08-2023		TLM2	
37.	**Tutorial-V**	1	24-08-2023		TLM2	
38.	**I-Mid Exams :28.08.2023 to 02.09.2023**					
39.	Threaded joints -Terminology of screw threads	1	04-09-2023		TLM2	
40.	Bolted joints	1	05-09-2023		TLM2	
41.	Eccentrically loaded bolted joints in shear	1	05-09-2023		TLM2	
42.	Problems on Eccentrically loaded bolted joints in shear	1	07-09-2023		TLM2	
43.	Eccentrically loaded bolted joints in shear	1	11-09-2023		TLM2	
44.	Problems on Eccentrically loaded bolted joints in shear	1	12-09-2023		TLM2	

45.	Eccentric load perpendicular to axis of bolt	1	12-09-2023		TLM2	
46.	Problems on Eccentric load perpendicular to axis of bolt	1	13-09-2023		TLM2	
47.	Bolts of uniform strength	1	14-09-2023		TLM2	
48.	**Tutorial-VI & Quiz-III**	1	19-09-2023		TLM2	
No. of classes required to complete UNIT-III:				No. of classes taken:		

UNIT-IV: SHAFTS

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 transmission shafts Shaft design on strength basis	1	19-09-2023		TLM2	
50.	Shaft design on strength basis	1	20-09-2023		TLM2	
51.	Shaft design on torsional rigidity basis	1	21-09-2023		TLM2	
52.	ASME code for shaft design	1	25-09-2023		TLM2	
53.	**Tutorial-VII**	1	26-09-2023		TLM2	
54.	Design of hollow shaft on strength and torsional rigidity basis	1	26-09-2023		TLM2	
55.	Design of hollow shaft on strength and torsional rigidity basis	1	27-09-2023		TLM2	
56.	Problems on shafts	1	03-10-2023		TLM2	
57.	Problems on shafts	1	03-10-2023		TLM2	
58.	Problems on shafts	1	04-10-2023		TLM2	
59.	**Tutorial-VIII & Quiz-IV**	1	05-10-2023		TLM2	
No. of classes required to complete UNIT-IV:				No. of classes taken:		

UNIT-V: KEYS, COTTER AND KNUCKLE JOINTS, SHAFT 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
60.	Design of square and flat keys-types,	1	09-10-2023		TLM2	
61.	Design of Socket and Spigot cotter joint	1	10-10-2023		TLM2	
62.	Design of Socket and Spigot cotter joint	1	10-10-2023		TLM2	
63.	Problem on Design of Socket and Spigot cotter joint	1	11-10-2023		TLM2	
64.	Problem on Design of Socket and **Spigot cotter joint**	1	12-10-2023			
65.	Design of Cotter joints	1	16-10-2023		TLM2	
66.	Design of Knuckle joint-Failures	1	17-10-2023		TLM1	
67.	Problems on Knuckle joint	1	17-10-2023			
68.	Quiz-IV	1	18-10-2023		TLM1	
69.	**Tutorial-IX**	1	19-10-2023		TLM1	

70.	Flange coupling- Muff coupling	1	24-10-2023		TLM2	
71.	Clamp coupling	1	24-10-2023		TLM3	
72.	Bushed pin flexible coupling	1	25-10-2023		TLM2	
73.	Quiz-V **/Tutorial-X**	1	26-10-2023		TLM2	
No. of classes required to complete UNIT-V:				No. of classes taken:		
II-Mid Exams :				30.10.2023 to 04.11.2023		

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 & 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 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	**Dr.B.Sudheer Kumar**	**Dr.B.Sudheer Kumar**	**Dr.B.Sudheer Kumar**	**Dr. S.Pichi Reddy**
Signature				

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L.B.Reddy Nagar, Mylavaram-521230, Krishna Dist, Andhra Pradesh, India

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART - A

PROGRAM : **B.Tech. - V-Sem. - Mechanical Engineering – A Section**
ACADEMIC YEAR : 2023-24
COURSE NAME & CODE : **ROBOTICS – 20ME14**
L-T-P STRUCTURE : 3-0-0
COURSE CREDITS : 3
COURSE INSTRUCTOR :**Dr. Siva Sankara Babu Chinka, Associate Professor**
COURSE COORDINATOR : **Dr. M B S Sreekara Reddy, Associate Professor**
PER-REQUISITE : Engineering Mechanics & Kinematics of Machines

COURSE EDUCATIONAL OBJECTIVES:

The main objective of this course is to cultivate the interest and ability to develop robotic systems for social and industrial development.

COURSE OUTCOMES:

After completion of the course student will be able to:

CO1: Understand the basics of robots, end effectors and its applications.
CO2: Familiarize the working of actuators and sensors for robotic application.
CO3: Formulate D-H matrices for different kinematics problems.
CO4: Model the dynamic behavior of robot.
CO5: Analyze the trajectory of robotic motion.

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

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

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

BOS APPROVED TEXT BOOKS:

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

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

BOS APPROVED REFERENCE BOOKS:

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

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

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

COURSE DELIVERY PLAN (LESSON PLAN): ROBOTICS (20ME14)

