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

Name of Course Instructor : Dr.K.Dilip Kumar
Course Name & Code : 17ME20
L-T-P Structure : 3-1-0 Credits : 3
Program/Sem/Sec : B.Tech., Mech Engg., VI-Sem., Section- A A.Y : 2021-22

PRE-REQUISITE: Applied Mathematics, Thermodynamics, Thermal Engineering and Fluid Mechanics.

COURSE EDUCATIONAL OBJECTIVES (CEOs):
To learn the physical mechanisms on modes of heat transfer, differential equations in heat transfer and the significance of Non Dimensional Numbers in heat transfer applications.

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

CO1	**Understand** the basic heat transfer principles in Planes, Cylinders &Spherical components and can **Apply**conservation of mass and energy to a control volume or control surface to solve general heat conduction equation for planes, cylindrical surfaces.
CO2	**Analyze**steady and unsteady state heat transfer concepts and can solve the heat and temperature distribution in fins, time taken in cooling/heating of thermal components.
CO3	**Identify**the suitable empirical correlations to solve free and forced convection problems related to external and internal flows**.**
CO4	**Apply**the concepts of heat transfer in boiling, condensation and radiation thermal systems.
CO5	**Design** the heat exchanger for engineering applications.

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

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

TEXT BOOKS:

T1 R.C.Sachdeva - Fundamentals of Engineering Heat and Mass Transfer —New Age Science Publishers, 3rd Edition, 2009.

T2 Yunus. A. Cengel, Heat & Mass Transfer-A Practical Approach – Tata McGraw Hill, 4th Edition, 2012

REFERENCE BOOKS:

R1	M.NecatiOzisik, Heat Transfer- A basic Approach,4th Edition, McGraw-Hill book company, 1985
R2	J.P.Holman, Heat transfer - Tata McGraw-Hill, 9th Edition, 2010 P.K.Nag, Heat and Mass Transfer- TMH 2nd Edition, 2007 P.S.Ghoshdastidar Heat Transfer - Oxford Higher Education 6th Edition 2011. C.P.Kothandaraman and Subramanian, Heat and Mass Transfer, New Age International Publications 7th Edition 2010.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: INTRODUCTION,ONE- DIMENSIONAL STEADY STATE CONDUCTION

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to Course and Course Outcomes (COs) and POs articulation matrix.	1	22.02.2022		TLM1	
2.	Introduction to heat transfer and its applications, Basic modesand its physical mechanisms in heat transfer.	1	23.02.2022		TLM1	
3.	Steady, unsteady and periodic heat transfer and significance of thermal conductivity in heat conduction.	1	24.02.2022		TLM1, TLM2 TLM5	
4.	General heat conduction equation in Cartesian coordinate system and its simplifications.	1	26.02.2022		TLM1, TLM4	
5.	Fourier's law of heat conduction; Numerical Problems. **Tutorial-1**	1	02.03.2022		TLM1	
6.	General heat conduction equation in cylindrical coordinate system and its simplifications.	1	03.03.2022		TLM1, TLM2	
7.	General heat conduction equation in spherical coordinate system and its simplifications.	1	05.03.2022		TLM1	
8.	Heat conduction through plane wall and cylinder with constant thermal conductivity– Numerical Problems.	1	08.03.2022		TLM1, TLM2	
9.	Electrical analogy, thermal resistance and overall heat transfer coefficient.	1	09.03.2022		TLM1, TLM2	
10.	Numerical Problems on thermal resistance and overall heat transfer coefficient	1	10.03.2022		TLM1, TLM2 TLM5	
11.	Heat transfer through composite slab and cylinder, Numerical Problems. Critical radius of insulation for cylinder and Applications.	1	15.03.2022		TLM1, TLM2	
12.	Numerical Problems on critical radius of insulation, **Tutorial-2**	1	16.03.2022		TLM1, TLM2	
No. of classes required to complete UNIT-I: 12				No. of classes taken:		

UNIT-II: ONE DIMENSIONAL STEADY AND TRANSIENT STATE HEAT CONDUCTION:

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.	Heat flow through a plane wall with variable thermal conductivity, Numerical Problems.	1	17.03.2022		TLM1	
2.	Heat flow through the cylinder with variable thermal conductivity, Numerical Problems.	1	19.03.2022		TLM1	
3.	Derivation on Uniform Internal heat generation in slabsand cylinders	1	22.03.2022		TLM1, TLM2	
4.	Numerical Problems on Uniform Internal heat generation in slabs.	1	24.03.2022		TLM1	
5.	Numerical Problems on Uniform Internal heat generation in cylinders.**Tutorial-3**	1	26.03.2022		TLM1, TLM2	
6.	Extended surfaces and their applications;Thermal analysis of long Fins	1	29.03.2022		TLM3	
7.	Thermal analysis of short fins with insulated tip, Fin efficiency and effectiveness	1	30.03.2022		TLM1, TLM4	

