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/S

ACADEMIC YEAR : 2022-23

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-A

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	18-07-2022		TLM1	CO1	T1/R1	
2.	Basic Engine components and Nomenclature	01	19-07-2022		TLM1	CO1	T1/R1	
3.	Working principle of four stroke SI and CI Engines	02	21-07-2022		TLM2	CO1	T1/R1	
4.	Working principle of two stroke SI and CI Engines	01	22-07-2022		TLM2	CO1	T1/R1	
5.	Tutorial-I	01	23-07-2022		TLM3	CO1	T1/R1	
6.	Comparison of two stroke and four stroke/ SI and CI engines	01	25-07-2022		TLM1	CO1	T1/R1	
7.	Ideal and actual cycles and their analysis	01	26-07-2022		TLM5	CO1	T1/R1	
8.	Valve and Port timing diagrams for four stroke and two stroke SI & CI engines	01	28-07-2022		TLM1/TLM2	CO1	T1/R1	
9.	Port timing diagrams for four stroke and two stroke SI & CI engines	01	29-07-2022		TLM1/TLM2	CO1	T1/R1	
10.	Air-fuel mixture requirements, construction and working of simple carburetor	01	30-07-2022		TLM2	CO2	T1/R1	
11.	Tutorial-2	01	01-08-2022		TLM3	CO1	T1/R1	
12.	Calculation of air-fuel ratio, requirements of fuel injection systems	01	02-08-2022		TLM1	CO1	T1/R1	
13.	Classification of injection systems, working principle of fuel injector	01	04-08-2022		TLM1/TLM2	CO1	T1/R1	
14.	Injection in SI and CI engines	01	05-08-2022		TLM1/TLM2	CO1	T1/R1	
15.	Assignment/Quiz-1	01	06-08-2022		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	08-08-2022		TLM1	CO2	T1/R1	
17.	normal and abnormal combustion	01	11-08-2022		TLM1	CO2	T1/R1	
18.	Effect of detonation	01	12-08-2022		TLM1	CO2	T1/R1	
19.	Engine variables and other factors affecting knocking and its prevention	01	13-08-2022		TLM1	CO2	T1/R1	
20.	Theory of detonation in SI engines	01	16-08-2022		TLM1	CO2	T1/R1	
21.	Combustion chamber requirements-types of combustion chambers	01	18-08-2022		TLM1, TLM2	CO2	T1/R1	
22.	Octane number and rating of SI engine fuels	01	20-08-2022		TLM1	CO2	T1/R1	
23.	Tutorial-3	01	22-08-2022		TLM3	CO1	T1/R1	
24.	Stages of combustion in CI engines	01	23-08-2022		TLM1/TLM2	CO2	T1/R1	
25.	Variables affecting delay period	01	25-08-2022		TLM1	CO2	T1/R1	
26.	Diesel knock-methods of controlling diesel knock	01	26-08-2022		TLM1	CO2	T1/R1	
27.	CI engine combustion chamber requirements-Types of combustion chambers	01	29-08-2022		TLM1/TLM2	CO2	T1/R1	
28.	Cold starting of CI engines	01	30-08-2022		TLM1/TLM2	CO2	T1/R1	
29.	Tutorial-4	01	01-09-2022		TLM3	CO1	T1/R1	
30.	Cetane number and rating of CI engine fuels	01	02-09-2022		TLM1	CO2	T1/R1	
31.	Assignment/Quiz-2	01	03-09-2022		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	05-09-2022		TLM1	CO3	T1/R1	
33.	Engine power and engine efficiency	01	06-09-2022		TLM1	CO3	T1/R1	
34.	Performance characteristics	01	08-09-2022		TLM1	CO3	T1/R1	
35.	Variables effecting Performance characteristics	01	09-09-2022		TLM1	CO3	T1/R1	

36.	Methods of improving engine performance	01	10-09-2022		TLM1, TLM2	CO3	T1/R1	
37.	Heat balance sheet	01	04-10-2022		TLM1	CO3	T1/R1	
38.	Tutorial-5	01	06-10-2022		TLM3	CO3	T1/R1	
39.	Modern automotive engines-introduction	01	07-10-2022		TLM1	CO3	T1/R1	
40.	Changes in fuel injection methods in SI and CI engines	01	08-10-2022		TLM1	CO3	T1/R1	
41.	Common rail direct injection system	01	10-10-2022		TLM1	CO3	T1/R1	
42.	Gasoline direct injection	01	11-10-2022		TLM1	CO3	T1/R1	
43.	Variable valve technology-VVT	01	13-10-2022		TLM2	CO3	T1/R1	
44.	DTSi Technology	01	14-10-2022		TLM2	CO3	T1/R1	
45.	Tutorial-6	01	15-10-2022		TLM3	CO3	T1/R1	
46.	Assignment/Quiz-3	01	17-10-2022		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	18-10-2022		TLM1	CO4	T2/R1	
48.	Development of gas turbines	01	20-10-2022		TLM1	CO4	T2/R1	
49.	Classification and application of gas turbines	01	21-10-2022		TLM1	CO4	T2/R1	
50.	Ideal and actual cycles	01	22-10-2022		TLM4	CO4	T2/R1	
51.	Effect of intercooling	01	25-10-2022		TLM1	CO4	T2/R1	
52.	Tutorial-7	01	27-10-2022		TLM3	CO3	T2/R1	
53.	Reheating method	01	28-10-2022		TLM1	CO4	T2/R1	
54.	Regeneration method	01	29-10-2022		TLM1	CO4	T2/R1	
55.	Combined cycles	01	31-10-2022		TLM2, TLM4	CO4	T2/R1	
56.	Combined cycles	01	01-11-2022		TLM2, TLM4	CO4	T2/R1	
57.	Tutorial-8	01	04-11-2022		TLM3	CO4	T2/R1	
58.	Assignment/Quiz-4	01	05-11-2022		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	07-11-2022		TLM1	CO5	T2/R2	
60.	Intake and propelling nozzle efficiencies	01	10-11-2022		TLM1	CO5	T2/R2	
61.	Simple turbojet cycles	01	11-11-2022		TLM1, TLM2	CO5	T2/R2	
62.	Turboprop engine	01	14-11-2022		TLM2	CO5	T2/R2	
63.	Tutorial-8	01	15-11-2022		TLM3	CO3	T2/R2	
64.	Thrust augmentation	01	17-11-2022		TLM1	CO5	T2/R2	
65.	Gas turbine combustion systems	01	18-11-2022		TLM2	CO5	T2/R2	
66.	Combustion chamber designs	01	19-11-2022		TLM3	CO3	T2/R2	
67.	Gas turbine emissions	01	21-11-2022		TLM2	CO5	T2/R2	
68.	Tutorial-9	01	22-11-2022		TLM3	CO3	T2/R2	
69.	Assignment/Quiz-5	01	24-11-2022		TLM6	CO5	T2/R2	
70.	Revision	01	25-11-2022		TLM1	CO5	T2/R2	
71.	Revision	01	26-11-2022		TLM1	CO5	T2/R2	
72.	Revision	01	28-11-2022		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	29-11-2022		TLM2	-	T1/R2	
74.	Modern developments in IC Engines	01	01-12-2022		TLM2	-	T1/R2	
75.	Alternate fuels for IC Engines	01	02-12-2022		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: 18-07-2022			
I Phase of Instructions	18/07/2022	10/09/2022	8
I Mid Examinations	26/09/2022	01/10/2022	
II Phase of Instructions	03/10/2022	26/11/2022	10
II Mid Examinations	28/11/2022	03/12/2022	
Preparation and Practical's	05/12/2022	10/12/2022	1
Semester End Examinations	12/12/2022	24/12/2022	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

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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.:** 2022-23

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	18.7.2022		TLM2	
2.	Introduction of metal cutting, Machine tools, Metrology	1	19.7.2022		TLM2	
3.	Elements of cutting process	1	19.7.2022		TLM2	
4.	Methods of Metal Cutting: Orthogonal Array Vs Oblique	1	20.7.2022		TLM2	
5.	Geometry of Single Point Cutting Tool	1	21.7.2022		TLM2	
6.	Various types of cutting tools	1	25.7.2022		TLM2	
7.	Mechanism of Chip formation	1	26.7.2022		TLM2	
8.	Types of Chip formation	1	26.7.2022		TLM2	
9.	Chip formation problems	1	27.7.2022		TLM2	
10.	Merchant's Force Diagram	1	28.7.2022		TLM2	
11.	Measurement of cutting forces	1	1.8.2022		TLM2	
12.	MCD problems	1	2.8.2022		TLM1	
13.	Machining parameters calculations	1	2.8.2022		TLM2	
14.	Tool wear life	1	3.8.2022		TLM2	
15.	Machinability	1	4.8.2022		TLM2	
16.	Machining economics.	1	8.8.2022		TLM2	
17.	Tool Life problems	1	10.8.2022		TLM1	
No. of classes required to complete UNIT-I: 17				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
18.	Introduction to Lathe	1	10.8.2022		TLM2	
19.	Principle of working and specifications of lathe	1	11.8.2022		TLM2	
20.	Types of lathes	1	16.8.2022		TLM2	

21.	Lathe accessories- tool holding	1	16.8.2022		TLM2	
22.	Lathe accessories-work holding	1	17.8.2022		TLM2	
23.	Lathe accessories- attachments	1	18.8.2022		TLM2	
24.	Operations on Lathe machine	1	22.8.2022		TLM2	
25.	Lathe accessories-supporting devices	1	23.8.2022		TLM2	
26.	Taper turning-methods	1	23.8.2022		TLM2	
27.	Reciprocating Machines: SHAPING Principle of working	1	24.8.2022		TLM2	
28.	Parts of Shaper Machine– Specifications,	1	25.8.2022		TLM2	
29.	Size and Specifications of Shaper,	1	29.8.2022		TLM2	
30.	classifications,	1	30.8.2022		TLM2	
31.	Operations , tool holding , work holding	1	30.8.2022		TLM2	
32.	SLOTTING Principle of working – Principal parts – Specifications,	1	1.9.2022		TLM2	
33.	classifications	1	5.9.2022		TLM2	
34.	operations	1	6.9.2022		TLM2	
35.	PLANNER Principle of working Principal parts –	1	6.9.2022		TLM2	
36.	Size and Specifications	1	7.9.2022		TLM2	
37.	classifications	1	8.9.2022		TLM2	
38.	Operations	1	12.9.2022		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
39.	Introduction of Grinding machines Defiance with cutting and surface finishing , examples	1	13.9.2022		TLM2	
40.	Fundamentals – Theory of grinding	1	13.9.2022		TLM2	
41.	Classification of grinding machine	1	14.9.2022		TLM2	
42.	Non precision grinding machines	1	15.9.2022		TLM2	
43.	Cylindrical grinding machines	1	16.9.2022		TLM2	
44.	Surface grinding machines	1	19.9.2022		TLM2	

45.	Tool and cutter grinding machine	1	20.9.2022		TLM2	
46.	Special types of grinding machines.	1	20.9.2022		TLM2	
47.	MILLING MACHINES: Principle of working –	1	21.9.2022		TLM2	
48.	Specifications, Methods of Milling	1	22.9.2022		TLM2	
49.	Classifications of milling machines	1	10.10.2022		TLM2	
50.	Machining operations	1	11.10.2022		TLM2	
51.	Machining operations	1	11.10.2022		TLM2	
52.	Drilling , Introduction	1	12.10.2022		TLM2	
53.	Size and Specifications	1	13.10.2022		TLM2	
54.	Types of Drilling machines	1	17.10.2022		TLM2	
55.	Drilling operations	1	18.10.2022		TLM2	
No. of classes required to complete UNIT-III: 17				No. of classes taken:		
I-Mid Exams :26.09.2022 to 01.09.2022						

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
56.	Introduction to Metrology	1	18.10.2022		TLM2	
57.	Linear and angular measurements	1	19.10.2022		TLM2	
58.	Standards of measurements - line and end standards	1	20.10.2022		TLM2	
59.	Dial indicators	1	25.10.2022		TLM2	
60.	Micrometers	1	25.10.2022		TLM2	
61.	Basic principle and applications of slip gauges Angle slip gauges	1	26.10.2022		TLM2	
62.	Sine bar and rollers	1	27.10.2022		TLM2	
63.	SURFACE TEXTURE Introduction, Factors effecting surface roughness	1	31.11.2022		TLM2	
64.	reasons for controlling surface texture	1	1.11.2022			
65.	Differences between surface roughness and surface waviness	1	1.11.2022			
66.	Elements of surface texture - Numerical assessment of surface finish	1	2.11.2022			
67.	C.L.A., R.M.S Values	1	3.11.2022			
68.	R_a values, and R_z values	1	7.11.2022			

69.	ISI symbols for indication of surface finish.	1	8.11.2022			
70.	Profile meters	1	8.11.2022			
71.	Tomlinson surface meter	1	9.11.2022			
No. of classes required to complete UNIT-IV: 17				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
72.	Introduction	1	10.10.2022		TLM2	
73.	Tolerance limits Normal size	1	14.10.2022		TLM2	
74.	Deviations, Allowance, Fits and their types	1	15.10.2022		TLM2	
75.	Unilateral tolerance system	1	15.10.2022		TLM2	
76.	Bilateral tolerance system	1	16.10.2022		TLM2	
77.	Hole basis systems	1	17.10.2022		TLM2	
78.	Shaft basis systems	1	21.10.2022		TLM2	
79.	Hole basis systems problems	1	22.10.2022		TLM1	
80.	Shaft basis systems problems	1	22.10.2022		TLM1	
81.	Interchangeability and selective assembly	1	23.10.2022		TLM2	
82.	ALIGNMENT TESTS: Alignment tests on Lathe	1	24.10.2022		TLM2	
No. of classes required to complete UNIT-V: 11				No. of classes taken:		
II-Mid Exams :				28.11.2022 to 03.12.2022		

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 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	**K.Venkateswara Reddy**	**V.Venkata Rami Reddy**		**Dr. S.Pichi Reddy**
Signature				

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

COURSE HANDOUT

PART-A

Name of Course Instructor: Dr.P.V.Chandra Sekhar Rao
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.:** 2022-23