PART - B

UNIT-I: INTRODUCTION TO ROBOTICS, ANATOMY, ROBOT END EFFECTORS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
1.	**Introduction to Robotics**	1	03-07-2023		TLM2	CO1	T1, T2, R1, R2	
2.	CEOs, Course Outcomes, POs and PSOs	1	04-07-2023		TLM2	-	-	
3.	Basic concepts – Robot anatomy	1	04-07-2023		TLM2	CO1	T1, T2, R1, R2	
4.	Components of robots, **Tutorial**	1	07-07-2023		TLM3	CO1	T1, T2, R1, R2	
5.	Robot motions	1	10-07-2023		TLM2	CO1	T1, T2, R1, R2	
6.	Number of D.O.F – Work volume	1	11-07-2023		TLM2	CO1	T1, T2, R1, R2	
7.	Robot applications in Material transfer and machine loading / unloading applications	1	11-07-2023		TLM2	CO1	T1, T2, R1, R2	
8.	Robot applications in Processing operations – Assembly and inspection – Future applications	1	14-07-2023		TLM2	CO1	T1, T2, R1, R2	
9.	**Robot End Effectors –** Introduction, **Tutorial**	1	15-07-2023		TLM3	CO1	T1, T2, R1, R2	
10.	Types of end effectors – Mechanical grippers	1	17-07-2023		TLM2	CO1	T1, T2, R1, R2	
11.	Vacuum cups, magnetic grippers, adhesive gripers and others	1	18-07-2023		TLM2	CO1	T1, T2, R1, R2	
12.	Robot / End effectors interface	1	18-07-2023		TLM2	CO1	T1, T2, R1, R2	
13.	Considerations in gripper selection and design	1	21-07-2023		TLM2	CO1	T1, T2, R1, R2	
14.	Case Studies, Numericals, **Tutorial**	1	22-07-2023		TLM3	CO1	T1, T2, R1, R2	
15.	Numericals	1	24-07-2023		TLM2	CO1	T1, T2, R1, R2	
No. of classes required to complete UNIT-I:		**15**			**No. of classes taken:**			

UNIT-II: ROBOT ACTUATORS AND SENSORS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
16.	Introduction to Actuators	1	25-07-2023		TLM2	CO2	T1,R1	
17.	Characteristics of Actuating System	1	25-07-2023		TLM2	CO2	T1,R1	
18.	Pneumatic Actuators	1	28-07-2023		TLM2	CO2	T1,R1	
19.	Hydraulic Actuators, **Tutorial**	1	31-07-2023		TLM3	CO2	T1,R1	
20.	Electric Motors	1	01-08-2023		TLM2	CO2	T1,R1	
21.	Introduction to Sensors	1	01-08-2023		TLM2	CO2	T1,R1	
22.	Sensor characteristics	1	04-08-2023		TLM1	CO2	T1,R1	
23.	Position sensors: Potentiometers, LVDT	1	05-08-2023		TLM1	CO2	T1,R1	
24.	Resolvers, Encoders, **Tutorial**	1	07-08-2023		TLM3	CO2	T1,R1	
25.	Magnetostrictive Displacement Transducers (MDT)	1	08-08-2023		TLM1	CO2	T1,R1	
26.	Velocity Sensors: Encoders, Tachometers	1	08-08-2023		TLM1	CO2	T1,R1	
27.	Industrial Applications, **Tutorial**	1	11-08-2023		TLM3	CO2	T1,R1	
No. of classes required to complete UNIT-II		**12**		**No. of classes taken:**				

UNIT-III: MANIPULATOR KINEMATICS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
28.	Introduction to Manipulator Kinematics	1	14-08-2023		TLM2	CO3	T1,R1	
29.	Coordinate Frames	1	18-08-2023		TLM2	CO3	T1,R1	
30.	Description of Objects in space	1	19-08-2023		TLM2	CO3	T1,R1	
31.	Transformation of vectors, **Tutorial**	1	21-08-2023		TLM3	CO3	T1,R1	
32.	Numericals	1	22-08-2023		TLM1	CO3	T1,R1	
33.	Inverting a Homogeneous Transform	1	22-08-2023		TLM2	CO3	T1,R1	
34.	Fundamental Rotation Matrices	1	25-08-2023		TLM2	CO3	T1,R1	
35.	Numericals, **Tutorial**	1	26-08-2023		TLM3	CO3	T1,R1	
36.	**I Mid Examinations**	**5**	**28-08-2023 to 02-09-2023**					
37.	D-H representation	1	04-09-2023		TLM2	CO3	T1,R1	
38.	Problems on Forward Kinematics	1	05-09-2023		TLM2	CO3	T1,R1	
39.	Numericals	1	05-09-2023		TLM2	CO3	T1,R1	
40.	Numericals	1	08-09-2023		TLM2	CO3	T1,R1	
41.	Numericals, **Tutorial**	1	11-09-2023		TLM3	CO3	T1,R1	
42.	Numericals	1	12-09-2023		TLM2	CO3	T1,R1	
No. of classes required to complete UNIT-III		**14**			**No. of classes taken:**			

UNIT-IV: ROBOT DYNAMICS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
43.	Introduction to Dynamics of Robots	1	12-09-2023		TLM2	CO4	T1,R1	
44.	Differential transformations	1	15-09-2023		TLM2	CO4	T1,R1	
45.	Numericals	1	16-09-2023		TLM2	CO4	T1,R1	
46.	Numericals, **Tutorial**	1	19-09-2023		TLM3	CO4	T1,R1	
47.	Numericals	1	19-09-2023		TLM2	CO4	T1,R1	
48.	Numericals	1	22-09-2023		TLM2	CO4	T1,R1	
49.	Jacobian Matrix	1	23-09-2023		TLM2	CO4	T1,R1	
50.	Numericals	1	25-09-2023		TLM1	CO4	T1,R1	
51.	Numericals, **Tutorial**	1	26-09-2023		TLM3	CO4	T1,R1	
52.	Numericals	1	26-09-2023		TLM1	CO4	T1,R1	
53.	Lagrange Euler formulation	1	29-09-2023		TLM2	CO4	T1,R1	
54.	Numericals	1	30-09-2023		TLM2	CO4	T1,R1	
55.	Numericals	1	02-10-2023		TLM1	CO4	T1,R1	
56.	Numericals, **Tutorial**	1	03-10-2023		TLM3	CO4	T1,R1	
57.	Numericals	1	03-10-2023		TLM1	CO4	T1,R1	
No. of classes required to complete UNIT-IV		**15**			**No. of classes taken:**			