8.	Systems with negligible internal Resistance (Lumped Heat Analysis), Significance of Biot and Fourier Numbers	1	31.03.2022		TLM1, TLM2	
9.	Plane wall with finite surface and Internal Resistance using Heisler Charts, **A**	1	05.04.2022		TLM1, TLM2	
10.	Numerical Problems,**Tutorial-4**	1	06.04.2022		TLM2	
No. of classes required to complete UNIT-II: 10				No. of classes taken:		

UNIT-III: CONVECTION

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.	Basics of convective (Forced and Natural) heat transfer and Applications.	1	07.04.2022		TLM1, TLM2	
2.	Dimensional analysis and Buckingham Pi theorem applied to Forced Convection.	1	09.04.2022		TLM1, TLM2	
3.	Significance of Non Dimensional Numbers.	1	19.04.2022		TLM1, TLM2	
4.	The concept of boundary layer; Velocity and Thermal Boundary Layers, Numerical Problems.	1	20.04.2022		TLM1, TLM2 TLM5	
5.	Forced convection analysis in external flows (Flow over a Flat Plate): Laminar and turbulent flows.	1	21.04.2022		TLM3	
6.	Forced convection analysis in internal flows (Flow through circular pipe): Laminar and turbulent flows.	1	23.04.2022		TLM1, TLM2	
7.	Numerical Problems on Forced Convection. **Tutorial-6**	1	26.04.2022		TLM1, TLM2	
8.	Reynolds Colburn Analogy,Natural convection: Development of Hydrodynamicand thermal boundary layer along vertical plate..	1	27.04.2022		TLM1, TLM2	
9.	Natural convection: empirical correlations for vertical and horizontal plate and numerical problems	1	28.04.2022		TLM3	
10.	Natural convection: empirical correlations for vertical and horizontal cylinders, and numerical problems **Tutorial-7**	1	30.04.2022		TLM1	
No. of classes required to complete UNIT-III:10				No. of classes taken:		

UNIT-IV:BOILING AND CONDENSATION,THERMAL RADIATION

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to boiling heat transfer and applications.	1	03.05.2022		TLM1, TLM2	
2.	Pool Boiling, Different regimes of boiling; Critical heat flux.	1	4.05.2022		TLM1, TLM2 TLM5	
3.	Numerical problems on nucleate boiling and critical heat flux conditions.	1	05.05.2022		TLM1, TLM2	

4.	Condensation: Film wise and Drop wise condensation	1	07.05.2022		TLM1, TLM2	
5.	Laminar film wise condensation on Vertical plate, Numerical Problems**Tutorial-8**	1	10.05.2022		TLM1, TLM2	
6.	Introduction and applications of Thermal Radiation	1	11.05.2022		TLM3	
7.	Emissive Power, Absorption, Reflection and Transmission and Definitions related to Radiation	1	12.05.2022		TLM1, TLM2	
8.	Concept of black and non-black Emissivity, Kirchhoff's law and Shape Factorsbodies; Laws of black body radiation	1	17.05.2022		TLM1, TLM2 TLM4	
9.	Radiation heat exchange between two black isothermal surfaces, nonblack infinite parallel plates; Derivation on Radiation shields,	1	18.05.2022		TLM1, TLM2 TLM5	
10.	Numerical problems on Radiation shields, Tutorial-**9**	1	19.05.2022		TLM1, TLM2	
No. of classes required to complete UNIT-IV:10				No. of classes taken:		

UNIT-V:HEAT EXCHANGERS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction-Classification of heat exchangers -Flow arrangement, Temperature distribution, Applications of Heat Exchangers	1	21.05.2022		TLM1, TLM2 TLM6	
2.	Overall heat transfer coefficient-Fouling factor	1	24.05.2022		TLM1, TLM2	
3.	LMTD method of Heat exchanger analysis- Parallel flow, Numerical Problems	1	25.05.2022		TLM1, TLM2 TLM4	
4.	LMTD method of Heat exchanger analysis- Counter flow, Numerical Problems	1	26.05.2022		TLM1, TLM2	
5.	Correction factor for LMTD for use with Multi pass and Cross flow Heat Exchangers**Tutorial -10**	1	28.05.2022		TLM1, TLM2	
6.	Effectiveness - NTU method of Heat Exchanger analysis –Parallel flow& Counter flow	1	31.05.2022		TLM3	
7.	Effectiveness - NTU method of Heat Exchanger analysis –Counter flow	1	01.06.2022		TLM1, TLM2	
8.	Numerical Problems on Effectiveness-NTU analysis		02.06.2022			
9.	**Content beyond the syllabus** – Design of helical coil heat exchangers, Radiation shields		04.06.2022			
No. of classes required to complete UNIT-V: 09				No. of classes taken:		

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

PART-C

EVALUATION PROCESS (R17 Regulations):

Evaluation Task	**Marks**
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20
I-Quiz Examination (Units-I & II)	Q1=10
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10
Attendance	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	40
Semester End Examination (SEE)	60
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 SPECIFC 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.