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	18-07-2022		TLM2	
2.	*Machine Design-Introduction&* Basic Procedure	1	19-07-2022		TLM2	
3.	Basic requirements of machine elements and Design of Machine Elements	1	20-07-2022		TLM2	
4.	Design analysis-Design synthesis Introduction to Indian standards	1	21-07-2022		TLM2	
5.	Selection of Preferred sizes & Modes of failure – Factor of safety	1	23-07-2022		TLM2	
6.	Stress-strain relationship, Shear stress and shear strain	1	25-07-2022		TLM2	
7.	Stresses due to bending moment	1	26-07-2022		TLM2	
8.	Stresses due to torsional moment	1	27-07-2022		TLM2	
9.	Eccentric axial loading	1	28-07-2022		TLM2	
10.	**Tutorial-I**	1	30-07-2022		TLM2	
11.	Theories of elastic failure – Introduction and principal stresses	1	01-08-2022		TLM2	
12.	Maximum principal stress theory	1	02-08-2022		TLM1	
13.	Maximum Shear stress theory	1	03-08-2022		TLM2	
14.	Distortion energy theory	1	04-08-2022		TLM2	
15.	**Tutorial-II & Quiz-I**	1	06-08-2022		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	08-08-2022		TLM2	
17.	Reduction of stress concentration Fluctuating stresses - Fatigue failure	1	10-08-2022		TLM2	
18.		1	11-08-2022		TLM2	
19.	*Endurance limit* Low cycle and high cycle fatigue	1	13-08-2022		TLM2	
20.	Notch sensitivity	1	16-08-2022		TLM2	
21.	Endurance limit - Approximate estimation	1	17-08-2022		TLM2	
22.	Introduction to reversed stresses	1	18-08-2022		TLM2	
23.	Reversed stresses and Design for infinite life	1	20-08-2022		TLM2	
24.	**Tutorial-III**	1	22-08-2022		TLM2	
25.	Soderberg, Goodman lines	1	23-08-2022		TLM2	
26.	Modified Goodman line	1	24-08-2022		TLM2	

27.	Infinite Life Problems under fluctuating loads	1	25-08-2022		TLM2	
28.	Infinite Life Problems under fluctuating loads	1	27-08-2022		TLM2	
29.	Gerber equation and Fatigue design under combined stresses	1	29-08-2022		TLM2	
30.	**Tutorial-IV & Quiz-II**	1	30-08-2022		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	01-09-2022		TLM2	
32.	Strength of butt welds- Strength of parallel fillet welds	1	03-09-2022		TLM2	
33.	*Strength of transverse fillet welds* Maximum shear stress in parallel fillet welds	1	05-09-2022		TLM2	
34.	Maximum shear stress in transverse fillet welds	1	06-09-2022		TLM2	
35.	*Axially loaded unsymmetrical* Welded joints	1	07-09-2022		TLM2	
36.	Welded joint subjected to bending moment	1	08-09-2022		TLM2	
37.	**Tutorial-V**	1	10-09-2022		TLM2	
38.	I-Mid Exams :26.09.2022 to 01.09.2022					
39.	Threaded joints -Terminology of screw threads	1	10-10-2022		TLM2	
40.	Bolted joints	1	11-10-2022		TLM2	
41.	Eccentrically loaded bolted joints in shear	1	12-10-2022		TLM2	
42.	Problems on Eccentrically loaded bolted joints in shear	1	13-10-2022		TLM2	
43.	Eccentrically loaded bolted joints in shear	1	15-10-2022		TLM2	
44.	Problems on Eccentrically loaded bolted joints in shear	1	17-10-2022		TLM2	
45.	Eccentric load perpendicular to axis of bolt	1	18-10-2022		TLM2	
46.	Problems on Eccentric load perpendicular to axis of bolt	1	19-10-2022		TLM2	
47.	Bolts of uniform strength	1	20-10-2022		TLM2	
48.	**Tutorial-VI & Quiz-III**	1	22-10-2022		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	25-10-2022		TLM2	
50.	Shaft design on strength basis	1	26-10-2022		TLM2	
51.	Shaft design on torsional rigidity basis	1	27-10-2022		TLM2	

52.	ASME code for shaft design	1	29-10-2022		TLM2	
53.	**Tutorial-VII**	1	31-10-2022		TLM2	
54.	Design of hollow shaft on strength and torsional rigidity basis	1	01-11-2022		TLM2	
55.	Design of hollow shaft on strength and torsional rigidity basis	1	02-11-2022		TLM2	
56.	Problems on shafts	1	03-11-2022		TLM2	
57.	Problems on shafts	1	05-11-2022		TLM2	
58.	Problems on shafts	1	07-11-2022		TLM2	
59.	**Tutorial-VIII & Quiz-IV**	1	08-11-2022		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	09-11-2022		TLM2	
61.	*Design of Socket and* Spigot cotter joint	1	10-11-2022		TLM2	
62.	*Design of Socket and* Spigot cotter joint	1	12-11-2022		TLM2	
63.	*Problem on Design of Socket and* Spigot cotter joint	1	14-11-2022		TLM2	
64.	Design of Cotter joints	1	15-11-2022		TLM2	
65.	Design of Knuckle joint-Failures	1	16-11-2022		TLM1	
66.	Quiz-IV	1	17-11-2022		TLM1	
67.	**Tutorial-IX**	1	19-11-2022		TLM1	
68.	Flange coupling- Muff coupling	1	21-11-2022		TLM2	
69.	Clamp coupling	1	22-11-2022		TLM3	
70.	Bushed pin flexible coupling		23-11-2022		TLM2	
71.	Quiz-V		24-11-2022		TLM2	
72.	**Tutorial-X**		26-11-2022		TLM2	
No. of classes required to complete UNIT-V:				No. of classes taken:		
II-Mid Exams :				28.11.2022 to 03.12.2022		

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 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. 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	**:** 2022-23
COURSE NAME & CODE	**: ROBOTICS – 20ME14**
L-T-P STRUCTURE	**:** 3-0-0
COURSE CREDITS	**:** 3
COURSE INSTRUCTOR	**: J. Subba 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	18-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
2.	CEOs, Course Outcomes, POs and PSOs	1	19-07-2022		**TLM2**	-	-	
3.	Basic concepts – Robot anatomy	1	20-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
4.	Components of robots, **Tutorial**	1	21-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
5.	Robot motions	1	22-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
6.	Number of D.O.F – Work volume	1	25-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
7.	Robot applications in Material transfer and machine loading / unloading applications	1	26-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
8.	Robot applications in Processing operations – Assembly and inspection – Future applications	1	27-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
9.	**Robot End Effectors –** Introduction, **Tutorial**	1	28-07-2022		**TLM3**	CO1	T1, T2, R1, R2	
10.	Types of end effectors – Mechanical grippers	1	29-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
11.	Vacuum cups, magnetic grippers, adhesive gripers and others	1	01-08-2022		**TLM2**	CO1	T1, T2, R1, R2	
12.	Robot / End effectors interface	1	02-08-2022		**TLM2**	CO1	T1, T2, R1, R2	
13.	Considerations in gripper selection and design	1	03-08-2022		**TLM2**	CO1	T1, T2, R1, R2	
14.	Case Studies, Numericals, **Tutorial**	1	04-08-2022		**TLM2**	CO1	T1, T2, R1, R2	
15.	Numericals	1	05-08-2022		**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	8-08-2022		**TLM2**	CO2	T1,R1	
17.	Characteristics of Actuating System	1	09-08-2022		**TLM2**	CO2	T1,R1	
18.	Pneumatic Actuators	1	10-08-2022		**TLM2**	CO2	T1,R1	
19.	Hydraulic Actuators, **Tutorial**	1	11-08-2022		**TLM2**	CO2	T1,R1	
20.	Electric Motors	1	12-08-2022		**TLM2**	CO2	T1,R1	
21.	Introduction to Sensors	1	16-08-2022		**TLM3**	CO2	T1,R1	
22.	Sensor characteristics	1	17-08-2022		**TLM1**	CO2	T1,R1	
23.	Position sensors: Potentiometers, LVDT	1	18-08-2022		**TLM1**	CO2	T1,R1	
24.	Resolvers, Encoders, **Tutorial**	1	19-08-2022		**TLM1**	CO2	T1,R1	
25.	Magnetostrictive Displacement Transducers (MDT)	1	22-08-2022		**TLM1**	CO2	T1,R1	
26.	Velocity Sensors: Encoders	1	23-08-2022		**TLM1**	CO2	T1,R1	
27.	Tachometers	1	24-08-2022		**TLM1**	CO2	T1,R1	
28.	Industrial Applications, **Tutorial**	1	25-08-2022		**TLM2**	CO2	T1,R1	
29.	Case Studies	1	26-08-2022		**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	29-08-2022		**TLM2**	CO3	T1,R1	
31.	Coordinate Frames	1	30-08-2022		**TLM2**	CO3	T1,R1	
32.	Description of Objects in space	1	31-08-2022		**TLM2**	CO3	T1,R1	
33.	Transformation of vectors, **Tutorial**	1	01-09-2022		**TLM2**	CO3	T1,R1	
34.	Numericals	1	02-09-2022		**TLM1**	CO3	T1,R1	
35.	Inverting a Homogeneous Transform	1	05-09-2022		**TLM3**	CO3	T1,R1	
36.	Numericals	1	06-09-2022		**TLM2**	CO3	T1,R1	
37.	Fundamental Rotation Matrices	1	07-09-2022		**TLM2**	CO3	T1,R1	
38.	Numericals, **Tutorial**	1	08-09-2022		**TLM2**	CO3	T1,R1	
39.	D-H representation	1	09-09-2022		**TLM2**	CO3	T1,R1	
40.	**CRT Classes**	**10**	**12-09-2022 to 24-09-2022**					
41.	**I Mid Examinations**	**5**	**26-09-2022 to 01-10-2022**					
42.	Problems on Forward Kinematics	1	03-10-2022		**TLM2**	CO3	T1,R1	
43.	Numericals	1	04-10-2022		**TLM2**	CO3	T1,R1	
44.	Numericals	1	05-10-2022		**TLM2**	CO3	T1,R1	
45.	Numericals, **Tutorial**	1	06-10-2022		**TLM2**	CO3	T1,R1	
46.	Numericals	1	07-10-2022		**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
47.	Introduction to Dynamics of Robots	1	10-10-2022		**TLM2**	CO4	T1,R1	
48.	Differential transformations	1	11-10-2022		**TLM2**	CO4	T1,R1	
49.	Numericals	1	12-10-2022		**TLM2**	CO4	T1,R1	
50.	Numericals, **Tutorial**	1	13-10-2022		**TLM2**	CO4	T1,R1	
51.	Numericals	1	14-10-2022		**TLM2**	CO4	T1,R1	
52.	Numericals	1	17-10-2022		**TLM2**	CO4	T1,R1	
53.	Jacobian Matrix	1	18-10-2022		**TLM2**	CO4	T1,R1	
54.	Numericals	1	19-10-2022		**TLM1**	CO4	T1,R1	
55.	Numericals, **Tutorial**	1	20-10-2022		**TLM2**	CO4	T1,R1	
56.	Numericals	1	21-10-2022		**TLM1**	CO4	T1,R1	
57.	Lagrange Euler formulation	1	24-10-2022		**TLM2**	CO4	T1,R1	
58.	Numericals	1	25-10-2022		**TLM2**	CO4	T1,R1	
59.	Numericals	1	26-10-2022		**TLM1**	CO4	T1,R1	
60.	Numericals, **Tutorial**	1	27-10-2022		**TLM2**	CO4	T1,R1	
61.	Numericals	1	28-10-2022		**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
62.	Introduction to Trajectory Planning	1	31-10-2022		**TLM2**	CO5	T1,R1	
63.	Considerations on Trajectory Planning	1	01-11-2022		**TLM2**	CO5	T1,R1	
64.	Joint Interpolated Trajectory	1	02-11-2022		**TLM2**	CO5	T1,R1	
65.	Numericals	1	03-11-2022		**TLM2**	CO5	T1,R1	
66.	Numericals, **Tutorial**	1	04-11-2022		**TLM3**	CO5	T1,R1	
67.	Numericals	1	07-11-2022		**TLM2**	CO5	T1,R1	
68.	Numericals	1	08-11-2022		**TLM2**	CO5	T1,R1	
69.	Numericals	1	09-11-2022		**TLM2**	CO5	T1,R1	
70.	Cartesian Path Trajectory	1	10-11-2022		**TLM2**	CO5	T1,R1	
71.	Numericals, **Tutorial**	1	11-11-2022		**TLM2**	CO5	T1,R1	
72.	Numericals	1	14-11-2022		**TLM2**	CO5	T1,R1	
73.	Numericals	1	15-11-2022		**TLM2**	CO5	T1,R1	
74.	Numericals	1	16-11-2022		**TLM2**	CO5	T1,R1	
75.	Numericals, **Tutorial**	1	17-11-2022		**TLM2**	CO5	T1,R1	
76.	Numericals	1	18-11-2022		**TLM2**	CO5	T1,R1	
77.	**Robot Programming**	1	21-11-2022		**TLM2**	CO5	T1,R1	
78.	**Robot Programming**	1	22-11-2022		**TLM2**	CO5	T1,R1	
79.	**Robot Programming**	1	23-11-2022		**TLM2**	CO5	T1,R1	
80.	**Robot Programming, Tutorial**	1	24-11-2022		**TLM2**	CO5	T1,R1	
81.	**Robot Programming**	1	25-11-2022		**TLM2**	CO5	T1,R1	
No. of classes required to complete UNIT-V		**15 + 05 (Beyond Syllabus)**			**No. of classes taken:**			
II Mid Examinations – 28-11-2022 to 03-12-2022								

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	**J. Subba 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
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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

COURSE HANDOUT

PART-A

Name of Course Instructor: Mr. P.GANDHI PRAKASH
Course Name & Code : INTRODUCTION TO ARTIFICIAL INTELLIGENCE – 20AD81
L-T-P Structure : **3-0-0**
Credits: 3
Program/Branch/Sem : **B.Tech/MECH/V-A&B** **A.Y.: 2022-23**

PRE-REQUISITE: Basic Engineering Mathematics Knowledge

Course Educational Objective:

The objective of the course is to present an overview of artificial intelligence (AI) principles and approaches. Develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents: Search, Knowledge representation, inference, logic, reasoning, and learning. Students will implement a small AI system in a team environment. The knowledge of artificial intelligence plays a considerable role in some applications students develop for courses in the program.

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

CO1	Enumerate the history and foundations of Artificial Intelligence. **(Understand-L2)**
CO2	Apply the basic principles of AI in problem solving. **(Apply-L3).**
CO3	Explain the different searching algorithms to find and optimize the solution for the given Problem. **(Understand-L2)**
CO4	Illustrate the different gaming algorithms and identify the importance of knowledge Representation in Artificial Intelligence. **(Apply-L3)**
CO5	Describe the use of predicate logic and rule-based system to represent the knowledge in AI domain. **(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	PSO2
CO1	2	3	2	-	3	-	-	-	-	-	-	2	3	-	-
CO2	2	3	3	3	3	-	-	-	-	-	-	2	3	-	-
CO3	2	3	3	-	3	-	-	-	-	-	-	2	3	-	-
CO4	2	3	3	2	3	-	-	-	-	-	-	2	3	-	-
CO5	2	3	3	2	3	-	-	-	-	-	-	2	3	-	-

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

BOS APPROVED TEXT BOOKS:

T1. Stuart Russell, Peter Norvig, "Artificial Intelligence: A Modern Approach",3rd edition,
Prentice Hall, 2009. Can also use 2nd Ed., Pearson Education International, 2003.
T2. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2011

BOS APPROVED REFERENCE BOOKS:

R1. Nils Nilsson, "Artificial Intelligence: A New Synthesis", Morgan Kaufmann, 1998.
R2. David Poole, Alan Mackworth, "Artificial Intelligence: Foundations for Computational
Agents", Cambridge Univ. Press, 2010.
R3. Ronald Brachman, "Knowledge Representation and Reasoning", Morgan Kaufmann,
2004.
R4. Frank van Harmelen, Vladimir Lifschitz, Bruce Porter (Eds), "Handbook of Knowledge
representation", Elsevier, 2008.
R5. Ivan Bratko, "Prolog Programming for Artificial Intelligence", 4th Ed., Addison-Wesley,
2011.