UNIT-V: TRAJECTORY PLANNING

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
58.	Introduction to Trajectory Planning	1	06-10-2023		TLM2	CO5	T1,R1	
59.	Considerations on Trajectory Planning	1	07-10-2023		TLM2	CO5	T1,R1	
60.	Joint Interpolated Trajectory	1	09-10-2023		TLM2	CO5	T1,R1	
61.	Numericals	1	10-10-2023		TLM2	CO5	T1,R1	
62.	Numericals, **Tutorial**	1	10-10-2023		TLM3	CO5	T1,R1	
63.	Numericals	1	13-10-2023		TLM2	CO5	T1,R1	
64.	Numericals	1	16-10-2023		TLM2	CO5	T1,R1	
65.	Numericals	1	17-10-2023		TLM2	CO5	T1,R1	
66.	Cartesian Path Trajectory	1	17-10-2023		TLM2	CO5	T1,R1	
67.	Numericals, **Tutorial**	1	20-10-2023		TLM3	CO5	T1,R1	
68.	Numericals	1	21-10-2023		TLM2	CO5	T1,R1	
69.	Numericals, **Tutorial**	1	24-10-2023		TLM3	CO5	T1,R1	
70.	**Robot Programming**	1	24-10-2023		TLM2	CO5	T1,R1	
71.	**Robot Programming**	1	27-10-2023		TLM2	CO5	T1,R1	
72.	**Robot Programming**	1	28-10-2023		TLM2	CO5	T1,R1	
No. of classes required to complete UNIT-V		**12 + 03 (Beyond Syllabus)**			**No. of classes taken:**			
II Mid Examinations – 30-10-2023 to 04-11-2023								

TEACHING LEARNING METHODS:

TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/ Project/Assignment/Quiz

PART – C

EVALUATION PROCESS (R20 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 EDUCATIONAL OBJECTIVES (PEOs):

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

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

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

PROGRAMME OUTCOMES (POs):

Engineering Graduates will be able to:

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

2. Problem analysis: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations.

6. The engineer and society: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):
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.

Signatures				
Faculty Name	**Dr. Siva Sankara Babu Ch**	**Dr. M B S Sreekara Reddy**	**Dr. M B S Sreekara Reddy**	**Dr. S. Pichi Reddy**
Designation	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**HOD**

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

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L.B. REDDY NAGAR, MYLAVARAM, KRISHNA DIST., A.P.-521 230.
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-20EE84
L-T-P Structure : 3-0-0 **Credits:** 3
Program/Sem/Sec : B.Tech., V-Sem., MECH –B section **A.Y** : 2023-24

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															
CO2															
CO3															
CO4															
CO5															
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	03/07/23		TLM1	
2.	Components	1	06/07/23		TLM1	
3.	Vehicle Mechanics	1	07/07/23		TLM1	
4.	Roadway Fundamentals	1	10/07/23		TLM1	
5.	Roadway Fundamentals	1	13/07/23		TLM1	
6.	Vehicle Kinetics	1	14/07/23		TLM1	
7.	Dynamics of vehicle motion	1	15/07/23		TLM1	
8.	Dynamics of vehicle motion	1	17/07/23		TLM1	
9.	Propulsion system design.	1	20/07/23		TLM1	
10.	Propulsion system design.	1	21/07/23		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	22/07/23		TLM1	
12	Parameters	1	24/07/23		TLM1	
13	Capacity	1	27/07/23		TLM1	
14	Discharge Rate	1	28/07/23		TLM1	
15	Sate of charge	1	31/07/23		TLM1	
16	State of Discharge	2	3/08/23		TLM1	
17	Depth od Discharge		4/08/23		TLM1	
18	Technical Characteristics	1	5/08/23		TLM1	
19	Battery pack Design	1	7/08/23		TLM2	

20	Battery pack Design	1	10/08/23		TLM2	
21	Properties of Batteries	1	11/08/23		TLM2	
No. of classes required to complete UNIT-II		11				

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	11/08/23		TLM1	
23	Motor & Engine rating, requirements	1	14/08/23		TLM1	
25	DC machines	1	17/08/23		TLM1	
26.	DC machines	1	18/08/23		TLM1	
27.	Three phase A.C. Machines	1	19/08/23		TLM1	
29.	Three phase A.C. Machines	1	21/08/23		TLM1	
30.	Induction Machines	1	24/08/23		TLM1	
31	Permanent magnet machines	1	25/08/23		TLM1	
32	Permanent magnet machines	1	26/08/23		TLM1	
33.	Switched reluctance machines	1	04/09/23		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	08/09/23		TLM1	
35	Transmission Configuration	1	11/09/23		TLM1	
36	Components	1	14/09/23		TLM1	
37	gears	1	15/09/23		TLM1	
38	differential	1	16/09/23		TLM1	
39	clutch	1	18/09/23		TLM1	
40	brakes	1	21/09/23		TLM2	

41	Regenerative braking	1	22/09/23		TLM1	
42	Regenerative braking	1	23/09/23		TLM1	
43	Motor sizing	1	25/09/23		TLM1	
44	Motor sizing	1	29/09/23		TLM2	
No. of classes required to complete UNIT-IV		11				

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	30/09/23		TLM1	
46	Series	1	5/10/23		TLM1	
47	Parallel and series	1	6/10/23		TLM1	
48	Parallel configuration	1	7/10/23		TLM1	
49	Design	1	9/10/23		TLM1	
50	Drive train	1	12/10/23		TLM2	
51	Sizing of components	1	13/10/23		TLM2	
52	Revision	1	14/10/23		TLM2	
53	Revision unit-I	1	16/10/23		TLM2	
54	Revision unit-II	1	19/10/23		TLM2	
55	Revision unit-III	1	26/10/23		TLM2	
56	Revision unit-IV	1	27/10/23		TLM2	
57	Revision unit-V	1	28/10/23		TLM2	
No. of classes required to complete UNIT-V		13				