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

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

Name of Course Instructor : Mr.S.Srinivasa Reddy
Course Name & Code : 17ME21, Mechanical Engineering Design-II
L-T-P Structure : 2-2-0 Credits: 3
Program/Sem/Sec : B.Tech., ME.,VI-Sem., Section- A A.Y: 2021-22

PRE-REQUISITE: Mechanics of Solids, Mechanical Engineering Design-I, Dynamics of Machines.

COURSE EDUCATIONAL OBJECTIVES (CEOs):
The main objective of this course is to understand and apply the standard procedure available for the design of machine elements and components of IC engine.

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

CO1	Design hydrodynamic journal bearings and selection of the antifriction bearings for given load, speed and life conditions
CO2	Design the internal combustion engine components for safe and continuous operation.
CO3	Select the belt and rope drives for elevators, cranes and hoisting machinery.
CO4	Design the springs under static and dynamic loads and combinations.
CO5	Design different types of gears for the given power transmission conditions for safe and continuous operation

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**	**3**									**1**			**3**
CO2	**3**	**2**	**3**		**1**							**1**			**3**
CO3	**3**	**2**	**3**									**1**			**3**
CO4	**3**	**3**	**3**									**1**			**3**
CO5	**3**	**2**	**3**									**1**			**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 Bhandari V.B., Design of Machine Elements, 3rd edition, TMG 2010

T2 Sundarajamoorthy T.V, Shanmugam N., Machine Design, Anuradha Publications

BOS APPROVED REFERENCE BOOKS:

R1 Norton R.L, Design of Machinery, TMG-2004

R2 Shigley J.E. and Mischke C.R., Mechanical Engineering Design, TMG-2003

R3 Ugural A.C, Mechanical Design-An Integral Approach, TMG-2004

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Bearings

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	Introduction to Subject, Pos, PEOs and CO's of the course	1	21-02-2022		TLM1	
2	Introduction to Unit-1, **Bearings** –Introduction, theory of lubrication, Types, materials	1	22-02-2022		TLM1 TLM2	
3	**Journal Bearings** – Types, Important dimensionless parameters,	1	23-02-2022		TLM1 TLM2	
4	Design procedure of journal bearing	1	25-02-2022		TLM1	
5	Journal bearings - problems	1	28-02-2022		TLM4	
6	Heat generated and heat dissipated in the bearing design – problems	1	01-03-2022		TLM4	
7	**Tutorial-I**	1	02-03-2022		TLM3	
8	**Rolling contact bearings**-types, bearing life, Materials and designation	1	04-03-2022		TLM3	
9	Static load and dynamic load capacity, equivalent bearing load	1	07-03-2022		TLM1 TLM2	
10	Selection of ball bearing - problems	1	08-03-2022		TLM1	
11	Selection of roller bearing - problems	1	09-03-2022		TLM4	
12	**Tutorial-II**	1	11-03-2022		TLM3	
13	Cubic mean load derivation, Reliability of bearings - problems	1	14-03-2022		TLM3	
14	Problem on roller bearings	1	15-03-2022		TLM4	
15	**Assignment -I/ Quiz-I**	1	16-03-2022		TLM6	
No. of classes required to complete UNIT-I: 15			No. of classes taken:			

UNIT-II: Design of IC Engine Components

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	Introduction to Unit-II, **Cylinder:**Cylinder liners, Design Procedure of Cylinder	1	18-03-2022		TLM1 TLM2	
2	Cylinder design - problems	1	21-03-2022		TLM4	
3	Problems on cylinder design	1	22-03-2022		TLM1	
4	**PISTON** : Piston design, -design	1	23-03-2022		TLM1 TLM2	
5	Problems on piston design	1	25-03-2022		TLM3	
6	Problems on Piston	1	28-03-2022		TLM2	
7	**Tutorial-III**	1	29-03-2022		TLM3	
8	**CONNECTING ROD**: Thrust in C.R, buckling load	1	30-03-2022		TLM1 TLM2	
9	Stresses due to whipping action on connecting rod ends- problems	1	01-04-2022		TLM4	
10	**CRANK SHAFT:** Design of crank and crank shaft	1	04-04-2022		TLM1 TLM2	
11	Strength of overhung shaft, center crank shaft -problem	1	05-04-2022		TLM4	
12	**Tutorial-IV**	1	06-04-2022		TLM3	
13	**Assignment-II/Quiz-2**	1	08-04-2022		TLM6	
No. of classes required to complete UNIT-II: 13			No. of classes taken:			

UNIT-III: Belt & Rope Drives

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	**Introduction to Unit-III PULLEYS:** Introduction, Design of flat belts	1	18-04-2022		TLM1 TLM2	
2	Design of pulleys(mild steel & cast iron)	1	19-04-2022		TLM1	
3	V-belts –designation, design and selection	1	20-04-2022		TLM1 TLM2	
4	Design of V- grooved pulley	1	22-04-2022		TLM1	
5	Design of V belts - problems	1	25-04-2022		TLM4	
6	Problems on design of belts	1	26-04-2022		TLM1	
7	**Tutorial-V**	1	27-04-2022		TLM3	