Part-B

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

UNIT-I : INTRODUCTION

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
76.	Discussion of CEO's and CO's, Introduction to programming.	1	20-07-2022		-	CO1	-	
77.	Introduction: What Is AI?,	1	21-07-2022		TLM1	CO1	T1,T2	
78.	The Foundations of Artificial Intelligence	1	22-07-2022		TLM1	CO1	T1,T2	
79.	The History of Artificial Intelligence,	1	23-07-2022		TLM1	CO1	T1,T2	
80.	The State of the Art,.	1	27-07-2022		TLM1	CO1	T1,T2	
81.	Agents and Environments	1	28-07-2022		TLM1	CO1	T1,T2	
82.	Types of agents	1	29-07-2022		TLM2	CO1	T1,T2	
83.	Types of agents	1	30-07-2022		TLM2	CO1	T1,T2	
84.	Types of agents	1	03-08-2022		TLM2	CO1	T1,T2	
85.	Good Behavior: The Concept of Rationality	1	04-08-2022		TLM1	CO1	T1,T2	
86.	Omniscience vs Rational agent	1	05-08-2022		TLM1	CO1	T1,T2	
87.	The Nature of Environments	1	06-08-2022		TLM1	CO1	T1,T2	
88.	The Structure of Agents	1	10-08-2022		TLM1	CO1	T1,T2	
89.	Assignment/Quiz-2	1	11-08-2022		TLM1	CO1	-	
No. of classes required to complete UNIT-I				14	**No. of classes taken:**			

UNIT-II : PROBLEM SOLVING

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
90.	Problem-Solving Agents, Example Problems	1	12-08-2022		TLM1	CO2	T1,T2	
91.	searching for Solutions, Uninformed Search Strategies	1	13-08-2022		TLM1	CO2	T1,T2	
92.	Search algorithms terminologies	1	17-08-2022		TLM1	CO2	T1,T2	
93.	Properties of search algorithms	1	18-08-2022		TLM1	CO2	T1,T2	
94.	Types of search algorithms.	1	20-08-2022		TLM1	CO2	T1,T2	
95.	Best first search algorithm	1	24-08-2022		TLM2	CO2	T1,T2	
96.	A* Algorithm	1	25-08-2022		TLM2	CO2	T1,T2	
97.	AO* Algorithm	1	26-08-2022		TLM2	CO2	T1,T2	
98.	Local Search Algorithms	1	27-08-2022		TLM2	CO2	T1,T2	
99.	Local Search Algorithms	1	01-09-2022		TLM2	CO2	T1,T2	
100.	Searching with Nondeterministic Actions.	1	02-09-2022		TLM2	CO2	T1,T2	
101.	Assignment/Quiz-2	1	03-09-2022		TLM1	CO2	T1,R1	
No. of classes required to complete UNIT-II		12			No. of classes taken:			

UNIT-III : SEARCH ALGORITHMS

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
102.	Introduction	1	07-09-2022		TLM1	CO3	T1,T2	
103.	Uniformed/Blind Search Algorithms:	1	08-09-2022		TLM1	CO3	T1,T2	
104.	Breadth-first Search,	1	09-09-2022		TLM2	CO3	T1,T2	
105.	Depth-first Search,	1	10-09-2022		TLM2	CO3	T1,T2	
106.	Depth limited search	1	06-10-2022		TLM2	CO3	T1,T2	
107.	Iterative deepening depth-first search	1	07-10-2022		TLM2	CO3	T1,T2	
108.	Uniform cost search	1	08-10-2022		TLM2	CO3	T1,T2	
109.	Bidirectional Search.	1	12-10-2022		TLM2	CO3	T1,T2	

110.	Assignment/Quiz-3	1	13-10-2022		TLM1	CO3	-	
No. of classes required to complete UNIT-III		09			No. of classes taken:			

UNIT-IV: ADVERSARIAL SEARCH/ GAME PLAYING

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
111.	Introduction	1	14-10-2022		TLM1	CO4	T1,T2	
112.	Minimax algorithm	1	15-10-2022		TLM2	CO4	T1,T2	
113.	Alpha-Beta pruning	1	19-10-2022		TLM2	CO4	T1,T2	
114.	Knowledge Based Agent, Architecture	1	20-10-2022		TLM1	CO4	T1,T2	
115.	Knowledge base Levels and types	1	21-10-2022		TLM1			
116.	Representation mappings	1	22-10-2022		TLM1	CO4	T1,T2	
117.	Inference Engine:Forward chaining/reasoning	1	26-10-2022		TLM1	CO4	T1,T2	
118.	Backward chaining/reasoning	1	27-10-2022		TLM1	CO4	T1,T2	
119.	Approaches of knowledge representation,	1	28-10-2022		TLM1	CO4	T1,T2	
120.	issues in knowledge representation	1	29-10-2022		TLM1	CO4	T1,T2	
121.	Assignment/Quiz-4	1	02-11-2022		TLM1	CO4	-	
No. of classes required to complete UNIT-IV		11			No. of classes taken:			

UNIT-V: KNOWLEDGE REPRESENTATION TECHNIQUES

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
122.	Introduction	1	03-11-2022		TLM1	CO5	T1,T2	T1,T2
123.	Logic, Propositional Logic:	1	04-11-2022		TLM1	CO5	T1,T2	
124.	A Very Simple Logic,	1	05-11-2022		TLM1	CO4	T1,T2	
125.	Ontological Engineering	1	09-11-2022		TLM2	CO4	T1,T2	
126.	Categories and Objects, Events	1	10-11-2022		TLM2	CO5	T1,T2	
127.	Mental Events and Mental Objects	1	11-11-2022		TLM1	CO5	T1,T2	
128.	What is reasoning and Types	1	12-11-2022		TLM1	CO4	T1,T2	

129.	Types of reasoning	1	16-11-2022		TLM1	CO4	T1,T2	
130.	Reasoning Systems for Categories	1	17-11-2022		TLM2	CO5	T1,T2	
131.	The Internet Shopping World	1	18-11-2022		TLM1	CO5	T1,T2	
132.	Assignment/Quiz-5	1	19-11-2022		TLM1	CO5	-	
No. of classes required to complete UNIT-V		11			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
133.	Turing test, Interview Questions	1	23-11-2022		**TLM1**			

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam /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	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	To apply the fundamental engineering knowledge, computational principles, and methods for extracting knowledge from data to identify, formulate and solve real timeproblems.
PSO 2	To develop multidisciplinary projects with advanced technologies and tools to address social and environmental issues.
PSO 3	To provide a concrete foundation and enrich their abilities for Employment and Higher studies in Artificial Intelligence and Data science with ethical values

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**P.GANDHI PRAKASH**	**P.GANDHI PRAKASH**	**Dr. O. Rama Devi**	**Dr. O. Rama Devi**
Signature				

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(AUTONOMOUS)

Accredited by NAAC with 'A' Grade & 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	: Dr. B. Srinivasa Rao		
Course Name & Code	: OOPS through JAVA (20IT81)		
L-T-P Structure	: 3-0-0	Credits	: 3
Program/Sem/Sec	: B.Tech. –ME / V-Sem /A & B	A.Y.	: 2022 – 23
PRE-REQUISITE	: Programming for Problem Solving Using C		

COURSE EDUCATIONAL OBJECTIVE (CEO): Concentrates on the methodological and technical aspects of software design and Programming based on Object-Oriented Programming (OOP). Acquire the basic knowledge and skills necessary to implement Object-Oriented Programming Techniques in software development through JAVA. Know about the importance of Collections and GUI based applications through JAVA.

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

CO1	Understand Object Oriented Programming Concepts through constructs of JAVA. **(Understand- L2)**
CO2	Apply the concepts of Inheritance and Polymorphism on real-world applications. **(Apply - L3)**
CO3	Implement reusability using interface and packages**. (Understand- L2)**
CO4	Construct robust applications using exception handling. **(Apply - L3)**
CO5	Understand multi-threading concepts. **(Understand - L2)**

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

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

TEXTBOOK:

T1: **Java Fundamentals** – A comprehensive Introduction, Herbert Schildt and Dale Skrien, TMH.

REFERENCE BOOKS:

R1: The Java™ Programming Language: Ken Arnold, James Gosling, Pearson

R2: Introduction to Java Programming 7/e, Brief version, Y.Daniel Liang, Pearson

R3: Java for Programmers, P.J.Deitel and H.M.Deitel, Pearson education (OR) Java: How to Program P.J.Deitel and H.M.Deitel, PHI.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT – I: Introduction to OOP & JAVA:

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.	Java Buzzwords / Features	1	20/07/22		TLM1,2	
2.	Object Oriented Programming **(OOP)** concepts	1	21/07/22		TLM1,2	
3.	Java History, Advantages	1	22/07/22		TLM1,2	
4.	Data types	1	23/07/22		TLM1,2	
5.	Operators, Expressions	1	27/07/22		TLM1,2	
6.	Control Statements	1	28/07/22		TLM1,2	
7.	Methods and recursion , Sample programs	1	29/07/22		TLM1,2	
8.	Java Objects and References	1	30/07/22		TLM1,2	
9.	Constructors	1	03/08/22		TLM1,2	
10.	this keyword	1	04/08/22		TLM1,2	
11.	Arrays (single and multi-dimensional),	2	05/08/22 06/08/22		TLM1,2	
12.	String, StringBuffer, StringTokenizer Classes	3	10/08/22 11/08/22 12/08/22		TLM1,2	
No. of classes required to complete UNIT – I:15				**No. of classes taken:**		

UNIT – II: Extending Classes/ Reusability

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
13.	**Inheritance :** Introduction , Derived Classes	1	17/08/22		TLM1,2	
14.	Advantages and Types of Inheritance	1	18/08/22		TLM1,2	
15.	Implementation of Inheritance	1	20/08/22		TLM1,2	
16.	Inheritance and Member Accessibility	1	24/08/22		TLM1,2	
17.	Overriding	1	25/08/22		TLM1,2	
18.	super keyword	1	26/08/22		TLM1,2	
19.	abstract classes and methods	1	27/08/22		TLM1,2	
20.	final keyword	1	02/09/22		TLM1,2	
21.	final methods and final classes	1	03/09/22		TLM1,2	
22.	Dynamic Binding	1	10/09/22		TLM1,2	
23.	Polymorphism	1	14/09/22		TLM1,2	
No. of classes required to complete UNIT – II: 11				**No. of classes taken:**		

UNIT – III: Interfaces & Packages

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
24.	**Interfaces:** Differences between classes and interfaces	1	15/09/22		TLM1,2	
25.	defining an interface	1	22/09/22		TLM1,2	
26.	implementing interface	1	23/09/22		TLM1,2	
27.	variables in interface, extending interfaces	1	24/09/22		TLM1,2	
28.	**Packages:** Defining, Creating	1	06/10/22		TLM1,2	
29.	Accessing a Package,	1	07/10/22		TLM1,2	
30.	importing packages,	1	12/10/22		TLM1,2	
31.	Access controls (public, protected, default and private).	1	13/10/22		TLM1,2	
32.	Wrapper Classes (Like Integer, Float, Double).	1	14/10/22		TLM1,2	
No. of classes required to complete UNIT – III: 09				**No. of classes taken:**		

UNIT – IV: Exception handling

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.	**Exception Handling:** Concepts of exception handling	1	15/10/22		TLM1,2	
34.	benefits of exception handling	1	19/10/22		TLM1,2	
35.	usage of try, catch	1	20/10/22		TLM1,2	
36.	multiple catch clause	1	21/10/22		TLM1,2	
37.	Nested try, throw	1	22/10/22		TLM1,2	
38.	throws	1	24/10/22		TLM1,2	
39.	finally	1	26/10/22		TLM1,2	
40.	built in exceptions	1	27/10/22		TLM1,2	
41.	creating own exception	1	28/10/22		TLM1,2	
No. of classes required to complete UNIT – IV: 09				**No. of classes taken:**		

UNIT – V: Multithreading

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
42.	Multithreading: Introduction	1	29/10/22		TLM1,2	
43.	Thread life cycle	1	02/11/22		TLM1,2	
44.	creating threads (by extending thread class)	1	03/11/22		TLM1,2	
45.	creating threads (implementing Runnable Interface)	1	05/11/22		TLM1,2	
46.	Example programs on threads	1	09/11/22		TLM1,2	

47.	Synchronization : method	1	10/11/22		TLM1,2	
48.	Synchronization block	1	11/11/22		TLM1,2	
49.	Thread Priorities	1	12/11/22		TLM1,2	
50.	isAlive() and join() methods	1	16/11/22		TLM1,2	
51.	Inter thread Communication	2	17/11/22 18/11/22		TLM1,2	
No. of classes required to complete UNIT – V:11				**No. of classes taken:**		

Content beyond the Syllabus:

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
52.	Introduction to collection framework	2	23/11/22 24/11/22		TLM1,2	
53.	Introduction to GUI	1	25/11/22		TLM1,2	
54.	Differences between AWT & SWINGS	1	26/11/22		TLM1,2	

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):

PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**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.
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PO12	**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.

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**Dr. B. Srinivasa Rao**	**Dr. B. Srinivasa Rao**	**Dr. S. Naganjaneyulu**	**Dr. B. Srinivasa Rao**
Signature				

DEPARTMENT OF MECHANICAL ENGINEERING
COURSE HANDOUT
PART-A

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

ACADEMIC YEAR : 2022-23

COURSE NAME & CODE : **Thermal Engineering Lab**, 20ME60

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

COURSE CREDITS : 1.5

COURSE INSTRUCTOR : **Mr. Mallikarjuna Rao Dandu & Mr. S. Rami Reddy**

COURSE COORDINATOR : **Dr. V. Dhana Raju**

MODULE COORDINATOR : **Dr. P. Vijaya Kumar**

PRE-REQUISITE: IC Engines and Gas Turbines and Applied Thermodynamics

COURSE OBJECTIVE:

The main objective of this course is to demonstrate the concepts of engineering mechanics and fuels through experiments.