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	28/10/23		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 & 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.J.S.Vara Prasad**
Signature				

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DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code	**: 20ME60**	**Lab**	**:TE LAB**
Lab/Practicals	**: 3 hrs/ Week**	**Continuous Internal Assessment**	**: 15**
A.Y.	**: 2023-2024**	**Semester End Examination**	**: 35**
Class & Semester	**: B. Tech – V Sem**	**Section**	**: B**
Instructors	**: Dr. P. Vijaya Kumar, Professor**		
	Dr. V.Dhana Raju, Associate Professor		

COURSE EDUCATIONAL OBJECTIVE:

The main objective of the course is to familiarize the principles and evolution of various performance parameters of mechanical systems and its impact on global environment.

COURSE OUTCOMES:

After completion of the course students are able to:

CO1: Estimate various fuel characteristics through experimental testing.
CO2: Analyze the performance characteristics of Internal Combustion Engines.
CO3: Evaluate the performance parameters of refrigeration and air conditioning systems.
CO4: Draw the characteristic curves for the air compressors.

Course Articulation Matrix:

17ME69	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PS O1	PS O2	PS O3
CO1	3	2	2	2		1	1					2	2		
CO2	3	3	3	3		2	2					3	3		
CO3	2	3	3	2		2	2					2	3		
CO4	2	3	3	2		1	1					1	2		

Course Instructor **Course Coordinator** **Module Coordinator**

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DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code	**: 20ME60**	**Lab**	**:TE LAB**
Lab/Practicals	**: 3hrs/ Week**	**Continuous Internal Assessment**	**: 15**
A.Y.	**: 2023-2024**	**Semester End Examination**	**: 35**
Class & Semester	**: B. Tech – V Sem**	**Section**	**: B**
Instructors	**: Dr. P. Vijaya Kumar, Professor**		
	Dr. V.Dhana Raju, Associate Professor		

At least 10 experiments are to be conducted:

LIST OF EXPERIMENTS:

1. IC Engines Valve timing and Port timing diagram.**(TE 1)**
2. Performance Test on Variable Compression Ratio single cylinder 4-Stroke petrol Engine By using Eddy Current Dynamometer.**((TE 2)**
3. Test on single cylinder 4 -Stroke Diesel Engine by using Mechanical Dynamometer **(TE3)**
4. Evaluation of performance parameters of twin cylinder 4-stroke diesel engine **(TE 4)**
5. Determination of performance characteristics of 2-Stroke Petrol Engine **(TE 5)**
6. Evaluation of engine friction power by conducting Morse test on Multi cylinder 4-Stroke Petrol Engine **(TE 6)**
7. Heat Balance of 4 stroke single cylinder diesel engine **(TE 7)**
8. Performance Test on Reciprocating Air – Compressor. **(TE 8)**
9. Determination of COP of Vapour Compression Refrigeration Unit..**(TE 9)**
10. Performance Test on Air Conditioning Unit. (**TE10**)
11. Demonstration of automobile working components. (**TE11**)
12. Measurement of exhaust emissions and smoke of I.C Engines.(**TE12**)
13. Solar parabolic concentrator apparatus. **(TE 13)**
14. Determination of calorific value of fuel using bomb calorimeter **(TE14)**

REFERENCES

Lab Manual

Course Instructor **Course Coordinator** **Module Coordinator**

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DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code	**: 20ME60**	**Lab**	**:TE LAB**
Lab/Practicals	**: 3hrs/ Week**	**Continuous Internal Assessment**	**: 15**
A.Y.	**: 2023-2024**	**Semester End Examination**	**: 35**
Class & Semester	**: B. Tech – V Sem**	**Section**	**: B**
Instructors	**: Dr. P. Vijaya Kumar, Professor**		
	Dr. V.Dhana Raju, Associate Professor		

Batches (Section – B)

Total No. of students : 21761A0333-362&22765A0330-362 = 61

Batch B1 :21761A0333-362&22765A0330-332 = 31

Batch B2 :22765A0333-22765A0362 = 30

Sub Batches of B1:

S. No	Batch	Registered Nos	Total
1	$B1_1$	21761A0333-338	06
2	$B1_2$	21761A0339-344	06
3	$B1_3$	21761A0345-351	06
4	$B1_4$	21761A0352-357	06
5	$B1_5$	21761A0358-362&22765A0330-332	07
Total			31

Sub Batches of B2:

S. No	Batch	Registered Nos	Total
1	$B2_1$	22765A0333-338	06
2	$B2_2$	22765A0339-344	06
3	$B2_3$	22765A0345-350	06
4	$B2_4$	22765A0351-356	06
5	$B2_5$	22765A0357-362	06
Total			30

Course Instructor **Course Coordinator** **Module Coordinator**

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DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code	**: 20ME60**	**Lab**	**:TE LAB**
Lab/Practicals	**: 3hrs/ Week**	**Continuous Internal Assessment**	**: 15**
A.Y.	**: 2023-2024**	**Semester End Examination**	**: 35**
Class & Semester	**: B. Tech – V Sem**	**Section**	**: B**
Instructors	**: Dr. P. Vijaya Kumar, Professor**		
	Dr. V.Dhana Raju, Associate Professor		

Notification of Cycles (Section – B)

Batches	Laboratory	Cycle	Experiment No.s
B1 & B2	**Thermal Engineering LAB**	**I**	TE 1 to TE 5
		II	TE 6 to TE 10