8	**WIRE ROPES: I**ntroduction**,** designation classification	1	29-04-2022		TLM1 TLM2	
9	Selection of wire ropes, Stresses in hoisting ropes	1	02-05-2022		TLM1	
10	Design of wire ropes-problems	1	03-05-2022		TLM4	
11	**Tutorial-VI**	1	04-05-2022		TLM3	
12	**Assignment-III/Quiz-III**	1	06-05-2022		TLM6	
No. of classes required to complete UNIT-III: 12			No. of classes taken:			

UNIT-IV: Springs

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	**Introduction to Unit-IV SPRINGS:** Introduction, classification	1	09-05-2022		TLM1 TLM2	
2	Stresses, deflection and stiffness in springs and their derivations	1	10-05-2022		TLM1 TLM2	
3	Design of springs-problems	1	11-05-2022		TLM4	
4	Springs for fatigue loading	1	13-05-2022		TLM1	
5	**Tutorial-VII**	1	16-05-2022		TLM3	
6	Spring failures, design of helical springs	1	17-05-2022		TLM1	
7	Natural frequency of helical spring Energy storage capacity in springs Tension and torsion springs	1	18-05-2022		TLM1	
8	Co-axial springs design- Problems	1	20-05-2022		TLM4	
9	Design of leaf springs- Problems	1	23-05-2022		TLM4	
10	**Tutorial-VIII**	1	24-05-2022		TLM3	
11	**Assignment-IV/Quiz-IV**	1	25-05-2022		TLM6	
No. of classes required to complete UNIT-V: 11			No. of classes taken:			

UNIT-V: Gears

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	**Introduction to Unit-V GEARS**: Introduction and terminology, Types of gears, design formulae	1	27-05-2022		TLM1 TLM2	

2	Design Analysis of gears, Estimation of centre distance, module & face width	1	27-05-2022		TLM1 TLM2	
3	Design procedure of spur gears, Check for dynamic and wear considerations	1	30-05-2022		TLM1 TLM2	
4	Design of spur gears - problems.	1	30-05-2022		TLM4	
5	Design procedure of helical gears.	1	31-05-2022		TLM1	
6	**Tutorial-IX**	1	31-05-2022		TLM3	
7	**GEAR BOX**: Functions, Progress ratio, Speed diagram, Kinematic arrangement	1	01-06-2022		TLM1	
8	Gear box design procedure - problems		01-06-2022		TLM4	
9	**Tutorial-X**	1	03-06-2022		TLM3	
10	**Assignment-V/Quiz-V**	1	03-06-2022		TLM6	
No. of classes required to complete UNIT-V: 10			No. of classes taken:			

Contents beyond the Syllabus:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	HOD Sign Weekly
1	Design of flywheels	1	04-06-2022		TLM1 TLM2		
2	Design of epicycle gear train	1	04-06-2022		TLM1 TLM2		

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

PART-C

EVALUATION PROCESS:

Evaluation Task	**Marks**
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5

I-Mid Examination (Units-I & II)	M1=20
I-Quiz Examination (Units-I & II)	Q1=10
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10
Attendance	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	40
Semester End Examination (SEE)	60
Total Marks = CIE + SEE	100

PART-D

PROGRAM OUTCOMES:

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):

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.

Course Instructor	Course Coordinator	Module Coordinator	HoD
Mr. S.Srinivasa Reddy	Mr.S.Srinivasa Reddy	Mr.B.Sudheer Kumar	Dr.S.Pichi Reddy

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

Name of Course Instructor : S.Snigdha
Course Name & Code : CAD/CAM & 17ME22
L-T-P Structure : 3-0-0 Credits : 3
Program/Sem/Sec : B.Tech., MECH., VI-Sem., Sections- A A.Y : 2021-22

PRE-REQUISITE: Machine Drawing, Machine Design, Machine Tools

COURSE EDUCATIONAL OBJECTIVES (CEOs): The main objective of this course is to familiarize the principles of geometric modelling, numerical control and part programming.

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

CO 1	Comprehend the principles of CAD/CAM for design and manufacturing
CO 2	Formulate mathematical equations for geometrical entities like curves, surface, and solids.
CO 3	Program for part profiles to accomplish numerical control machining
CO 4	Develop a pseudo codes for different parts using GT codes and apply in automated manufacturing systems.
CO 5	Become cognizant about CAQC techniques that are to be applied in manufacturing industry and able to comprehend the applications of Computer Integrated Manufacturing.

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

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

TEXT BOOKS:

BOS APPROVED TEXT BOOKS:

T1 MikelP.Groover and Emory W.Zimmers, CAD/CAM-prentice Hall of India private Ltd.New Delhi, 20thedition, May 2010.

T2 Ibrahim Zeid, Mastering CAD/CAM, TATA McGraw-Hill publishing Co.Ltd, New Delhi2011.

T3 P N Rao, CAD/CAM Principle and applications, Tata McGraw Hill Education Private Ltd,New Delhi,8th edition 2013.