COURSE OUTCOMES:

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

CO1: Examine the valve timing diagram and port timing diagram of internal combustion engines

CO2: Analyze the performance characteristics of an internal combustion engines

CO3: Estimate the energy distribution and frictional power of diesel engine using heat balance and morse test

CO4: Describe the performance parameters of refrigeration system and air compressor

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

20ME60	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	PSO3
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		

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

LIST OF EXPERIMENTS: **Thermal Engineering Lab**, 20ME60

CYCLE-I

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

CYCLE-II

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

REFERENCES:

Lab-Manual

PART-B

COURSE DELIVERY PLAN (LESSON PLAN): **Thermal Engineering Lab**, 20ME60

Batches (Section – B)

S.No	Batches	Regd.Nos	Total No. of Students
1	**B. Tech – V Sem**	20761A0301-20761A0347 21765A0301-21765A0319	**66**
2	**Batch 1**	20761A0301-20761A0333	**33**
3	**Batch 2**	20761A0334-20761A0347, 21765A0301-21765A0319	**33**

Sub Batch of B
20761A0301-20761A0333 (33)

Sub Batch of B:
20761A0334-20761A0347
21765A0301-21765A0315 (33)

COURSE DELIVERY PLAN (LESSON PLAN): Thermal Engineering LAB

PART - B

Batch: I

S. No.	Batch-1	Registered No.	Total
1	**A1**	20761A0301-20761A0306	6
2	**A2**	20761A0307-20761A0312	6
3	**A3**	20761A0313-20761A0319	7
4	**A4**	20761A0320-20761A0326	7
5	**A5**	20761A0327-20761A0333	7
Total			33

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
134.	Introduction CO's, PO'S & PSO's	3	20-07-2022		**TLM4**	CO1		
CYCLE-I								
135.	EXP-01	1	27-07-2022		**TLM4**	CO1		
136.	EXP-02	1	03-08-2022		**TLM4**	CO1		
137.	EXP-03	1	10-08-2022		**TLM4**	CO2		
138.	EXP-04	1	24-08-2022		**TLM4**	CO2		
139.	EXP-05	1	07-09-2022		**TLM4**	CO2		
CYCLE-II								
140.	EXP-06	1	12-10-2022		**TLM4**	CO3		
141.	EXP-07	1	19-10-2022		**TLM4**	CO3		
142.	EXP-08	1	26-10-2022		**TLM4**	CO4		
143.	EXP-09	1	02-11-2022		**TLM4**	CO4		
144.	EXP-10	1	09-11-2022		**TLM4**	CO4		
145.	Repetition	1	16-11-2022		**TLM4**	--		
146.	Internal Exam	1	23-11-2022		--	--		

Batch: II

S. No.	Batch-2	Registered No.	Total
1	**B1**	20761A0334-20761A0339	6
2	**B2**	20761A0340-20761A0345	6
3	**B3**	20761A0346 & 347-21765A0301-305	7
4	**B4**	21765A0306-21765A0312	7
5	**B5**	21765A0313-21765A0319	6
Total			33

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 CO's, PO'S & PSO's	3	22-07-2022		**TLM4**	CO1		
CYCLE-I								
2.	EXP-01	1	29-07-2022		**TLM4**	CO1		
3.	EXP-02	1	05-08-2022		**TLM4**	CO1		
4.	EXP-03	1	12-08-2022		**TLM4**	CO2		
5.	EXP-04	1	26-08-2022		**TLM4**	CO2		
6.	EXP-05	1	02-09-2022		**TLM4**	CO2		
CYCLE-II								
7.	EXP-06	1	09-09-2022		**TLM4**	CO3		
8.	EXP-07	1	14-10-2022		**TLM4**	CO3		
9.	EXP-08	1	21-10-2022		**TLM4**	CO4		
10.	EXP-09	1	28-10-2022		**TLM4**	CO4		
11.	EXP-10	1	04-11-2022		**TLM4**	CO4		
12.	Repetition	1	11-11-2022		**TLM4**	--		
13.	Repetition	1	18-11-2022		**TLM4**	--		
14.	Internal Exam	1	25-11-2022		--	--		

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 Course	12-09-2022	24-09-2022	2
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 Practicales	05-12-2022	10-12-2022	1 Week
Semester End Examinations	12-12-2022	24-12-2022	2 Week

PART-C

EVALUATION PROCESS (R20 Regulation):

Evaluation Task	Expt. no's	Marks
Day to Day work = **A**	1,2,3,4,5,6,7,8…	A=05
Record = **B**	1,2,3,4,5,6,7,8	B=05
Internal Test = **C**	1,2,3,4,5,6,7,8	C = 05
Cumulative Internal Examination : A + B + C = 15	1,2,3,4,5,6,7,8	**15**
Semester End Examinations = D	1,2,3,4,5,6,7,8	**D = 35**
Total Marks: A + B + C + D = 50	1,2,3,4,5,6,7,8	**50**

PART-D

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

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

PROGRAMME OUTCOMES (POs):

PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis**: Identify, formulate, review research literature, and 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.
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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 engineer**ing 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	**Mr. Mallikarjuna Rao Dandu& Mr. S. Rami Reddy**	**Dr. V. Dhana Raju**	**Dr. P. Vijaya Kumar**	**Dr. S. Pichi Reddy**
Signature				

DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code	**:** 20ME61	**Lab**	: Machine Tools and Metrology Lab
A.Y.	**:** 2022-2023	**Class**	**:** B. Tech – V Semester (Section –A)
Lab/Practicals	**:** 3 hrs/ Week	**Continuous Internal Assessment**	**:** 15
Credits	**:** 01	**Semester End Examination**	**:** 35
Name of the Faculty	**:** Dr.Murahari Kolli(Assoc Prof.) / P. Mounika (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 Dynamics Lab (17ME68)															
		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)															

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

DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code	**:** 20ME61	**Lab**	: Machine Tools and Metrology Lab
A.Y.	**:** 2022-2023	**Class**	**:** B. Tech – V Semester (Section –A)
Lab/Practicals	**:** 3 hrs/ Week	**Continuous Internal Assessment**	**:** 15
Credits	**:** 01	**Semester End Examination**	**:** 35
Name of the Faculty	**:** Dr.Murahari Kolli(Assoc Prof.) / P. Mounika (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.

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

DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code	**:** 20ME61	**Lab**	: Machine Tools and Metrology Lab
A.Y.	**:** 2022-2023	**Class**	**:** B. Tech – V Semester (Section –A)
Lab/Practicals	**:** 3 hrs/ Week	**Continuous Internal Assessment**	**:** 15
Credits	**:** 01	**Semester End Examination**	**:** 35
Name of the Faculty	**:** Dr.Murahari Kolli(Assoc Prof.) / P. Mounika (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 callipers 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 callipers.
- Machine tool alignment test on the lathe.
- Measurement of screw thread parameters using tool makers's microscope.
- Angle and taper measurement using bevel protractor, slip guage and sine bars, etc.
- Thread measurement by three wire method.
- Surface roughness measurement by Talysurf.

Lab In-charge – I **Lab 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. : 2022-2023 **Class** : B. Tech – V Semester (Section –A)
Lab/Practicals : 3 hrs/ Week **Continuous Internal Assessment** : 15
Credits : 01 **Semester End Examination** : 35
Name of the Faculty : Dr.Murahari Kolli(Assoc Prof.) / P. Mounika (Asst Prof.)

Batches (Section – A)

S.No	Batches	Regd.Nos	Total No. of Students
1	B. Tech – V Sem - A/S	20761A0301-347, 21765A0301–319	66
2	Batch A1	20761A0301-333	33
3	Batch A2	20761A0334-347, 21765A0301–319	33

Sub Batch of A11:

S. No	Batch	Registered Nos	Total
1	A111	20761A0301-304	04
2	A112	20761A0305-308	04
3	A113	20761A0309-311	03
4	A114	20761A0312-314	03
5	A115	20761A0315-317	03
Total (C11)			17

Sub Batch of A12:

S. No	Batch	Registered Nos	Total
1	A121	20761A0318-320	03
2	A122	20761A0321-323	03
3	A123	20761A0324-326	03
4	A124	20761A0327-329	03
5	A125	20761A0330-333	04
Total (C12)			16

Sub Batches of A21:

S. No	Batch	Registered Nos	Total
1	A211	20761A0334-336	03
2	A212	20761A0337-339	03
3	A213	20761A0340-342	03
4	A214	20761A0343-46	04
5	A215	20761A0-347 21765A0301–303	04
Total (C21)			17

Sub Batches of A22:

S. No	Batch	Registered Nos	Total
1	A221	20765A0304–306	03
2	A222	20765A0307–309	03
3	A223	20765A0310–312	03
4	A224	20765A0313–315	03
5	A225	20765A0316–319	04
Total (C22)			16

Lab In-charge – I **Lab 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.	**:** 2022-2023	**Class**	**:** B. Tech – V Semester (Section –A)
Lab/Practicals	**:** 3 hrs/ Week	**Continuous Internal Assessment**	**:** 15
Credits	**:** 01	**Semester End Examination**	**:** 35
Name of the Faculty	**:** Dr.Murahari Kolli(Assoc Prof.) / P. Mounika (Asst Prof.)		

Notification of Cycles (Section – A)

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: DYNAMICS LAB

At least SIX experiments may be conducted.
LIST OF EXPERIMENTS
Any of the 6 Experiments are required to be conducted

- a) To determine gyroscopic couple on Motorized Gyroscope
  b) Determination of transmission efficiency of gear reducers
- a) To find the stability and sensitivity of Watt governor
  b) To find the stability and sensitivity of Porter governor
- To find the transverse vibrations of free-free beam
- a) Balancing of rotating masses
  b) Balancing of reciprocating masses
- Determination of damping coefficient of single degree of freedom system using spring mass system
- Determination of critical speed of shaft with concentration loads
- a) Determine the moment of inertia of connecting rod by compound pendulum method

Lab in charge – I **Lab – 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. : 2022-2023 **Class** : B. Tech – V Semester (Section –A)
Lab/Practicals : 3 hrs/ Week **Continuous Internal Assessment** : 15
Credits : 01 **Semester End Examination** : 35
Name of the Faculty : Dr.Murahari Kolli(Assoc Prof.) / P. Mounika (Asst Prof.)

Schedule of Experiments (Section –A: A1 Batch)

S.No	Batches	Regd.Nos	Total No. of Students
1	**Batch A1**	20761A0301-333	**33**

Date	Experiment (Batch)					
	Ex - 1	**Ex – 2**	**Ex – 3**	**Ex – 4**	**Ex – 5**	**Ex – 6**
22.07.2022	**Demonstration of all experiments, CEOs and COs of the Laboratory (Ex – 01 to 06)**					
MACHINE TOOLS LAB						
29.07.2022	A111	A112	A113	A114	A115	A116
05.08.2022	A116	A111	A112	A113	A114	A115
12.08.2022	A115	A116	A111	A112	A113	A114
26.08.2022	A114	A115	A116	A111	A112	A113
02.09.2022	A113	A114	A115	A116	A111	A112
09.09.2022	A112	A113	A114	A115	A116	A111
I Mid Examinations						
	Ex - 1	**Ex – 2**	**Ex – 3**	**Ex – 4**	**Ex – 5**	**Ex – 6**
30.09.2022	A121	A122	A123	A124	A125	A126
07.10.2022	A126	A121	A122	A123	A124	A125
14.10.2022	A125	A126	A121	A122	A123	A124
21.10.2022	A124	A125	A126	A121	A122	A123
28.10.2022	A123	A124	A125	A126	A121	A122
04.11.2022	A122	A123	A124	A125	A126	A121
	Backlog experiments / Additional Experiments					
	Internal Mid –II Examinations					
14-10-2019 to 19-10-2019: *II Mid Examinations*						
	Preparation and Practicals					
	Semester End Examinations					

Lab in charge **Head of the Department**

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(Autonomous)

Approved by AICTE, New Delhi and Permanently Affiliated to JNTUK, Kakinada
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. : 2022-2023 **Class** : B. Tech – V Semester (Section –A)
Lab/Practicals : 3 hrs/ Week **Continuous Internal Assessment** : 15
Credits : 01 **Semester End Examination** : 35
Name of the Faculty : Dr.Murahari Kolli(Assoc Prof.) / P. Mounika (Asst Prof.)

Schedule of Experiments (Section – A: A2 Batch)

S.No	Batches	Regd.Nos	Total No. of Students
1	**Batch A2**	20761A0334-347, 21765A0301–319	**33**

Date	Experiment (Batch)					
	Ex - 1	**Ex – 2**	**Ex – 3**	**Ex – 4**	**Ex – 5**	**Ex – 6**
27.07.2022	**Demonstration of all experiments, CEOs and COs of the Laboratory (Ex – 01 to 06)**					
Machine Tools LAB						
03.08.2022	A121	A122	A123	A124	A125	A126
10.08.2022	A126	A121	A122	A123	A124	A125
17.08.2022	A125	A126	A121	A122	A123	A124
24.08.2022	A124	A125	A126	A121	A122	A123
31.08.2022	A123	A124	A125	A126	A121	A122
07.08.2022	A122	A123	A124	A125	A126	A121
I Mid Examinations						
	Ex - 1	**Ex – 2**	**Ex – 3**	**Ex – 4**	**Ex – 5**	**Ex – 6**
31.09.2022	A111	A112	A113	A114	A115	A116
05.10.2022	A116	A111	A112	A113	A114	A115
12.10.2022	A115	A116	A111	A112	A113	A114
19.10.2022	A114	A115	A116	A111	A112	A113
26.10.2022	A113	A114	A115	A116	A111	A112
02.10.2022	A112	A113	A114	A115	A116	A111
	Backlog experiments / Additional Experiments					
	Internal Mid Examinations					
II Mid Examinations						
	Preparation and Practicals					
	Semester End Examinations					

Lab 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. : 2022-2023 **Class** : B. Tech – V Semester (Section –A)
Lab/Practicals : 3 hrs/ Week **Continuous Internal Assessment** : 15
Credits : 01 **Semester End Examination** : 35
Name of the Faculty : Dr.Murahari Kolli(Assoc Prof.) / P. Mounika (Asst Prof.)

Schedule of Experiments (Section – A: A2 Batch)

S.No	Batches	Regd.Nos	Total No. of Students
1	**Batch A1**	20761A0301-333	**33**

Date	Experiment (Batch)					
	Ex - 1	**Ex – 2**	**Ex – 3**	**Ex – 4**	**Ex – 5**	**Ex – 6**
22.07.2022	**Demonstration of all experiments, CEOs and COs of the Laboratory (Ex – 01 to 06)**					
Metrology LAB						
29.07.2022	A211	A212	A213	A214	A215	A216
05.08.2022	A216	A211	A212	A213	A214	A215
12.08.2022	A215	A216	A211	A212	A213	A214
26.08.2022	A214	A215	A216	A211	A212	A213
02.09.2022	A213	A214	A215	A216	A211	A212
09.09.2022	A212	A213	A214	A215	A216	A211
I Mid Examinations						
	Ex - 1	**Ex – 2**	**Ex – 3**	**Ex – 4**	**Ex – 5**	**Ex – 6**
30.09.2022	A221	A222	A223	A224	A225	A226
07.10.2022	A226	A221	A222	A223	A224	A225
14.10.2022	A225	A226	A221	A222	A223	A224
21.10.2022	A224	A225	A226	A221	A222	A223
28.10.2022	A223	A224	A225	A226	A221	A222
04.11.2022	A222	A223	A224	A225	A226	A221
	Repetition					
	Internal Mid Examinations					
II Mid Examinations						
	Preparation and Practicals					
	Semester End Examinations					

Lab 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. : 2022-2023 **Class** : B. Tech – V Semester (Section –A)
Lab/Practicals : 3 hrs/ Week **Continuous Internal Assessment** : 15
Credits : 01 **Semester End Examination** : 35
Name of the Faculty : Dr.Murahari Kolli(Assoc Prof.) / P. Mounika (Asst Prof.)