Total No. of students :21761A0333-362&22765A0330-362 = 61

Batch B1 :21761A0333-362&22765A0330-332 = 31

Batch B2 :22765A0333-22765A0362 = 30

Course Instructor **Course Coordinator** **Module Coordinator**

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DEPARTMENT OF MECHANICAL ENGINEERING

Schedule of THERMAL ENGINEERING LAB (Section – B)

Laboratory Code : 20ME60 Lab: TE LAB Lab/Practicals : 3 hrs/ Week

A.Y. : 2023-2024 Class & Semester : B. Tech – V Semester Section : B

Instructors : Dr. P. Vijaya Kumar, Professor & Dr. V.Dhana Raju, Associate Professor

S. No	Date		Batches								
		$B1_1$	$B1_2$	$B1_3$	$B1_4$	$B1_5$	$B1_6$	$B1_7$	$B1_8$	$B1_9$	$B1_{10}$
1	06-07-2023		**Demonstration of TE Lab**								
2	13-07-2023	TE – 1	TE – 2	TE – 3	TE – 4	TE – 5	TE – 1	TE – 2	TE – 3	TE – 4	TE – 5
3	20-07-2023	TE – 2	TE – 3	TE – 4	TE – 5	TE – 1	TE – 2	TE – 3	TE – 4	TE – 5	TE – 1
4	27-07-2023	TE – 3	TE – 4	TE – 5	TE – 1	TE – 2	TE – 3	TE – 4	TE – 5	TE – 1	TE – 2
5	03-08-2023	TE – 4	TE – 5	TE – 1	TE – 2	TE – 3	TE – 4	TE – 5	TE – 1	TE – 2	TE – 3
6	10-08-2023	TE – 5	TE – 1	TE – 2	TE – 3	TE – 4	TE – 5	TE – 1	TE – 2	TE – 3	TE – 4
28-08-2023 to 02-09-2023		**I Mid Examinations**									
7	07-09-2023	TE – 6	TE – 7	TE– 8	TE – 9	TE- 10	TE – 6	TE – 7	TE– 8	TE – 9	TE- 10
8	14-09-2023	TE – 7	TE – 8	TE –9	TE – 10	TE – 1	TE – 7	TE – 8	TE –9	TE – 10	TE – 1
9	21-09-2023	TE – 8	TE –9	TE – 10	TE – 1	TE –2	TE – 8	TE –9	TE – 10	TE – 1	TE –2
10	05-10-2023	TE – 9	TE – 10	TE – 1	TE –2	TE – 3	TE – 9	TE – 10	TE – 1	TE –2	TE – 3
11	12-10-2023	TE – 10	TE – 1	TE– 2	TE– 3	TE – 4	TE – 10	TE – 1	TE– 2	TE– 3	TE – 4
12	19-10-2023	Repetition									
13	26-10-2023	**Internal Examination**									
30-10-2023 to 04-11-2023		**II Mid Examinations**									

Course Instructor **Course Coordinator** **Module Coordinator**

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING (Autonomous)

Affiliated to JNTUK, Kakinada & Approved by AICTE New Delhi, Accredited by NBA (Tier – I), New Delhi & certified by ISO 9001:2015

DEPARTMENT OF MECHANICAL ENGINEERING

Schedule of THERMAL ENGINEERING LAB (Section – B)

Laboratory Code : 20ME60 Lab: TE LAB Lab/Practicals : 3 hrs/ Week

A.Y. : 2023-2024 Class & Semester : B. Tech – V Semester Section : B

Instructors : Dr. P. Vijaya Kumar, Professor & Dr. V.Dhana Raju, Associate Professor

S. No	Date	Batches									
		$B2_1$	$B2_2$	$B2_3$	$B2_4$	$B2_5$	$B2_6$	$B2_7$	$B2_8$	$B2_9$	$B2_{10}$
1	08-07-2023		**Demonstration of TE Lab**								
2	15-07-2023	TE – 1	TE – 2	TE – 3	TE – 4	TE – 5	TE – 1	TE – 2	TE – 3	TE – 4	TE – 5
3	22-07-2023	TE – 2	TE – 3	TE – 4	TE – 5	TE – 1	TE – 2	TE – 3	TE – 4	TE – 5	TE – 1
4	05-08-2023	TE – 3	TE – 4	TE – 5	TE – 1	TE – 2	TE – 3	TE – 4	TE – 5	TE – 1	TE – 2
5	12-08-2023	TE – 4	TE – 5	TE – 1	TE – 2	TE – 3	TE – 4	TE – 5	TE – 1	TE – 2	TE – 3
6	19-08-2023	TE – 5	TE – 1	TE – 2	TE – 3	TE – 4	TE – 5	TE – 1	TE – 2	TE – 3	TE – 4
28-08-2023 to 02-09-2023		**I Mid Examinations**									
7	09-09-2023	TE – 6	TE – 7	TE– 8	TE – 9	TE- 10					
8	16-09-2023	TE – 7	TE – 8	TE –9	TE – 10	TE – 1	TE – 7	TE – 8	TE –9	TE – 10	TE – 1
9	23-09-2023	TE – 8	TE –9	TE – 10	TE – 1	TE –2	TE – 8	TE –9	TE – 10	TE – 1	TE –2
10	30-09-2023	TE – 9	TE – 10	TE – 1	TE –2	TE – 3	TE – 9	TE –10	TE – 1	TE –2	TE – 3
11	07-10-2023	TE – 10	TE – 1	TE– 2	TE– 3	TE – 4	TE – 10	TE – 1	TE– 2	TE– 3	TE – 4
12	21-10-2023	Repetition									
13	28-10-2023	**Internal Examination**									
30-10-2023 to 04-11-2023		**II Mid Examinations**									

Course Instructor **Course Coordinator** **Module Coordinator**

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING (Autonomous)

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DEPARTMENT OF MECHANICAL ENGINEERING