BOS APPROVED REFERENCE BOOKS:

R1 P.Radhakrishnan, S.Subramanyam &V.Raju, CAD/CAM/CIM, New Age International

Publishers,3rd edition 2010.

R2 MikelP.Groover, Automaiton, Production Systems and Computer Integrated Manufacturing, Prentice Hall of India private Ltd.New Delhi, 3rd edition, May 2008.

R3 Ibrahim Zeid and R. Sivasubramanian, CAD/CAM theory and practice, Tata McGraw Hill publishing Co. Ltd,New Delhi 2009.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction CAD/CAM, Computer Graphics

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to CAD/CAM	1	22.02.2022			
2.	Product Cycle Revised with CAD/CAM	1	23.02.2022			
3.	Reasons for implementing CAD	1	25.02.2022			
4.	Creating Manufacturing database & Benefits of CAD	1	02.03.2022			
5.	Computer Graphics- Introduction , Database structure	1	04.03.2022			
6.	Functions of a graphics package	1	08.03.2022			
7.	Raster scan graphics, Concatenated transformations	1	09.03.2022			
8.	Translation, scaling, reflection, rotation	1	11.03.2022			
9.	Problems on Transformations	1	15.03.2022			
No. of classes required to complete UNIT-I: 9				No. of classes taken:		

UNIT-II: Geometric Modeling

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.	Geometric Modelling: Introduction		16.03.2022			
2.	Wireframe Modelling: Entities wireframe models		22.03.2022			
3.	Parametric representation of analytical curves		23.03.2022			
4.	Hermite cubic spline curve		25.03.2022			
5.	Bezier and B-spline curves		29.03.2022			
6.	Characteristics of Curves, Problems		30.03.2022			
7.	Surface representation: Entities		01.04.2022			
8.	Solid modelling , B-Rep, CSG		06.04.2022			
No. of classes required to complete UNIT-II: 8				No. of classes taken:		

UNIT-III: NC Programming

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.	Numerical control: Introduction, NC Modes, NC elements, N C	1	08.04.2022			

	Coordinate systems					
2.	Structure of CNC machine tools, Spindle design and spindle drives,	1	19.04.2022			
3.	Feed drives, actuation systems	1	20.04.2022			
4.	CNC Part programming: fundamentals	1	22.04.2022			
5.	Manual part programming	1	26.04.2022			
6.	Computer Aided part programming	1	27.04.2022			
7.	Part programming examples, examples	1	29.04.2022			
No. of classes required to complete UNIT-III: 7				No. of classes taken:		

UNIT-IV : Group Technology, FMS, CAPP

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.	Group Technology, Coding and classification schemes-OPITZ	1	04.05.2022			
2.	MICLASS, example for coding	1	06.05.2022			
3.	CODE Systems, examples for coding	1	10.05.2022			
4.	Production Flow Analysis, Advantages and limitations, GT Machine cells, Benefits of GT	1	11.05.2022			
5.	CAPP- Retrieval and Generative	1	13.05.2022			
6.	Flexible Manufacturing System: Introduction,	1	17.05.2022			
7.	FMS equipment, FMS layouts, benefits, implementation.	1	18.05.2022			
No. of classes required to complete UNIT-IV: 7				No. of classes taken:		

UNIT-V : CAQC, CIM, Lean Manufacturing

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.	CAQC: Introduction, The computers in QC	1	20.05.2022			
2.	Contact inspection methods, Non-Contact inspection methods: Optical	1	24.05.2022			
3.	Non-Contact inspection methods: non optical	1	25.05.2022			
4.	Computer aided testing, CAQC with CAD/CAM	1	27.05.2022			
5.	CIM Introduction, CIM integration,	1	31.05.2022			
6.	Implementation, Benefits of CIM	1	01.06.2022			
7.	Lean manufacturing	1	05.06.2022			
No. of classes required to complete UNIT-V: 7				No. of classes taken:		

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

PART-C

EVALUATION PROCESS (R17 Regulations):

Evaluation Task	**Marks**
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20
I-Quiz Examination (Units-I & II)	Q1=10
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10
Attendance	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	40
Semester End Examination (SEE)	60
Total Marks = CIE + SEE	100

PART-D

PROGRAMME OUTCOMES (POs):

PO 1	An ability to apply knowledge of Mathematics, Sciences and Engineering fundamentals to find the solution to real time Mechanical Engineering problems.
PO 2	An ability to identify and formulate mathematical models to analyze complex engineering problems.
PO 3	An ability to design a mechanical systems/ processes to meet the desired needs within realistic constraints such as economic, environmental, societal, health & safety .
PO 4	An ability to design and conduct experiments, perform analysis, interpretation of data and synthesis of information to provide valid conclusions.
PO 5	An ability to develop the model and analyze the Mechanical systems using modern software tools.
PO 6	An ability to understand societal, health, safety, legal, cultural issues and the consequent responsibilities relevant to engineering practice.
PO 7	An ability to understand the impact of engineering solutions in societal, environmental context and demonstrate the knowledge for sustainable development.
PO 8	An ability to understand the professional ethics to follow the norms of engineering practice.
PO 9	An ability to function effectively as an individual and as a member / leader in diverse technical teams.
PO 10	An ability to communicate effectively with the engineering community and society through reports & presentations.
PO 11	An ability to apply management principles to organise the multidisciplinary projects.
PO 12	An ability to understand the need of independent and lifelong learning so as to address day to day technological changes.