Schedule of Experiments (Section – A: A2 Batch)

S.No	Batches	Regd.Nos	Total No. of Students
1	A22	20761A0334-347, 21765A0301–319	**33**

Date	Experiment (Batch)					
	Ex - 1	**Ex – 2**	**Ex – 3**	**Ex – 4**	**Ex – 5**	**Ex – 6**
27.07.2022	**Demonstration of all experiments, CEOs and COs of the Laboratory (Ex – 01 to 06)**					
Metrology LAB						
03.08.2022	A221	A222	A223	A224	A225	A226
10.08.2022	A226	A221	A222	A223	A224	A225
17.08.2022	A225	A226	A221	A222	A223	A224
24.08.2022	A224	A225	A226	A221	A222	A223
31.08.2022	A223	A224	A225	A226	A221	A222
07.08.2022	A222	A223	A224	A225	A226	A221
	Additional Experiments and Backlogs					
I Mid Examinations						
	Ex - 1	**Ex – 2**	**Ex – 3**	**Ex – 4**	**Ex – 5**	**Ex – 6**
31.09.2022	A211	A212	A213	A214	A215	A216
05.10.2022	A216	A211	A212	A213	A214	A215
12.10.2022	A215	A216	A211	A212	A213	A214
19.10.2022	A214	A215	A216	A211	A212	A213
26.10.2022	A213	A214	A215	A216	A211	A212
02.11.2022	A212	A213	A214	A215	A216	A211
	Backlog experiments / Additional Experiments					
	Viva – Voce and Repetition / Beyond the Syllabus					
II Mid Examinations						
	Preparation and Practicals					
	Semester End Examinations					

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

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-521230, Krishna Dist, Andhra Pradesh, India

COURSE HANDOUT

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

ACADEMIC YEAR : 2022-23

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

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

COURSE CREDITS : 3

COURSE INSTRUCTOR : Dr P.RAVINDRA 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	-	2	-	-	-	-	-	3	3	1	2
CO3	3	-	3	3	-	1	3	-	2	-	-	2	3	1	2
CO4	3	-	3	1	-	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-A

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, applications CEO, COs, POs, Course Articulation Matrix	01	19-07-22		TLM1	CO1	T1/R1	
2.	Classification, Basic Engine components and Nomenclature	01	20-07-22		TLM1	CO1	T1/R1	
3.	Working principle of four stroke SI and CI Engines	02	21-07-22		TLM2	CO1	T1/R1	
4.	Working principle of two stroke SI and CI Engines	01	22-07-22		TLM2	CO1	T1/R1	
5.	Tutorial-I	01	23-07-22		TLM3	CO1	T1/R1	
6.	Comparison of two stroke and four stroke/ SI and CI engines	01	26-07-22		TLM1	CO1	T1/R1	
7.	Ideal and actual cycles and their analysis	01	27-07-22		TLM5	CO1	T1/R1	
8.	Valve timing diagrams for four stroke and two stroke SI & CI engines	01	28-07-22		TLM1/ TLM2	CO1	T1/R1	
9.	Port timing diagrams for four stroke and two stroke SI & CI engines	01	29-07-22		TLM1/ TLM2	CO1	T1/R1	
10.	**Carburettors & Fuel Injection** Air-fuel mixture requirements, construction and working of simple carburetor	01	30-07-22		TLM2	CO2	T1/R1	
11.	Calculation of air-fuel ratio, requirements of fuel injection systems	01	02-08-22		TLM3	CO1	T1/R1	
12.	Classification of injection systems, working principle of fuel injector	01	03-08-22		TLM1	CO1	T1/R1	
13.	Injection in SI and CI engines	01	04-08-22		TLM1/ TLM2	CO1	T1/R1	
14.	Assignment/Quiz-1	01	05-08-22		TLM1/ TLM2	CO1	T1/R1	
15.	Tutorial	01	06-08-22		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- Course Outcome** Stages of combustion	01	10-08-22		TLM1	CO2	T1/R1	
17.	Normal and abnormal combustion	01	11-08-22		TLM1	CO2	T1/R1	
18.	Effect of detonation	01	12-08-22		TLM1	CO2	T1/R1	
19.	Engine variables and other factors affecting knocking and its prevention	01	13-08-22		TLM1	CO2	T1/R1	
20.	Theory of detonation in SI engines	01	16-08-22		TLM1	CO2	T1/R1	
21.	Combustion chamber requirements-types of combustion chambers	01	18-08-22		TLM1, TLM2	CO2	T1/R1	
22.	**Tutorial-3**	01	20-08-22		TLM1	CO2	T1/R1	
23.	Octane number and rating of SI engine fuels	01	22-08-22		TLM3	CO1	T1/R1	
24.	**Combustion in CI engines** – Stages of combustion	01	23-08-22		TLM1/TLM 2	CO2	T1/R1	
25.	Variables affecting delay period	01	25-08-22		TLM1	CO2	T1/R1	
26.	Diesel knock-methods of controlling diesel knock	01	26-08-22		TLM1	CO2	T1/R1	
27.	CI engine combustion chamber requirements- Types of combustion chambers	01	27-08-22		TLM1/TLM 2	CO2	T1/R1	
28.	Cold starting of CI engines	01	30-08-22		TLM1/TLM 2	CO2	T1/R1	
29.	Cetane number and rating of CI engine fuels	01	01-09-22		TLM3	CO1	T1/R1	
30.	**Assignment/Quiz-2**	01	02-09-22		TLM1	CO2	T1/R1	
31.	**Tutorial-4**	01	03-09-22		TLM6	CO1	T1/R1	
No. of classes required to complete UNIT-II		16						

UNIT-III: IC ENGINE PERFORMANCE PARAMETERS AND 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.	Course Outcome Performance parameters for IC engines	01	06-09-22		TLM1	CO3	T1/R1	
33.	Engine power and engine efficiency	01	07-09-22		TLM1	CO3	T1/R1	

34.	Performance characteristics	01	08-09-22		TLM1	CO3	T1/R1	
35.	Variables effecting Performance characteristics	01	09-09-22		TLM1	CO3	T1/R1	
36.	**Tutorial-5**	01	10-09-22		TLM1, TLM2	CO3	T1/R1	
37.	Methods of improving engine performance	01	07-10-22		TLM1	CO3	T1/R1	
38.	Heat balance sheet	01	08-10-22		TLM3	CO3	T1/R1	
39.	Modern automotive engines-introduction	01	11-10-22		TLM1	CO3	T1/R1	
40.	Changes in fuel injection methods in SI and CI engines	01	12-10-22		TLM1	CO3	T1/R1	
41.	Common rail direct injection system	01	13-10-22		TLM1	CO3	T1/R1	
42.	Gasoline direct injection	01	14-10-22		TLM1	CO3	T1/R1	
43.	**Tutorial-6**	01	15-10-22		TLM2	CO3	T1/R1	
44.	DTSi Technology	01	18-10-22		TLM2	CO3	T1/R1	
45.	Variable valve technology-VVT	01	19-10-22		TLM3	CO3	T1/R1	
46.	Assignment/Quiz-3	01	20-10-22		TLM6	CO3	T1/R1	
No. of classes required to complete UNIT-III		15			No. of classes taken:			

UNIT-IV: GAS TURBINES- INTERCOOLING, REHEATING AND 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	21-10-22		TLM1	CO4	T2/R1	
48.	Development of gas turbines	01	22-10-22		TLM1	CO4	T2/R1	
49.	Classification and application of gas turbines	01	21-10-22		TLM1	CO4	T2/R1	
50.	Ideal and actual cycles	01	25-10-22		TLM4	CO4	T2/R1	
51.	Effect of intercooling	01	26-10-22		TLM1	CO4	T2/R1	
52.	Reheating method	01	27-10-22		TLM3	CO3	T2/R1	
53.	Regeneration method	01	28-10-22		TLM1	CO4	T2/R1	
54.	**Tutorial-7**	01	29-10-22		TLM1	CO4	T2/R1	
55.	Combined cycles	01	01-11-22		TLM2, TLM4	CO4	T2/R1	
56.	Combined cycles	01	02-11-22		TLM2, TLM4	CO4	T2/R1	
57.	Assignment/Quiz-4	01	03-11-22		TLM3	CO4	T2/R1	
58.	**Tutorial-8**	01	04-11-22		TLM6	CO4	T2/R1	
No. of classes required to complete UNIT-IV		12			No. of classes taken:			

UNIT-V: GAS TURBINE CYCLES 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	05-11-22		TLM1	CO5	T2/R2	
60.	Intake and propelling nozzle efficiencies	01	08-11-22		TLM1	CO5	T2/R2	
61.	Simple turbojet cycles	01	09-11-22		TLM1, TLM2	CO5	T2/R2	
62.	Turboprop engine	01	10-11-22		TLM2	CO5	T2/R2	
63.	Thrust augmentation	01	11-11-22		TLM3	CO3	T2/R2	
64.	**Tutorial-8**	01	12-11-22		TLM1	CO5	T2/R2	
65.	Gas turbine combustion systems	01	15-11-22		TLM2	CO5	T2/R2	
66.	Combustion chamber designs	01	16-11-22		TLM3	CO3	T2/R2	
67.	Gas turbine emissions	01	17-11-22		TLM2	CO5	T2/R2	
68.	Assignment/Quiz-5	01	18-11-22		TLM3	CO3	T2/R2	
69.	**Tutorial-9**	01	19-11-22		TLM6	CO5	T2/R2	
70.	Revision	01	22-11-22		TLM1	CO5	T2/R2	
71.	Revision	01	23-11-22		TLM1	CO5	T2/R2	
72.	Revision	01	24-11-22		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	25-11-22		TLM2	-	T1/R2	
74.	Modern developments in IC Engines	01	26-12-22		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: 18-07-2022			
I Phase of Instructions	18/07/2022	10/09/2022	8
I Mid Examinations	26/09/2022	01/10/2022	
II Phase of Instructions	03/10/2022	26/11/2022	10

II Mid Examinations	28/11/2022	03/12/2022	
Preparation and Practical's	05/12/2022	10/12/2022	1
Semester End Examinations	12/12/2022	24/12/2022	2

EVALUATION PROCESS:

Evaluation Task	COs	Marks
Assignment-1	1	A1=05
Assignment- 2	2	A2=05
I-Mid Examination	1,2 1/2	B1=15
I-Mid Quiz Examination	1,2	C1=10
Assignment– 3, 4 and 5 , Cycle -II	3	A3=05
II-Mid Examination	3,4,5	B2=15
II-Mid Quiz Examination	3,4,5	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,B	1,2,3,4,5	**B=20**
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+D	**1,2,3,4,5**	**A+B+C+D=30**
Semester End Examinations: E	**1,2,3,4,5**	**E=70**
Total Marks: A+B+C+D+E	**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.Ravindra Kumar	Dr.P.Vijay Kumar	Dr.P.Vijay Kumar	Dr.S.Pichi Reddy
Course Instructor	Course Coordinator	Module Coordinator	HOD

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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&B **A.Y.:** 2022-23

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	19.7.2022		TLM2	
2.	Introduction of metal cutting, Machine tools, Metrology	1	21.7.2022		TLM2	
3.	Elements of cutting process	1	22.7.2022		TLM2	
4.	Methods of Metal Cutting: Orthogonal Array Vs Oblique	1	22.7.2022		TLM2	
5.	Geometry of Single Point Cutting Tool	1	23.7.2022		TLM2	
6.	Various types of cutting tools	1	26.7.2022		TLM2	
7.	Mechanism of Chip formation	1	28.7.2022		TLM2	
8.	Types of Chip formation	1	29.7.2022		TLM2	
9.	Chip formation problems	1	29.7.2022		TLM2	
10.	Merchant's Force Diagram	1	30.7.2022		TLM2	
11.	Measurement of cutting forces	1	2.8.2022		TLM2	
12.	MCD problems	1	4.8.2022		TLM1	
13.	Machining parameters calculations	1	5.8.2022		TLM2	
14.	Tool wear life	1	5.8.2022		TLM2	
15.	Machinability	1	6.8.2022		TLM2	
16.	Machining economics.	1	11.8.2022		TLM2	
17.	Tool Life problems	1	12.8.2022		TLM1	
No. of classes required to complete UNIT-I: 17				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
18.	Introduction to Lathe	1	12.8.2022		TLM2	
19.	Principle of working and specifications of lathe	1	16.8.2022		TLM2	
20.	Types of lathes	1	18.8.2022		TLM2	
21.	Lathe accessories- tool holding	1	19.8.2022		TLM2	
22.	Lathe accessories-work holding	1	19.8.2022		TLM2	
23.	Lathe accessories- attachments	1	20.8.2022		TLM2	

24.	Operations on Lathe machine	1	23.8.2022		TLM2	
25.	Lathe accessories-supporting devices	1	25.8.2022		TLM2	
26.	Taper turning-methods	1	26.8.2022		TLM2	
27.	Reciprocating Machines: SHAPING Principle of working	1	26.8.2022		TLM2	
28.	Parts of Shaper Machine– Specifications,	1	27.8.2022		TLM2	
29.	Size and Specifications of Shaper,	1	30.8.2022		TLM2	
30.	classifications,	1	1.9.2022		TLM2	
31.	Operations , tool holding , work holding	1	30.8.2022		TLM2	
32.	SLOTTING Principle of working – Principal parts – Specifications,	1	1.9.2022		TLM2	
33.	classifications	1	2.9.2022		TLM2	
34.	operations	1	2.9.2022		TLM2	
35.	PLANNER Principle of working Principal parts –	1	3.9.2022		TLM2	
36.	Size and Specifications	1	6.9.2022		TLM2	
37.	classifications	1	8.9.2022		TLM2	
38.	Operations	1	9.9.2022		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
39.	Introduction of Grinding machines Defiance with cutting and surface finishing , examples	1	9.9.2022		TLM2	
40.	Fundamentals – Theory of grinding	1	13.9.2022		TLM2	
41.	Classification of grinding machine	1	15.9.2022		TLM2	
42.	Non precision grinding machines	1	16.9.2022		TLM2	
43.	Cylindrical grinding machines	1	16.9.2022		TLM2	
44.	Surface grinding machines	1	17.9.2022		TLM2	
45.	Tool and cutter grinding machine	1	20.9.2022		TLM2	
46.	Special types of grinding machines.	1	22.9.2022		TLM2	
47.	MILLING MACHINES: Principle of working –	1	23.9.2022		TLM2	
48.	Specifications, Methods of Milling	1	24.9.2022		TLM2	