Schedule of THERMAL ENGINEERING LAB (Section – B)

Laboratory Code : 20ME60 Lab: TE LAB Lab/Practicals : 3 hrs/ Week

A.Y. : 2023-2024 Class & Semester : B. Tech – V Semester Section : B

Instructors : Dr. P. Vijaya Kumar, Professor & Dr. V.Dhana Raju, Associate Professor

Batches

(Section – B)

Total No. of students :21761A0333-362&22765A0330-362 = 61

Batch B1 :21761A0333-362&22765A0330-332 = 31

Batch B2 :22765A0333-22765A0362 = 30

Sub Batches of B1:

S. No	Batch	Registered Nos	Total
1	$B1_1$	21761A0333-338	06
2	$B1_2$	21761A0339-344	06
3	$B1_3$	21761A0345-351	06
4	$B1_4$	21761A0352-357	06
5	$B1_5$	21761A0358-362&22765A0330-332	07
Total			31

Sub Batches of B2:

S. No	Batch	Registered Nos	Total
1	$B2_1$	22765A0333-338	06
2	$B2_2$	22765A0339-344	06
3	$B2_3$	22765A0345-350	06
4	$B2_4$	22765A0351-356	06
5	$B2_5$	22765A0357-362	06
Total			30

Course Instructor Course Coordinator Module Coordinator

DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code : 20ME61 **Lab** : Machine Tools and Metrology Lab
A.Y. : 2023-24 **Class** : B. Tech – V Semester (Section –B)
Lab/Practicals : 3 hrs/ Week **Continuous Internal Assessment** : 15
Credits : 01 **Semester End Examination** : 35
Name of the Faculty : S.Srinivasa Reddy (Sr.Asst. Prof.) / V.Sankararao (Sr. Asst. Prof.)

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

PRE-REQUISITES: Engineering Drawing, Production Technology, Machine Tools and Metrology

COURSE EDUCATIONAL OBJECTIVES:

The main objective of this laboratory course is to provide hands on experience using machine tools and metrology instruments.

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

CO1: Develop sequence of machining operations to produce the component. (**Applying-L3**)
CO2: Capable of machining components according to given drawing using various machine tools. (**Applying-L3**)
CO3: Perform linear, angular and gear measurements of machined components. (**Applying-L3**)
CO4: Analyze the measurement of the surface roughness and perform alignment tests. (**Applying-L3**)

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	12	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**

DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code	**:** 20ME61	**Lab**	: Machine Tools and Metrology Lab
A.Y.	**:** 2023-24	**Class**	**:** B. Tech – V Semester (Section –B)
Lab/Practicals	**:** 3 hrs/ Week	**Continuous Internal Assessment**	**:** 15
Credits	**:** 01	**Semester End Examination**	**:** 35
Name of the Faculty	**:** S.Srinivasa Reddy (Sr.Asst. Prof.) / V.Sankararao (Sr. Asst. Prof.)		

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 analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.

3. Design/development of solutions: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

4. Conduct investigations of complex problems: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. Modern tool usage: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and 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):

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

PSO2: To apply the principles of manufacturing technology, scientific management towards improvement of quality and optimization of engineering systems in the design, analysis and manufacturability of products.

PSO3: To apply the basic principles of mechanical engineering design for evaluation of performance of various systems relating to transmission of motion and power, conservation of energy and other process equipment.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code	**:** 20ME61	**Lab**	: Machine Tools and Metrology Lab
A.Y.	**:** 2023-24	**Class**	**:** B. Tech – V Semester (Section –B)
Lab/Practicals	**:** 3 hrs/ Week	**Continuous Internal Assessment**	**:** 15
Credits	**:** 01	**Semester End Examination**	**:** 35
Name of the Faculty	**:** S.Srinivasa Reddy (Sr.Asst. Prof.) / V.Sankararao (Sr. Asst. Prof.)		

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.
- To perform the step turning and taper turning operation on lathe machine.
- To perform knurling and threading operations on lathe machine.
- To prepare a single point cutting tool.
- To produce a spur gear using milling machine.
- To cut a rectangular groove or key way shaping, planar and slotter machines.
- To perform drilling and tapping operations using drilling machine.
- To prepare a smooth flat surface using surface grinding machine.

PART-B (Metrology Lab)

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

- Measurement of lengths, height, diameter using vernier calipers and micrometers.
- Measurement of bores by dial bore indicators.
- Taper measurement using balls and rollers.
- Check the gear parameters of a gear using Gear teeth vernier calipers.
- Machine tool alignment test on the lathe.
- Measurement of screw thread parameters using tool maker's microscope.
- Angle and taper measurement using bevel protractor, slip gauge and sine bars, etc.
- Thread measurement by three wire method.
- Surface roughness measurement by Talysurf.

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

DEPARTMENT OF MECHANICAL ENGINEERING (Accredited by NBA Tier – I)

Laboratory Code : 20ME61 **Lab** : Machine Tools and Metrology Lab
A.Y. : 2023-24 **Class** : B. Tech – V Semester (Section –B)
Lab/Practicals : 3 hrs/ Week **Continuous Internal Assessment** : 15
Credits : 01 **Semester End Examination** : 35
Name of the Faculty : S.Srinivasa Reddy (Sr.Asst. Prof.) / V.Sankararao (Sr. Asst. Prof.)