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.

Course Instructor	Course Coordinator	Module Coordinator	HOD
S.SNIGDHA	A NAGESWARA RAO	J SUBBAREDDY	Dr S PICHI REDDY

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

COURSE HANDOUT

PART-A

Name of Course Instructor: B. SUDHEER KUMAR

COURSE NAME & CODE : FINITE ELEMENT ANALYSIS – 17ME23

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

Program /Sem/Sec : B.Tech. MECH., VI-Sem., Section -A A.Y: 2021-22

COURSE COORDINATOR : B. SUDHEER KUMAR

PRE-REQUISITE: Mechanics of Materials, Machine Design, Numerical Methods & Heat Transfer

COURSE EDUCATIONAL OBJECTIVES (CEOs): The main objective of this course is to introduce the mathematical concepts of the Finite Element Method for obtaining an approximate solution of ordinary and partial differential equations and to understand the use of the basic finite elements for structural applications using beam, plane elements and use of the FE method for heat transfer problems.

COURSE OUTCOMES (CO):

CO1	Identify mathematical model for solution of common engineering problems.
CO2	Solve the flexure elements subjected to loading and plane stress problems.
CO3	Solve the 2-D structures with isoparametric elements and axi-symmetric problem.
CO4	Analyze complex cases involving heat transfer with the applications of fem.
CO5	Formulate the finite element model for stepped bar & beam and perform the simulation.

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	3	2	3		3					3	2			3
CO2	2	2	2	3	3	3					3	2			3
CO3	2	3	2	2	3	3					3	2			3
CO4	3	2	2	3		3					3	2			3
CO5	2	2	2	3	3	3					3	2			3

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

TEXT BOOKS:

T1 Chandraputla, Ashok and Belegundu, Introduction to Finite Elements in Engineering, 3rd edition,Prentice-Hall,2008

T2 S.S Rao, The Finite Element Methods in Engineering4th edition,B.H.Pergamon.2010

REFERENCE BOOKS:

R1 JN.Reddy, An introduction to Finite Element Method, 3rd edition, Mc Graw Hill, 2011.

R2 George R. Buchanan and R.RudraMoorthy, Finite Element Analysis, Tata Mc Graw Hill, 2006

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: ONE DIMENSIONAL PROBLEM

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to Finite Element Method	1	23-2-22		**TLM1, TLM2**	
2.	Equilibrium equations in elasticity, Stresses in typical element, Stresses& equilibrium	1	24-2-22		**TLM1,**	
3.	Strain displacement relations, Stress strain relations	1	25-2-22		**TLM1**	
4.	Plane stress and plane strain problems. Potential energy and equilibrium method	1	02-3-22		**TLM1**	
5.	FE Formulation from governing differential equations. One dimensional Problem, FE Modeling	1	03-3-22		**TLM1**	
6.	Shape functions & coordinates of shape functions	1	04-3-22		**TLM1**	
7.	Assembly of GSM & Load vector, Finite element equations and	1	09-3-22		**TLM1**	

	treatment of boundary conditions					
8.	Problems	1	10-3-22		**TLM1**	
9.	Problems Assignment/Quiz-1	1	11-3-22		**TLM1 TLM6**	
No. of classes required to complete: 9				No. of classes taken:		

UNIT-II: ANALYSIS OF BEAMS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Analysis of Beams: Beam elements	1	16-3-22		**TLM1**	
2.	Types loading, DOF, Boundary conditions	1	17-3-22		**TLM1**	
3.	Hermite shape functions	1	23-3-22		**TLM1**	
4.	Stiffness matrix for two node DOF per node	1	24-3-22		**TLM1**	
5.	Problems	1	25-3-22		**TLM1**	
6.	2-D elements (CST), Boundary Conditions.	1	30-3-22		**TLM1**	
7.	Jacobian, Shape functions, Area of triangles	1	31-3-22		**TLM1**	
8.	Problems	1	01-4-22		**TLM1**	
9.	Assignment/Quiz-2	1	06-4-22		**TLM6**	
No. of classes required to complete:9				No. of classes taken:		

UNIT-III: AXISYMMETRIC LOADING AND NUMERICAL INTEGRATION

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.	Axisymmetric solids , Axisymmetric loading	1	07-4-22		**TLM1 TLM2**	
2.	Finite element modeling	1	08-4-22		**TLM1**	
3.	Axisymmetric loading with triangular elements	1	20-4-22		**TLM1**	
4.	Problems	1	21-4-22		**TLM1**	
5.	2-D four nodded isoparametric elements, Jacobian, shape functions,	1	22-4-22		**TLM1**	
6.	Problems	1	27-4-22		**TLM1**	