49.	Classifications of milling machines	1	11.10.2022		TLM2	
50.	Machining operations	1	13.10.2022		TLM2	
51.	Machining operations	1	14.10.2022		TLM2	
52.	**Drilling** , Introduction	1	14.10.2022		TLM2	
53.	Size and Specifications	1	15.10.2022		TLM2	
54.	Types of Drilling machines	1	18.10.2022		TLM2	
55.	Drilling operations	1	19.10.2022		TLM2	
No. of classes required to complete UNIT-III: 17				No. of classes taken:		
I-Mid Exams :26.09.2022 to 01.09.2022						

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
56.	Introduction to Metrology	1	21.10.2022		TLM2	
57.	Linear and angular measurements	1	21.10.2022		TLM2	
58.	Standards of measurements - line and end standards	1	22.10.2022		TLM2	
59.	Dial indicators	1	25.10.2022		TLM2	
60.	Micrometers	1	27.10.2022		TLM2	
61.	Basic principle and applications of slip gauges Angle slip gauges	1	29.10.2022		TLM2	
62.	Sine bar and rollers	1	28.10.2022		TLM2	
63.	SURFACE TEXTURE Introduction, Factors effecting surface roughness	1	29.10.2022		TLM2	
64.	reasons for controlling surface texture	1	1.11.2022			
65.	Differences between surface roughness and surface waviness	1	3.11.2022			
66.	Elements of surface texture - Numerical assessment of surface finish	1	4.11.2022			
67.	C.L.A., R.M.S Values	1	4.11.2022			
68.	R_a values, and R_z values	1	5.11.2022			
69.	ISI symbols for indication of surface finish.	1	8.11.2022			
70.	Profile meters	1	10.11.2022			
71.	Tomlinson surface meter	1	11.11.2022			
No. of classes required to complete UNIT-IV: 14				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
72.	Introduction	1	11.10.2022		TLM2	
73.	Tolerance limits Normal size	1	12.10.2022		TLM2	
74.	Deviations, Allowance, Fits and their types	1	15.10.2022		TLM2	
75.	Unilateral tolerance system	1	17.10.2022		TLM2	
76.	Bilateral tolerance system	1	18.10.2022		TLM2	
77.	Hole basis systems	1	18.10.2022		TLM2	
78.	Shaft basis systems	1	19.10.2022		TLM2	
79.	Hole basis systems problems	1	22.10.2022		TLM1	
80.	Shaft basis systems problems	1	23.10.2022		TLM1	
81.	Interchangeability and selective assembly	1	25.10.2022		TLM2	
82.	ALIGNMENT TESTS:	1	25.10.2022		TLM2	
83.	Alignment tests on Lathe	1	26.10.2022		TLM2	
No. of classes required to complete UNIT-V: 9				No. of classes taken:		
II-Mid Exams :				28.11.2022 to 03.12.2022		

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 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	**K.Venkateswara Reddy**	**V.Venkata Rami Reddy**		**Dr. S.Pichi Reddy**
Signature				

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DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor: Mr.Srinivasa Reddy.S
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.:** 2022-23

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	18-07-2022		TLM2	
2.	*Machine Design-Introduction&* Basic Procedure	1	19-07-2022		TLM2	
3.	Basic requirements of machine elements and Design of Machine Elements	1	20-07-2022		TLM2	
4.	Design analysis-Design synthesis Introduction to Indian standards	1	21-07-2022		TLM2	
5.	Selection of Preferred sizes & Modes of failure – Factor of safety	1	23-07-2022		TLM2	
6.	Stress-strain relationship, Shear stress and shear strain	1	25-07-2022		TLM2	
7.	Stresses due to bending moment	1	26-07-2022		TLM2	
8.	Stresses due to torsional moment	1	27-07-2022		TLM2	
9.	Eccentric axial loading	1	28-07-2022		TLM2	
10.	**Tutorial-I**	1	30-07-2022		TLM2	
11.	Theories of elastic failure – Introduction and principal stresses	1	01-08-2022		TLM2	
12.	Maximum principal stress theory	1	02-08-2022		TLM1	
13.	Maximum Shear stress theory	1	03-08-2022		TLM2	
14.	Distortion energy theory	1	04-08-2022		TLM2	
15.	**Tutorial-II & Quiz-I**	1	06-08-2022		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	08-08-2022		TLM2	
17.	Reduction of stress concentration Fluctuating stresses - Fatigue failure	1	10-08-2022		TLM2	
18.		1	11-08-2022		TLM2	
19.	*Endurance limit* Low cycle and high cycle fatigue	1	13-08-2022		TLM2	
20.	Notch sensitivity	1	16-08-2022		TLM2	
21.	Endurance limit - Approximate estimation	1	17-08-2022		TLM2	
22.	Introduction to reversed stresses	1	18-08-2022		TLM2	
23.	Reversed stresses and Design for infinite life	1	20-08-2022		TLM2	
24.	**Tutorial-III**	1	22-08-2022		TLM2	
25.	Soderberg, Goodman lines	1	23-08-2022		TLM2	
26.	Modified Goodman line	1	24-08-2022		TLM2	

27.	Infinite Life Problems under fluctuating loads	1	25-08-2022		TLM2	
28.	Infinite Life Problems under fluctuating loads	1	27-08-2022		TLM2	
29.	Gerber equation and Fatigue design under combined stresses	1	29-08-2022		TLM2	
30.	**Tutorial-IV & Quiz-II**	1	30-08-2022		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	01-09-2022		TLM2	
32.	Strength of butt welds- Strength of parallel fillet welds	1	03-09-2022		TLM2	
33.	*Strength of transverse fillet welds* Maximum shear stress in parallel fillet welds	1	05-09-2022		TLM2	
34.	Maximum shear stress in transverse fillet welds	1	06-09-2022		TLM2	
35.	*Axially loaded unsymmetrical* Welded joints	1	07-09-2022		TLM2	
36.	Welded joint subjected to bending moment	1	08-09-2022		TLM2	
37.	**Tutorial-V**	1	10-09-2022		TLM2	
38.	I-Mid Exams :26.09.2022 to 01.09.2022					
39.	Threaded joints -Terminology of screw threads	1	10-10-2022		TLM2	
40.	Bolted joints	1	11-10-2022		TLM2	
41.	Eccentrically loaded bolted joints in shear	1	12-10-2022		TLM2	
42.	Problems on Eccentrically loaded bolted joints in shear	1	13-10-2022		TLM2	
43.	Eccentrically loaded bolted joints in shear	1	15-10-2022		TLM2	
44.	Problems on Eccentrically loaded bolted joints in shear	1	17-10-2022		TLM2	
45.	Eccentric load perpendicular to axis of bolt	1	18-10-2022		TLM2	
46.	Problems on Eccentric load perpendicular to axis of bolt	1	19-10-2022		TLM2	
47.	Bolts of uniform strength	1	20-10-2022		TLM2	
48.	**Tutorial-VI & Quiz-III**	1	22-10-2022		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	25-10-2022		TLM2	
50.	Shaft design on strength basis	1	26-10-2022		TLM2	
51.	Shaft design on torsional rigidity basis	1	27-10-2022		TLM2	
52.	ASME code for shaft design	1	29-10-2022		TLM2	
53.	**Tutorial-VII**	1	31-10-2022		TLM2	

54.	Design of hollow shaft on strength and torsional rigidity basis	1	01-11-2022		TLM2	
55.	Design of hollow shaft on strength and torsional rigidity basis	1	02-11-2022		TLM2	
56.	Problems on shafts	1	03-11-2022		TLM2	
57.	Problems on shafts	1	05-11-2022		TLM2	
58.	Problems on shafts	1	07-11-2022		TLM2	
59.	**Tutorial-VIII & Quiz-IV**	1	08-11-2022		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	09-11-2022		TLM2	
61.	*Design of Socket and* Spigot cotter joint	1	10-11-2022		TLM2	
62.	*Design of Socket and* Spigot cotter joint	1	12-11-2022		TLM2	
63.	*Problem on Design of Socket and* Spigot cotter joint	1	14-11-2022		TLM2	
64.	Design of Cotter joints	1	15-11-2022		TLM2	
65.	Design of Knuckle joint-Failures	1	16-11-2022		TLM1	
66.	Quiz-IV	1	17-11-2022		TLM1	
67.	**Tutorial-IX**	1	19-11-2022		TLM1	
68.	Flange coupling- Muff coupling	1	21-11-2022		TLM2	
69.	Clamp coupling	1	22-11-2022		TLM3	
70.	Bushed pin flexible coupling		23-11-2022		TLM2	
71.	Quiz-V		24-11-2022		TLM2	
72.	**Tutorial-X**		26-11-2022		TLM2	
No. of classes required to complete UNIT-V:				No. of classes taken:		
II-Mid Exams :				28.11.2022 to 03.12.2022		

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 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. S.Pichi Reddy**
Signature				

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

DEPARTMENT OF MECHANICAL ENGINEERING
COURSE HANDOUT

PART - A

PROGRAM : **B.Tech. - V-Sem. - Mechanical Engineering – B Section**
ACADEMIC YEAR : 2022-23
COURSE NAME & CODE : **ROBOTICS 20ME14L-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	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
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 publishingcompany 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) PrivateLimited,2012

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

R3 John.J Criag, Introduction to Robotics-Mechanics and Control, Third Edition,PearsonEducation,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		**TLM 2**	CO 1	T1, T2, R1, R2	
2.	CEOs, Course Outcomes, POs and PSOs	1	20-07-2022		**TLM 2**	-	-	
3.	Basic concepts – Robot anatomy	1	21-07-2022		**TLM 2**	CO 1	T1, T2, R1, R2	
4.	Components of robots, **Tutorial**	1	22-07-2022		**TLM 2**	CO 1	T1, T2, R1, R2	
5.	Robot motions	1	23-07-2022		**TLM 2**	CO 1	T1, T2, R1, R2	
6.	Number of D.O.F – Work volume	1	26-07-2022		**TLM 2**	CO 1	T1, T2, R1, R2	
7.	Robot applications in Material transfer and machine loading / unloading applications	1	27-07-2022		**TLM 2**	CO 1	T1, T2, R1, R2	
8.	Robot applications in Processing operations – Assembly and inspection – Future applications	1	28-07-2022		**TLM 2**	CO 1	T1, T2, R1, R2	
9.	**Robot End Effectors –** Introduction, **Tutorial**	1	29-07-2022		**TLM 3**	CO 1	T1, T2, R1, R2	

10.	Types of end effectors – Mechanical grippers	1	30-07-2022		**TLM 2**	CO 1	T1, T2, R1, R2	
11.	Vacuum cups, magnetic grippers, adhesive gripers and others	1	02-08-2022		**TLM 2**	CO 1	T1, T2, R1, R2	
12.	Robot / End effectors interface	1	03-08-2022		**TLM 2**	CO 1	T1, T2, R1, R2	
13.	Considerations in gripper selection and design	1	04-08-2022		**TLM 2**	CO 1	T1, T2, R1, R2	
14.	Case Studies, Numericals, **Tutorial**	1	05-08-2022		**TLM 2**	CO 1	T1, T2, R1, R2	
15.	Numericals	1	06-08-2022		**TLM 3**	CO 1	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		**TLM 2**	CO2	T1,R1	
17.	Characteristics of Actuating System	1	11-08-2022		**TLM 2**	CO2	T1,R1	
18.	Pneumatic Actuators	1	12-08-2022		**TLM 2**	CO2	T1,R1	
19.	Hydraulic Actuators, **Tutorial**	1	13-08-2022		**TLM 2**	CO2	T1,R1	
20.	Electric Motors	1	16-08-2022		**TLM 2**	CO2	T1,R1	
21.	Introduction to Sensors	1	17-08-2022		**TLM 3**	CO2	T1,R1	
22.	Sensor characteristics	1	18-08-2022		**TLM 1**	CO2	T1,R1	
23.	Position sensors: Potentiometers, LVDT	1	20-08-2022		**TLM 1**	CO2	T1,R1	
24.	Resolvers, Encoders, **Tutorial**	1	23-08-2022		**TLM 1**	CO2	T1,R1	
25.	Magnetostrictive Displacement Transducers (MDT)	1	24-08-2022		**TLM 1**	CO2	T1,R1	
26.	Velocity Sensors: Encoders	1	25-08-2022		**TLM 1**	CO2	T1,R1	
27.	Tachometers	1	26-08-2022		**TLM 1**	CO2	T1,R1	

28.	Industrial Applications, **Tutorial**	1	27-08-2022		**TLM 2**	CO2	T1,R1	
29.	Case Studies	1	30-08-2022		**TLM 2**	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		**TLM 2**	CO 3	T1,R1	
31.	Coordinate Frames	1	02-09-2022		**TLM 2**	CO 3	T1,R1	
32.	Description of Objects in space	1	03-09-2022		**TLM 2**	CO 3	T1,R1	
33.	Transformation of vectors, **Tutorial**	1	01-09-2022		**TLM 2**	CO 3	T1,R1	
34.	Numericals	1	06-09-2022		**TLM 1**	CO 3	T1,R1	
35.	Inverting a Homogeneous Transform	1	07-09-2022		**TLM 3**	CO 3	T1,R1	
36.	Numericals	1	08-09-2022		**TLM 2**	CO 3	T1,R1	
37.	Fundamental Rotation Matrices	1	09-09-2022		**TLM 2**	CO 3	T1,R1	
38.	Numericals, **Tutorial**	1	10-09-2022		**TLM 2**	CO 3	T1,R1	
39.	D-H representation	1	11-10-2022		**TLM**	CO	T1,R1	

					2	3		
40.	Problems on Forward Kinematics	1	12-10-2022		**TLM 2**	CO 3	T1,R1	
41.	Numericals	1	13-10-2022		**TLM 2**	CO 3	T1,R1	
42.	Numericals	1	14-10-2022		**TLM 2**	CO 3	T1,R1	
43.	Numericals, **Tutorial**	1	15-10-2022		**TLM 2**	CO 3	T1,R1	
44.	Numericals	1	18-10-2022		**TLM 2**	CO 3	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,R 1	
No. of classes required to complete UNIT-V		**15**			**No. of classes taken:**			

TEACHING LEARNING METHODS:

TLM1	Chalk and Talk	**TLM 4**	Demonstration (Lab/Field visit)
TLM2	PPT	**TLM 5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM 6**	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 successfulin 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 engineeringproblems 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 anunderstanding 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 solutionsin societal and environmental contexts, and demonstrate the knowledge of, and need for sustainabledevelopment.