Batches (Section – B)

S. No	Batches	Regd. Nos	Total No. of Students
1	B. Tech – V Sem - B/S	21761A0333-362 & 22765A0330–362	61
2	Batch B1	21761A0333-362, 22765A0330-332	31
3	Batch B2	22765A0333-362	30

Sub Batch of B11:

S. No	Batch	Registered Nos	Total
1	B111	21761A0333-336	04
2	B112	21761A0337-339	03
3	B113	21761A0340-342	03
4	B114	21761A0343-345	03
5	B115	21761A0346-348	03
Total (C11)			16

Sub Batch of B12:

S. No	Batch	Registered Nos	Total
1	B121	21761A0349-352	03
2	B122	21761A0353-355	03
3	B123	21761A0356-358	03
4	B124	21761A0359-362	03
5	B125	22765A0330-332	03
Total (C12)			15

Sub Batches of B21:

S. No	Batch	Registered Nos	Total
1	B211	22765A0333-335	03
2	B212	22765A0336-338	03
3	B213	22765A0339-341	03
4	B214	22765A0342-344	03
5	B215	22765A0345-347	03
Total (C21)			15

Sub Batches of B22:

S. No	Batch	Registered Nos	Total
1	B221	22765A0348-350	03
2	B222	22765A0351–353	03
3	B223	22765A0354–356	03
4	B224	22765A0357–359	03
5	B225	22765A0360–362	03
Total (C22)			15

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

DEPARTMENT OF MECHANICAL ENGINEERING (Accredited by NBA Tier – I)

Laboratory Code	**:** 20ME61	**Lab**	: Machine Tools and Metrology Lab
A.Y.	**:** 2023-24	**Class**	**:** B. Tech – V Semester (Section –B)
Lab/Practicals	**:** 3 hrs/ Week	**Continuous Internal Assessment**	**:** 15
Credits	**:** 01	**Semester End Examination**	**:** 35
Name of the Faculty	**:** S.Srinivasa Reddy (Sr.Asst. Prof.) / V.Sankararao (Sr. Asst. Prof.)		

Notification of Cycles (Section – B)

Cycle – I: MACHINE TOOLS LAB

At least SIX experiments may be conducted.
LIST OF EXPERIMENTS:

- To perform the step turning operation and taper turning operation.
- To perform knurling operation and threading operations
- To form and grind the given work piece (square rod) into single point cutting tool
- To cut spur gear on a given M.S.Round blank using milling machine.
- To cut a rectangular groove (or key way) with given dimensions on work piece using Shaping machine, Planar Machine and Slotter.
- To perform drilling and tapping operations on a given M.S. plate using universal drilling machine.
- To prepare a smooth flat surface on M.S.flat using surface Grinding machine.
- Study various machine tools

Cycle – II: METROLOGY LAB

At least SIX experiments may be conducted.

LIST OF EXPERIMENTS

- Measurement of lengths, height, diameter using vernier calipers and micrometers.
- Measurement of bores by dial bore indicators.
- Taper measurement using balls and rollers.
- Check the gear parameters of a gear using Gear teeth vernier calipers.
- Machine tool alignment test on the lathe.
- Measurement of screw thread parameters using tool maker's microscope.
- Angle and taper measurement using bevel protractor, slip gauge and sine bars, etc.
- Thread measurement by three wire method.

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

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

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Accredited by NAAC with "A" Grade and NBA (CSE, IT, ECE, EEE & ME) under Tier - I

DEPARTMENT OF MECHANICAL ENGINEERING (Accredited by NBA Tier – I)

Laboratory Code : 20ME61 **Lab** : Machine Tools and Metrology Lab
A.Y. : 2023-24 **Class** : B. Tech – V Semester (Section –B)
Lab/Practicals : 3 hrs/ Week **Continuous Internal Assessment** : 15
Credits : 01 **Semester End Examination** : 35
Name of the Faculty : S.Srinivasa Reddy (Sr.Asst. Prof.) / V.Sankararao (Sr. Asst. Prof.)

Schedule of Experiments (Section –B: B1 Batch)

S.No	Batches	Regd. Nos	Total No. of Students
1	Batch B1	21761A0333-362, 22765A0330-332	**31**

Date	Experiment (Batch)					
	Ex - 1	**Ex – 2**	**Ex – 3**	**Ex – 4**	**Ex – 5**	**Ex – 6**
15.07.2023	**Demonstration of all experiments, CEOs and COs of the Laboratory (Ex – 01 to 06)**					
MACHINE TOOLS LAB						
22.07.2023	B111	B112	B113	B114	B115	B116
29.07.2023	B116	B111	B112	B113	B114	B115
05.08.2023	B115	B116	B111	B112	B113	B114
12.08.2023	B114	B115	B116	B111	B112	B113
19.08.2023	B113	B114	B115	B116	B111	B112
26.08.2023	B112	B113	B114	B115	B116	B111
I Mid Examinations 28.08.2023 to 02.09.2023						
	Ex - 1	**Ex – 2**	**Ex – 3**	**Ex – 4**	**Ex – 5**	**Ex – 6**
09.09.2023	B121	B122	B123	B124	B125	B126
16.09.2023	B126	B121	B122	B123	B124	B125
23.09.2023	B125	B126	B121	B122	B123	B124
30.09.2023	B124	B125	B126	B121	B122	B123
14.10.2023	B123	B124	B125	B126	B121	B122
21.10.2023	B122	B123	B124	B125	B126	B121
28.10.2023	Backlog experiments / Additional Experiments					
***II Mid Examinations* 30-10-2023 to 04-11-2023**						

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

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DEPARTMENT OF MECHANICAL ENGINEERING (Accredited by NBA Tier – I)

Laboratory Code : 20ME61 **Lab** : Machine Tools and Metrology Lab
A.Y. : 2023-24 **Class** : B. Tech – V Semester (Section –B)
Lab/Practicals : 3 hrs/ Week **Continuous Internal Assessment** : 15
Credits : 01 **Semester End Examination** : 35
Name of the Faculty : S.Srinivasa Reddy (Sr.Asst. Prof.) / V.Sankararao (Sr. Asst. Prof.)