7.	Isoparametric formulation of 4- node quadrilateral element	1	28-4-22		**TLM1**	
8.	Problems Assignment/Quiz-3	1	29-5-22		**TLM1 TLM6**	
No. of classes required to complete:8				No. of classes taken:		

UNIT-IV: HEAT TRANSFER ANALYSIS

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.	One dimensional analysis of HT problems		04-5-22		**TLM1, TLM2**	
2.	Conductivity matrix, boundary conditions		05-5-22		**TLM1**	
3.	1-D analysis of a fin, Conductivity matrix boundary conditions, Problems	1	06-5-22		**TLM1**	
4.	Problems	1	11-5-22		**TLM1**	
5.	Problems	1	12-5-22		**TLM1**	
6.	Two dimensional analysis of thin plate &Conductivity matrix, boundary conditions	1	13-5-22		**TLM1**	
7.	Convection matrix, Heat rate vector Problems. Assignment/Quiz-4.	1	18-5-22		**TLM1 TLM6**	
No. of classes required to complete: 08				No. of classes taken:		

UNIT-V: DYNAMIC ANALYSIS

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.	Dynamic analysis introduction, Formulation	1	19-5-22		**TLM1**	
2.	Mass matrices, consistent Mass	1	20-5-22		**TLM1**	

	Matrices, Lumped Mass Matrices					
3.	Evaluation of Eigen values & Eigen vectors	1	25-7-22		**TLM1**	
4.	Problems	1	26-5-22		**TLM1**	
5.	Problems	1	27-5-22		**TLM1**	
6.	Problems		01-6-22		**TLM1**	
7.	Assignment/Quiz-5	1	02-6-22		**TLM6**	
No. of classes required to complete:06				No. of classes taken:		

Contents beyond the Syllabus

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Analysis of beams for Uniformly variable loads Evaluation of Eigen values &Eigenvectors for beams	1	03-6-22		**TLM1**	

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 Regulations):

Evaluation Task	**Marks**
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20
I-Quiz Examination (Units-I & II)	Q1=10
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10
Attendance	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	40
Semester End Examination (SEE)	60
Total Marks = CIE + SEE	100

PART-D

PROGRAMME OUTCOMES (POs):

PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

PO 5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modeling to complex engineering activities with an understanding of the limitations
PO 6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**Ethic**s: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
PO 9	**Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
PO 10	**Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
PO 11	**Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
PO 12	**Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

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.

B.Sudheer Kumar	**B.Sudheer Kumar**	**B.Sudheer Kumar**	**Dr.S.Pichi Reddy**
Course Instructor	**Course Coordinator**	**Module Coordinator**	**HOD**

DEPARTMENT OF MECHANICAL ENGINEERING
COURSE HANDOUT

Part-A

PROGRAM : B.Tech, VI Sem., Mechanical Engineering
ACADEMIC YEAR : 2021-22
COURSE NAME & CODE : **Automobile Engineering-17ME24**
L-T-P STRUCTURE : 3 (L) – 0 (T) –0(P)
COURSE CREDITS : 3
COURSE INSTRUCTOR : **Mr. K Lakshmi Prasad**
COURSE COORDINATOR : **Mr. K Lakshmi Prasad**
RE-REQUISITES : **Thermodynamics, Internal Combustion Engines**

COURSE EDUCATIONAL OBJECTIVES (CEOs): The objective of this course is to make students learn about automobile layout, Engine Emissions, working of Transmission system, Steering system, Suspension system, Braking system, Fuel system and different Electrical systems.

COURSE OUTCOMES(COs)

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

CO1 : Acquire the basic knowledge of anatomy of an Automobile and its components.
CO2 : Comprehend the fuel supply system in petrol and Diesel Engines.
CO3 : Realize the functions of various electrical systems used in automobiles.
CO4 : Distinguish various transmission systems used in automobiles.
CO5 : Compare various types of Steering systems, Braking systems and Suspension systems.

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	2		
CO2						2	3	2		1		2	2		
CO3			2			2	2						2		1
CO4	1	1				2	2					2	2		2
CO5		2				2	2					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 Dr.Kirpal Singh, Automobile Engineering-Vol I& II, 13thEdition, Standard Publishers Distributors, 2014.
T2 R.B.Gupta, Automobile Engineering, 8th edition, Tech India publication series, 2013.

BOS APPROVED REFERENCE BOOKS:

R1 V.A.W Hillier and David R.Rogers, Hillier's Fundamentals of Motor Vehicle Technology, Book1, 5th edition- 2007.
R2 Heinz Heisler, Advanced Vehicle Technology, 2ndedition, Butterworth-Heinemann Series, 2002.
R3 David A Crolla, Automotive Engineering,1st edition, Butterworth-Heinemann series, 2009.