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 clearinstructions.

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 leaderin 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	**J. Subba Reddy**	**J.Subba Reddy**	**J.Subba Reddy**	**Dr. S. Pichi Reddy**
Designation	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**HOD**
Signature				

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DEPARTMENT OF ARTIFICIAL INTELLIGENCE AND DATA SCIENCE

COURSE HANDOUT

PART-A

Name of Course Instructor: Mr. P.GANDHI PRAKASH
Course Name & Code : INTRODUCTION TO ARTIFICIAL INTELLIGENCE& 20AD81
L-T-P Structure : **3-0-0** **Credits:** 3
Program/Branch/Sem : **B.Tech/MECH/V-A&B** **A.Y.: 2022-23**

PRE-REQUISITE: Basic Engineering Mathematics Knowledge

Course Educational Objective:

The objective of the course is to present an overview of artificial intelligence (AI) principles and approaches. Develop a basic understanding of the building blocks of AI as presented in terms of intelligent agents: Search, Knowledge representation, inference, logic, reasoning, and learning. Students will implement a small AI system in a team environment. The knowledge of artificial intelligence plays a considerable role in some applications students develop for courses in the program.

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

CO1	Enumerate the history and foundations of Artificial Intelligence. **(Understand-L2)**
CO2	Apply the basic principles of AI in problem solving. **(Apply-L3).**
CO3	Explain the different searching algorithms to find and optimize the solution for the given Problem. **(Understand-L2)**
CO4	Illustrate the different gaming algorithms and identify the importance of knowledge Representation in Artificial Intelligence. **(Apply-L3)**
CO5	Describe the use of predicate logic and rule-based system to represent the knowledge in AI domain. **(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	PSO2
CO1	2	3	2	-	3	-	-	-	-	-	-	2	3	-	-
CO2	2	3	3	3	3	-	-	-	-	-	-	2	3	-	-
CO3	2	3	3	-	3	-	-	-	-	-	-	2	3	-	-
CO4	2	3	3	2	3	-	-	-	-	-	-	2	3	-	-
CO5	2	3	3	2	3	-	-	-	-	-	-	2	3	-	-

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

BOS APPROVED TEXT BOOKS:

T1. Stuart Russell, Peter Norvig, "Artificial Intelligence: A Modern Approach",3rd edition, Prentice Hall, 2009. Can also use 2nd Ed., Pearson Education International, 2003.
T2. Saroj Kaushik, "Artificial Intelligence", Cengage Learning India, 2011

BOS APPROVED REFERENCE BOOKS:

R1. Nils Nilsson, "Artificial Intelligence: A New Synthesis", Morgan Kaufmann, 1998.
R2. David Poole, Alan Mackworth, "Artificial Intelligence: Foundations for Computational
Agents", Cambridge Univ. Press, 2010.
R3. Ronald Brachman, "Knowledge Representation and Reasoning", Morgan Kaufmann,
2004.
R4. Frank van Harmelen, Vladimir Lifschitz, Bruce Porter (Eds), "Handbook of Knowledge
representation", Elsevier, 2008.
R5. Ivan Bratko, "Prolog Programming for Artificial Intelligence", 4th Ed., Addison-Wesley,
2011.

Part-B

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

UNIT-I : INTRODUCTION

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.	Discussion of CEO's and CO's, Introduction to programming.	1	20-07-2022		-	CO1	-	
2.	Introduction: What Is AI?,	1	21-07-2022		TLM1	CO1	T1,T2	
3.	The Foundations of Artificial Intelligence	1	22-07-2022		TLM1	CO1	T1,T2	
4.	The History of Artificial Intelligence,	1	23-07-2022		TLM1	CO1	T1,T2	
5.	The State of the Art,.	1	27-07-2022		TLM1	CO1	T1,T2	
6.	Agents and Environments	1	28-07-2022		TLM1	CO1	T1,T2	
7.	Types of agents	1	29-07-2022		TLM2	CO1	T1,T2	
8.	Types of agents	1	30-07-2022		TLM2	CO1	T1,T2	
9.	Types of agents	1	03-08-2022		TLM2	CO1	T1,T2	
10.	Good Behavior: The Concept of Rationality	1	04-08-2022		TLM1	CO1	T1,T2	
11.	Omniscience vs Rational agent	1	05-08-2022		TLM1	CO1	T1,T2	
12.	The Nature of Environments	1	06-08-2022		TLM1	CO1	T1,T2	
13.	The Structure of Agents	1	10-08-2022		TLM1	CO1	T1,T2	
14.	Assignment/Quiz-2	1	11-08-2022		TLM1	CO1	-	
No. of classes required to complete UNIT-I				14	**No. of classes taken:**			

UNIT-II : PROBLEM SOLVING

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
15.	Problem-Solving Agents, Example Problems	1	12-08-2022		TLM1	CO2	T1,T2	
16.	searching for Solutions, Uninformed Search Strategies	1	13-08-2022		TLM1	CO2	T1,T2	
17.	Search algorithms terminologies	1	17-08-2022		TLM1	CO2	T1,T2	
18.	Properties of search algorithms	1	18-08-2022		TLM1	CO2	T1,T2	
19.	Types of search algorithms.	1	20-08-2022		TLM1	CO2	T1,T2	
20.	Best first search algorithm	1	24-08-2022		TLM2	CO2	T1,T2	
21.	A* Algorithm	1	25-08-2022		TLM2	CO2	T1,T2	
22.	AO* Algorithm	1	26-08-2022		TLM2	CO2	T1,T2	
23.	Local Search Algorithms	1	27-08-2022		TLM2	CO2	T1,T2	
24.	Local Search Algorithms	1	01-09-2022		TLM2	CO2	T1,T2	
25.	Searching with Nondeterministic Actions.	1	02-09-2022		TLM2	CO2	T1,T2	
26.	Assignment/Quiz-2	1	03-09-2022		TLM1	CO2	T1,R1	
No. of classes required to complete UNIT-II		12			No. of classes taken:			

UNIT-III : SEARCH ALGORITHMS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome Cos	Text Book followed	HOD Sign Weekly
27.	Introduction	1	07-09-2022		TLM1	CO3	T1,T2	
28.	Uniformed/Blind Search Algorithms:	1	08-09-2022		TLM1	CO3	T1,T2	
29.	Breadth-first Search,	1	09-09-2022		TLM2	CO3	T1,T2	
30.	Depth-first Search,	1	10-09-2022		TLM2	CO3	T1,T2	
31.	Depth limited search	1	06-10-2022		TLM2	CO3	T1,T2	

32.	Iterative deepening depth-first search	1	07-10-2022		TLM2	CO3	T1,T2	
33.	Uniform cost search	1	08-10-2022		TLM2	CO3	T1,T2	
34.	Bidirectional Search.	1	12-10-2022		TLM2	CO3	T1,T2	
35.	Assignment/Quiz-3	1	13-10-2022		TLM1	CO3	-	
No. of classes required to complete UNIT-III		09			No. of classes taken:			

UNIT-IV: ADVERSARIAL SEARCH/ GAME PLAYING

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
36.	Introduction	1	14-10-2022		TLM1	CO4	T1,T2	
37.	Minimax algorithm	1	15-10-2022		TLM2	CO4	T1,T2	
38.	Alpha-Beta pruning	1	19-10-2022		TLM2	CO4	T1,T2	
39.	Knowledge Based Agent, Architecture	1	20-10-2022		TLM1	CO4	T1,T2	
40.	Knowledge base Levels and types	1	21-10-2022		TLM1			
41.	Representation mappings	1	22-10-2022		TLM1	CO4	T1,T2	
42.	Inference Engine:Forward chaining/reasoning	1	26-10-2022		TLM1	CO4	T1,T2	
43.	Backward chaining/reasoning	1	27-10-2022		TLM1	CO4	T1,T2	
44.	Approaches of knowledge representation,	1	28-10-2022		TLM1	CO4	T1,T2	
45.	issues in knowledge representation	1	29-10-2022		TLM1	CO4	T1,T2	
46.	Assignment/Quiz-4	1	02-11-2022		TLM1	CO4	-	
No. of classes required to complete UNIT-IV		11			No. of classes taken:			

UNIT-V: KNOWLEDGE REPRESENTATION TECHNIQUES

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.	Introduction	1	03-11-2022		TLM1	CO5	T1,T2	T1,T2
48.	Logic, Propositional Logic:	1	04-11-2022		TLM1	CO5	T1,T2	
49.	A Very Simple Logic,	1	05-11-2022		TLM1	CO4	T1,T2	
50.	Ontological Engineering	1	09-11-2022		TLM2	CO4	T1,T2	

51.	Categories and Objects, Events	1	10-11-2022		TLM2	CO5	T1,T2	
52.	Mental Events and Mental Objects	1	11-11-2022		TLM1	CO5	T1,T2	
53.	What is reasoning and Types	1	12-11-2022		TLM1	CO4	T1,T2	
54.	Types of reasoning	1	16-11-2022		TLM1	CO4	T1,T2	
55.	Reasoning Systems for Categories	1	17-11-2022		TLM2	CO5	T1,T2	
56.	The Internet Shopping World	1	18-11-2022		TLM1	CO5	T1,T2	
57.	Assignment/Quiz-5	1	19-11-2022		TLM1	CO5	-	
No. of classes required to complete UNIT-V		11			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
58.	Turing test, Interview Questions	1	23-11-2022		**TLM1**			

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam /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	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

PSO 1	To apply the fundamental engineering knowledge, computational principles, and methods for extracting knowledge from data to identify, formulate and solve real time problems.
PSO 2	To develop multidisciplinary projects with advanced technologies and tools to address social and environmental issues.
PSO 3	To provide a concrete foundation and enrich their abilities for Employment and Higher studies in Artificial Intelligence and Data science with ethical values

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**P.GANDHI PRAKASH**	**P.GANDHI PRAKASH**	**Dr. O. Rama Devi**	**Dr. O. Rama Devi**
Signature				

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(AUTONOMOUS)

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Phone: 08659-222933, Fax: 08659-222931

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor	: Dr. B. Srinivasa Rao		
Course Name & Code	: OOPS through JAVA (20IT81)		
L-T-P Structure	: 3-0-0	Credits	: 3
Program/Sem/Sec	: B.Tech. –ME / V-Sem /A & B	A.Y.	: 2022 – 23
PRE-REQUISITE	: Programming for Problem Solving Using C		

COURSE EDUCATIONAL OBJECTIVE (CEO): Concentrates on the methodological and technical aspects of software design and Programming based on Object-Oriented Programming (OOP). Acquire the basic knowledge and skills necessary to implement Object-Oriented Programming Techniques in software development through JAVA. Know about the importance of Collections and GUI based applications through JAVA.

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

CO1	Understand Object Oriented Programming Concepts through constructs of JAVA. **(Understand- L2)**
CO2	Apply the concepts of Inheritance and Polymorphism on real-world applications. **(Apply - L3)**
CO3	Implement reusability using interface and packages**. (Understand- L2)**
CO4	Construct robust applications using exception handling. **(Apply - L3)**
CO5	Understand multi-threading concepts. **(Understand - L2)**

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

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

TEXTBOOK:

T1: **Java Fundamentals** – A comprehensive Introduction, Herbert Schildt and Dale Skrien, TMH.

REFERENCE BOOKS:

R1: The Java™ Programming Language: Ken Arnold, James Gosling, Pearson

R2: Introduction to Java Programming 7/e, Brief version, Y.Daniel Liang, Pearson

R3: Java for Programmers, P.J.Deitel and H.M.Deitel, Pearson education (OR) Java: How to Program P.J.Deitel and H.M.Deitel, PHI.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT – I: Introduction to OOP & JAVA:

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.	Java Buzzwords / Features	1	20/07/22		TLM1,2	
2.	Object Oriented Programming **(OOP)** concepts	1	21/07/22		TLM1,2	
3.	Java History, Advantages	1	22/07/22		TLM1,2	
4.	Data types	1	23/07/22		TLM1,2	
5.	Operators, Expressions	1	27/07/22		TLM1,2	
6.	Control Statements	1	28/07/22		TLM1,2	
7.	Methods and recursion , Sample programs	1	29/07/22		TLM1,2	
8.	Java Objects and References	1	30/07/22		TLM1,2	
9.	Constructors	1	03/08/22		TLM1,2	
10.	this keyword	1	04/08/22		TLM1,2	
11.	Arrays (single and multi-dimensional),	2	05/08/22 06/08/22		TLM1,2	
12.	String, StringBuffer, StringTokenizer Classes	3	10/08/22 11/08/22 12/08/22		TLM1,2	
No. of classes required to complete UNIT – I:15				**No. of classes taken:**		

UNIT – II: Extending Classes/ Reusability

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
13.	**Inheritance :** Introduction , Derived Classes	1	17/08/22		TLM1,2	
14.	Advantages and Types of Inheritance	1	18/08/22		TLM1,2	
15.	Implementation of Inheritance	1	20/08/22		TLM1,2	
16.	Inheritance and Member Accessibility	1	24/08/22		TLM1,2	
17.	Overriding	1	25/08/22		TLM1,2	
18.	super keyword	1	26/08/22		TLM1,2	
19.	abstract classes and methods	1	27/08/22		TLM1,2	
20.	final keyword	1	02/09/22		TLM1,2	
21.	final methods and final classes	1	03/09/22		TLM1,2	
22.	Dynamic Binding	1	10/09/22		TLM1,2	
23.	Polymorphism	1	14/09/22		TLM1,2	
No. of classes required to complete UNIT – II: 11				**No. of classes taken:**		

UNIT – III: Interfaces & Packages

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
24.	**Interfaces:** Differences between classes and interfaces	1	15/09/22		TLM1,2	
25.	defining an interface	1	22/09/22		TLM1,2	
26.	implementing interface	1	23/09/22		TLM1,2	
27.	variables in interface, extending interfaces	1	24/09/22		TLM1,2	
28.	**Packages:** Defining, Creating	1	06/10/22		TLM1,2	
29.	Accessing a Package,	1	07/10/22		TLM1,2	
30.	importing packages,	1	12/10/22		TLM1,2	
31.	Access controls (public, protected, default and private).	1	13/10/22		TLM1,2	
32.	Wrapper Classes (Like Integer, Float, Double).	1	14/10/22		TLM1,2	
No. of classes required to complete UNIT – III: 09				**No. of classes taken:**		

UNIT – IV: Exception handling

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.	**Exception Handling:** Concepts of exception handling	1	15/10/22		TLM1,2	
34.	benefits of exception handling	1	19/10/22		TLM1,2	
35.	usage of try, catch	1	20/10/22		TLM1,2	
36.	multiple catch clause	1	21/10/22		TLM1,2	
37.	Nested try, throw	1	22/10/22		TLM1,2	
38.	throws	1	24/10/22		TLM1,2	
39.	finally	1	26/10/22		TLM1,2	
40.	built in exceptions	1	27/10/22		TLM1,2	
41.	creating own exception	1	28/10/22		TLM1,2	
No. of classes required to complete UNIT – IV: 09				**No. of classes taken:**		

UNIT – V: Multithreading

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
42.	Multithreading: Introduction	1	29/10/22		TLM1,2	
43.	Thread life cycle	1	02/11/22		TLM1,2	
44.	creating threads (by extending thread class)	1	03/11/22		TLM1,2	
45.	creating threads (implementing Runnable Interface)	1	05/11/22		TLM1,2	
46.	Example programs on threads	1	09/11/22		TLM1,2	

47.	Synchronization : method	1	10/11/22		TLM1,2	
48.	Synchronization block	1	11/11/22		TLM1,2	
49.	Thread Priorities	1	12/11/22		TLM1,2	
50.	isAlive() and join() methods	1	16/11/22		TLM1,2	
51.	Inter thread Communication	2	17/11/22 18/11/22		TLM1,2	
No. of classes required to complete UNIT – V:11				**No. of classes taken:**		

Content beyond the Syllabus:

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
52.	Introduction to collection framework	2	23/11/22 24/11/22		TLM1,2	
53.	Introduction to GUI	1	25/11/22		TLM1,2	
54.	Differences between AWT & SWINGS	1	26/11/22		TLM1,2	

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):

PO1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO2	**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.
PO3	**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.
PO4	**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.
PO5	**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
PO6	**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
PO7	**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.
PO8	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO9	**Individual and teamwork**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO10	**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.
PO11	**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.
PO12	**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.