Schedule of Experiments (Section – B: B2 Batch)

S.No	Batches	Regd. Nos	Total No. of Students
1	Batch B2	22765A0333–362	**30**

Date	Experiment (Batch)					
	Ex - 1	**Ex – 2**	**Ex – 3**	**Ex – 4**	**Ex – 5**	**Ex – 6**
06.07.2023	**Demonstration of all experiments, CEOs and COs of the Laboratory (Ex – 01 to 06)**					
Machine Tools LAB						
13.07.2023	B121	B122	B123	B124	B125	B126
20.07.2023	B126	B121	B122	B123	B124	B125
27.07.2023	B125	B126	B121	B122	B123	B124
03.08.2023	B124	B125	B126	B121	B122	B123
10.08.2023	B123	B124	B125	B126	B121	B122
17.08.2023	B122	B123	B124	B125	B126	B121
24.08.2023	Backlog experiments / Additional Experiments					
I Mid Examinations 28.08.2023 to 02.09.2023						
	Ex - 1	**Ex – 2**	**Ex – 3**	**Ex – 4**	**Ex – 5**	**Ex – 6**
07.09.2023	B111	B112	B113	B114	B115	B116
14.09.2023	B116	B111	B112	B113	B114	B115
21.09.2023	B115	B116	B111	B112	B113	B114
28.09.2023	B114	B115	B116	B111	B112	B113
05.10.2023	B113	B114	B115	B116	B111	B112
12.11.2023	B112	B113	B114	B115	B116	B111
19.11.2023	Backlog experiments / Additional Experiments					
***II Mid Examinations* 30-10-2023 to 04-11-2023**						

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

DEPARTMENT OF MECHANICAL ENGINEERING (Accredited by NBA Tier – I)

Laboratory Code : 20ME61 **Lab** : Machine Tools and Metrology Lab
A.Y. : 2023-24 **Class** : B. Tech – V Semester (Section –B)
Lab/Practicals : 3 hrs/ Week **Continuous Internal Assessment** : 15
Credits : 01 **Semester End Examination** : 35
Name of the Faculty : S.Srinivasa Reddy (Sr.Asst. Prof.) / V.Sankararao (Sr. Asst. Prof.)

Schedule of Experiments (Section – B: B2 Batch)

S.No	Batches	Regd. Nos	Total No. of Students
1	Batch B1	21761A0333-362, 22765A0330-332	**31**

Date	Experiment (Batch)					
	Ex - 1	**Ex – 2**	**Ex – 3**	**Ex – 4**	**Ex – 5**	**Ex – 6**
15.07.2022	**Demonstration of all experiments, CEOs and COs of the Laboratory (Ex – 01 to 06)**					
Metrology LAB						
22.07.2023	B211	B212	B213	B214	B215	B216
29.07.2023	B216	B211	B212	B213	B214	B215
05.08.2023	B215	B216	B211	B212	B213	B214
12.08.2023	B214	B215	B216	B211	B212	B213
19.08.2023	B213	B214	B215	B216	B211	B212
26.08.2023	B212	B213	B214	B215	B216	B211
I Mid Examinations 28.08.2023 to 02.09.2023						
	Ex - 1	**Ex – 2**	**Ex – 3**	**Ex – 4**	**Ex – 5**	**Ex – 6**
09.09.2023	B221	B222	B223	B224	B225	B226
16.09.2023	B226	B221	B222	B223	B224	B225
23.09.2023	B225	B226	B221	B222	B223	B224
30.09.2023	B224	B225	B226	B221	B222	B223
14.10.2023	B223	B224	B225	B226	B221	B222
21.10.2023	B222	B223	B224	B225	B226	B221
28.10.2023	**Repetition**					
***II Mid Examinations* 30-10-2023 to 04-11-2023**						

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

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DEPARTMENT OF MECHANICAL ENGINEERING (Accredited by NBA Tier – I)

Laboratory Code : 20ME61 **Lab** : Machine Tools and Metrology Lab

A.Y. : 2023-24 **Class** : B. Tech – V Semester (Section –B)

Lab/Practicals : 3 hrs/ Week **Continuous Internal Assessment** : 15

Credits : 01 **Semester End Examination** : 35

Name of the Faculty : S.Srinivasa Reddy (Sr.Asst. Prof.) / V.Sankararao (Sr. Asst. Prof.)

Schedule of Experiments (Section – B: B2 Batch)

S.No	Batches	Regd. Nos	Total No. of Students
1	B2	22765A0333-362	**30**

Date	Experiment (Batch)					
	Ex - 1	**Ex – 2**	**Ex – 3**	**Ex – 4**	**Ex – 5**	**Ex – 6**
06.07.2022	**Demonstration of all experiments, CEOs and COs of the Laboratory (Ex – 01 to 06)**					
Metrology LAB						
13.07.2023	B221	B222	B223	B224	B225	B226
20.07.2023	B226	B221	B222	B223	B224	B225
27.07.2023	B225	B226	B221	B222	B223	B224
03.08.2023	B224	B225	B226	B221	B222	B223
10.08.2023	B223	B224	B225	B226	B221	B222
17.08.2023	B222	B223	B224	B225	B226	B221
24.08.2023	Backlog experiments / Additional Experiments					
I Mid Examinations 28.08.2023 to 02.09.2023						
	Ex - 1	**Ex – 2**	**Ex – 3**	**Ex – 4**	**Ex – 5**	**Ex – 6**
07.09.2023	B211	B212	B213	B214	B215	B216
14.09.2023	B216	B211	B212	B213	B214	B215
21.09.2023	B215	B216	B211	B212	B213	B214
28.09.2023	B214	B215	B216	B211	B212	B213
05.10.2023	B213	B214	B215	B216	B211	B212
12.11.2023	B212	B213	B214	B215	B216	B211
19.11.2023	Backlog experiments / Additional Experiments					
II Mid Examinations **30-10-2023 to 04-11-2023**						

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