Title	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**Head of the Department**
Name of the Faculty	**Dr. B. Srinivasa Rao**	**Dr. B. Srinivasa Rao**	**Dr. S. Naganjaneyulu**	**Dr. B. Srinivasa Rao**
Signature				

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 MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

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

ACADEMIC YEAR : 2022-23

COURSE NAME & CODE : **Thermal Engineering Lab**, 20ME60

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

COURSE CREDITS : 1.5

COURSE INSTRUCTOR : **Dr. V. Dhana Raju & Mr. K. Sai Babu**

COURSE COORDINATOR : **Dr. V. Dhana Raju**

MODULE COORDINATOR : **Dr. P. Vijaya Kumar**

PRE-REQUISITE: IC Engines and Gas Turbines and Applied Thermodynamics

COURSE OBJECTIVE:
The main objective of this course is to demonstrate the concepts of engineering mechanics and fuels through experiments.

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

CO1: Examine the valve timing diagram and port timing diagram of internal combustion engines

CO2: Analyze the performance characteristics of an internal combustion engines

CO3: Estimate the energy distribution and frictional power of diesel engine using heat balance and morse test

CO4: Describe the performance parameters of refrigeration system and air compressor

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

20ME60	PO 1	PO 2	PO 3	PO 4	PO 5	PO 6	PO 7	PO 8	PO 9	PO 10	PO 11	PO 12	PSO1	PSO2	PSO3
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		

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

LIST OF EXPERIMENTS: **Thermal Engineering Lab**, 20ME60

CYCLE-I

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

CYCLE-II

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

REFERENCES:

Lab-Manual

PART-B

COURSE DELIVERY PLAN (LESSON PLAN): Thermal Engineering Lab, 20ME60

Batches (Section – B)

S.No	Batches	Regd.Nos	Total No. of Students
1	**B. Tech – V Sem**	20761A0348-21765A0334	**67**
2	**Batch 1**	21761A0301-21761A0382	**34**
3	**Batch 2**	21761A0383-21765A0334	**33**

Sub Batch of B
21761A0301-21761A0382 (34)

Sub Batch of B:
21761A0383-21765A0334 (33)

S. No.	Batch-1	Registered No.	Total
1	A1	20761A0348-20761A0354	7
2	A2	20761A0355-20761A0361	7
3	A3	20761A0362-20761A0368	7
4	A4	20761A0369-20761A0375	7
5	A5	20761A0377-20761A0382	6
Total			34

S. No.	Batch-2	Registered No.	Total
1	B1	20761A0383-20761A0389	7
2	B2	20761A0390-20761A0396	7
3	B3	20761A0397-21765A0322	7
4	B4	21765A0323-21765A0329	7
5	B5	21765A0330-21765A0334	5
Total			33

Schedule of Experiments (Batch 1)

S. No	Date	Batches				
		A1	A2	A3	A4	A5
1	20/07/2022	Demonstration of TE Lab				
2	27/07/2022	TE – 1	TE – 2	TE – 3	TE – 4	TE – 5
3	03/08/2022	TE – 2	TE – 3	TE – 4	TE – 5	TE – 1
4	10/08/2022	TE – 3	TE – 4	TE – 5	TE – 1	TE – 2
5	17/08/2022	TE – 4	TE – 5	TE – 1	TE – 2	TE – 3
6	24/08/2022	TE – 5	TE – 1	TE – 2	TE – 3	TE – 4
7	07/09/2022	TE – 6	TE – 7	TE– 8	TE – 9	TE- 10
8	14/09/2022	TE – 7	TE – 8	TE –9	TE – 10	TE – 6
9	21/09/2022	TE – 8	TE –9	TE – 10	TE – 6	TE –7
26/09/2022 To 01/10/2022		I Mid Examinations				
10	12/10/2022	TE – 9	TE – 10	TE – 6	TE –7	TE – 8
11	19/10/2022	TE – 10	TE – 6	TE– 7	TE– 8	TE – 9
12	26/10/2022	Repetition for cycle-1				
13	02/11/2022	Repetition for cycle-2				
14	09/11/2022	Viva discussion on cycle-1				
15	16/11/2022	Viva discussion on cycle-2				
16	23/11/2022	Lab internal				
28/11/2022 To 03/12/2022		II Mid Examinations				

Schedule of Experiments (Batch 2)

S. No	Date		Batches			
		B1	B2	B3	B4	B5
1	18/07/2022	Demonstration of TE Lab				
2	25/07/2022	TE – 1	TE – 2	TE – 3	TE – 4	TE – 5
3	01/08/2022	TE – 2	TE – 3	TE – 4	TE – 5	TE – 1
4	08/08/2022	TE – 3	TE – 4	TE – 5	TE – 1	TE – 2
5	22/08/2022	TE – 4	TE – 5	TE – 1	TE – 2	TE – 3
6	29/08/2022	TE – 5	TE – 1	TE – 2	TE – 3	TE – 4
7	05/09/2022	TE – 6	TE – 7	TE– 8	TE – 9	TE- 10
8	12/09/2022	TE – 7	TE – 8	TE –9	TE – 10	TE – 6
9	19/09/2022	TE – 8	TE –9	TE – 10	TE – 6	TE –7
26/09/2022 To 01/10/2022		I Mid Examinations				
10	10/10/2022	TE – 9	TE – 10	TE – 6	TE –7	TE – 8
11	17/10/2022	TE – 10	TE – 6	TE– 7	TE– 8	TE – 9
12	31/10/2022	Repetition for cycle-1				
13	07/11/2022	Repetition for cycle-2				
14	14/11/2022	Viva discussion				
15	21/11/2022	Lab internal				
28/11/2022 To 03/12/2022		II Mid Examinations				

Title	Course Instructor	Course Coordinator	Module Coordinator	Head of the Department
Name of the Faculty	Dr. V. Dhana Raju & Mr. K. Sai Babu	Dr. V. Dhana Raju	Dr. P. Vijaya Kumar	Dr. S. Pichi Reddy
Signature				

PART-C

EVALUATION PROCESS (R20 Regulation):

Evaluation Task	Expt. no's	M
Day to Day work = **A**	1,2,3,4,5,6,7,8..	A=
Record = **B**	1,2,3,4,5,6,7,8	B=
Internal Test = **C**	1,2,3,4,5,6,7,8	C =
Cumulative Internal Examination : A + B + C = 15	1,2,3,4,5,6,7,8	**15**
Semester End Examinations = D	1,2,3,4,5,6,7,8	**D**
Total Marks: A + B + C + D = 50	1,2,3,4,5,6,7,8	**50**

PART-D

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

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

PROGRAMME OUTCOMES (POs):

PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis**: Identify, formulate, review research literature, and 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 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. V. Dhana Raju & Mr. K. Sai Babu**	**Dr. V. Dhana Raju**	**Dr. P. Vijaya 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

Laboratory Code	**:** 20ME61	**Lab**	: Machine Tools and Metrology Lab
A.Y.	**:** 2022-2023	**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.) / P. Mounika (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 Dynamics Lab (17ME68)																
		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)																

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

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A.Y.	**:** 2022-2023	**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.) / P. Mounika (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.

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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.

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

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DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code	**:** 20ME61	**Lab**	: Machine Tools and Metrology Lab
A.Y.	**:** 2022-2023	**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.) / P. Mounika (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 callipers 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 callipers.
- Machine tool alignment test on the lathe.
- Measurement of screw thread parameters using tool makers's microscope.
- Angle and taper measurement using bevel protractor, slip guage and sine bars, etc.
- Thread measurement by three wire method.
- Surface roughness measurement by Talysurf.

Lab In-charge – I **Lab In-charge – II** **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. : 2022-2023 **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.) / P. Mounika (Asst Prof.)

Batches (Section – B)

S.No	Batches	Regd.Nos	Total No. of Students
1	B. Tech – V Sem - B/S	20761A0348-3A0, 21765A0320–334	67
2	Batch B1	20761A0348-382	34
3	Batch B2	20761A0383-3A0, 21765A0320–334	33

Sub Batch of B11:

S. No	Batch	Registered Nos	Total
1	B111	20761A0348-350	03
2	B112	20761A0351-353	03
3	B113	20761A0354-356	03
4	B114	20761A0357-360	04
5	B115	20761A0361-364	04
Total (C11)			17

Sub Batch of B12:

S. No	Batch	Registered Nos	Total
1	B121	20761A0365-367	03
2	B122	20761A0368-370	03
3	B123	20761A0371-374	04
4	B124	20761A0375-378	04
5	B125	20761A0379-382	04
Total (C12)			18

Sub Batches of B21:

S. No	Batch	Registered Nos	Total
1	B211	20761A0383-385	03
2	B212	20761A0386-388	03
3	B213	20761A0389-391	03
4	B214	20761A0392-395	04
5	B215	20761A0396-399	04
Total (C21)			17

Sub Batches of B22:

S. No	Batch	Registered Nos	Total
1	B221	20765A03A0–11765A0320,21	03
2	B222	21765A0322–324	03
3	B223	21765A0325–327	03
4	B224	21765A0328–330	03
5	B225	21765A0331–334	04
Total (C22)			16

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

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

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

Laboratory Code	**:** 20ME61	**Lab**	: Machine Tools and Metrology Lab
A.Y.	**:** 2022-2023	**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.) / P. Mounika (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: DYNAMICS LAB

At least SIX experiments may be conducted.
LIST OF EXPERIMENTS
Any of the 6 Experiments are required to be conducted

- a) To determine gyroscopic couple on Motorized Gyroscope
  b) Determination of transmission efficiency of gear reducers
- a) To find the stability and sensitivity of Watt governor
  b) To find the stability and sensitivity of Porter governor
- To find the transverse vibrations of free-free beam
- a) Balancing of rotating masses
  b) Balancing of reciprocating masses
- Determination of damping coefficient of single degree of freedom system using spring mass system
- Determination of critical speed of shaft with concentration loads
- a) Determine the moment of inertia of connecting rod by compound pendulum method

Lab in charge – I **Lab – in charge – II** **Head of the Department**

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Lab/Practicals : 3 hrs/ Week **Continuous Internal Assessment** : 15
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Name of the Faculty : S. Srinivasa Reddy(Sr.Asst Prof.) / P. Mounika (Asst Prof.)

Schedule of Experiments (Section –A: A1 Batch)

S.No	Batches	Regd.Nos	Total No. of Students
1	**Batch B1**	20761A0348-382	**34**

Date	Experiment (Batch)					
	Ex - 1	**Ex – 2**	**Ex – 3**	**Ex – 4**	**Ex – 5**	**Ex – 6**
18.07.2022	**Demonstration of all experiments, CEOs and COs of the Laboratory (Ex – 01 to 06)**					
MACHINE TOOLS LAB						
25.07.2022	B111	B112	B113	B114	B115	B116
01.08.2022	B116	B111	B112	B113	B114	B115
08.08.2022	B115	B116	B111	B112	B113	B114
22.08.2022	B114	B115	B116	B111	B112	B113
24.08.2022	B113	B114	B115	B116	B111	B112
05.09.2022	B112	B113	B114	B115	B116	B111
I Mid Examinations						
	Ex - 1	**Ex – 2**	**Ex – 3**	**Ex – 4**	**Ex – 5**	**Ex – 6**
05.09.2022	B121	B122	B123	B124	B125	B126
12.09.2022	B126	B121	B122	B123	B124	B125
09.09.2022	B125	B126	B121	B122	B123	B124
19.10.2022	B124	B125	B126	B121	B122	B123
26.10.2022	B123	B124	B125	B126	B121	B122
03.11.2022	B122	B123	B124	B125	B126	B121
	Backlog experiments / Additional Experiments					
	Internal Mid –II Examinations					
14-10-2019 to 19-10-2019: *II Mid Examinations*						
	Preparation and Practicals					
	Semester End Examinations					

Lab 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. : 2022-2023 **Class** : B. Tech – V Semester (Section –A)
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.) / P. Mounika (Asst Prof.)

Schedule of Experiments (Section – A: A2 Batch)

S.No	Batches	Regd.Nos	Total No. of Students
1	**Batch B2**	20761A0383-3A0, 21765A0320–334	**33**

Date	Experiment (Batch)					
	Ex - 1	**Ex – 2**	**Ex – 3**	**Ex – 4**	**Ex – 5**	**Ex – 6**
20.07.2022	**Demonstration of all experiments, CEOs and COs of the Laboratory (Ex – 01 to 06)**					
Machine Tools LAB						
07.07.2022	B121	B122	B123	B124	B125	B126
10.08.2022	B126	B121	B122	B123	B124	B125
03.08.2022	B125	B126	B121	B122	B123	B124
10.08.2022	B124	B125	B126	B121	B122	B123
17.08.2022	B123	B124	B125	B126	B121	B122
07.09.2022	B122	B123	B124	B125	B126	B121
I Mid Examinations						
	Ex - 1	**Ex – 2**	**Ex – 3**	**Ex – 4**	**Ex – 5**	**Ex – 6**
28.09.2022	B111	B112	B113	B114	B115	B116
12.10.2022	B116	B111	B112	B113	B114	B115
19.10.2022	B115	B116	B111	B112	B113	B114
02.11.2022	B114	B115	B116	B111	B112	B113
09.11.2022	B113	B114	B115	B116	B111	B112
16.11.2022	B112	B113	B114	B115	B116	B111
	Backlog experiments / Additional Experiments					
	Internal Mid Examinations					
II Mid Examinations						
	Preparation and Practicals					
	Semester End Examinations					

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