Part-B

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

UNIT-I:INTRODUCTION, ENGINE AND AUTOMOBILE POLLUTION

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
1.	Introduction to CO's and PO's	1	21.02.2022		TLM1/ TLM2	CO1	T1,T2	
2.	**Introduction-** Components of an Automobile, classification of automobiles	1	24.02.2022		TLM1/ TLM2	CO1	T1,T2	
3.	Chassis, Frame-Types, Specifications of Automobiles, Types of Automobiles	1	25.02.2022		TLM1/ TLM2	CO1	T1,T2	
4.	Rear wheel drive, front wheel drive and four wheel drive	1	28.02.2022		TLM1/ TLM2	CO1	T1,T2	
5.	**ENGINE:** Basic terminology and working of engines	1	03.03.2022		TLM1/ TLM2	CO1	T1,T2	
6.	Engine construction Details- Cylinder Blockand Crankcase- Cylinder Head- Oil Pan- Manifolds- Gaskets- Cylinder Liners- Piston- Connecting Rod- Engine Valves,	2	04.03.2022 07.03.2022		TLM1/ TLM2	CO1	T1,T2	
7.	Firing Order, Turbo charging.	1	10.03.2022		TLM1/ TLM2	CO1	T1,T2	
8.	**AUTOMOBILE POLLUTION:** Emissions from Automobiles, Nitrogen oxides, Soot, Carbonmonoxide, Hydrocarbons, Particulates, Emission Regulations	1	11.03.2022		TLM1/ TLM2	CO1	T1,T2	
No. of classes required to complete UNIT-I: 08					No. of classes taken:			

UNIT-II: ENGINE SERVICING, FUEL SUPPLY SYSTEM IN PETROL& DIESEL 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
1.	**ENGINE SERVICING:** Engine Removal, Cylinder Head, Gaskets, Valves, Piston-connecting Rod Assembly.	2	14.03.2022 17.03.2022		TLM1/ TLM2	CO2	T1,T2	
2.	Fuel Supply system in petrol engines-Fuel pump, fuel gauge, simple carburetor-defects	1	21.03.2022		TLM1/ TLM2	CO2	T1,T2	
3.	**Zenith carburetor, SU carburetor**	1	24.03.2022		TLM1/ TLM2	CO2	T1,T2	
4.	Petrol Injection- Types, Mechanical and Electronic injection systems.	1	25.03.2022		TLM1/ TLM2	CO2	T1,T2	
5.	Types of Injection systems in Diesel Engines-Fuel filters, Air filters, Air cleaners	1	28.03.2022		TLM1/ TLM2	CO2	T1,T2	
6.	**Fuel injection pumps-Jerk type pump**	1	31.03.2022		TLM1/ TLM2	CO2	T1,T2	
7.	Governors-Types	1	01.04.2022		TLM1/ TLM2	CO2	T1,T2	
No. of classes required to complete UNIT-II: 8					No. of classes taken:			

UNIT-III: IGNITION SYSTEM, CHARGING SYSTEM & STARTING SYTEMS

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.	**IGNITION SYSTEM:** Types of Ignition systems	1	04.04.2022		TLM1/ TLM2	CO3	T1,T2	
2.	Battery Ignition system- Components of Battery Ignition system, Ignition timing, Spark plug,	1	07.04.2022		TLM1/ TLM2	CO3	T1,T2	
3.	Magneto Ignition system,	1	08.04.2022		TLM1/ TLM2	CO3	T1,T2	
4.	Electronic Ignition system-Capacitive discharge Ignition system.	1	18.04.2022		TLM1/ TLM2	CO3	T1,T2	
5.	**CHARGING SYSTEM & STARTING SYTEMS:** Batteries- Types-Lead acid battery	1	21.04.2022		TLM1/ TLM2	CO3	T1,T2	
6.	Charging system- Introduction- Principle of Generator and constructional details, Generator output control	1	22.04.2022		TLM1/ TLM2	CO3	T1,T2	
7.	Starting Motor, Starting drives, Bendix rives, Solenoid switch.	1	25.04.2022		TLM1/ TLM2	CO3	T1,T2	
No. of classes required to complete UNIT-I: 07					No. of classes taken:			

UNIT-IV: TRANSMISSION SYSTEM, WHEELS AND TYRES

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.	**TRANSMISSION SYSTEM:** Clutches- Introduction, Types, Single plate clutch,	1	28.04.2022		TLM1/ TLM2	CO4	T1,T2	
2.	Multi plateClutch,Centrifugal clutch, Fluid Fly wheel,	1	29.04.2022		TLM1/ TLM2	CO4	T1,T2	
3.	Necessity of Transmission , Types of Transmission, Sliding Mesh Gear Box.	1	02.05.2022		TLM1/ TLM2	CO4	T1,T2	
4.	Constant Mesh gear box, Torque convertor, Propeller shaft,	1	05.05.2022		TLM1/ TLM2	CO4	T1,T2	
5.	Final drive,Differential, Rear axle drives.	1	06.05.2022		TLM1/ TLM2	CO4	T1,T2	
6.	**WHEELS AND TYRES:** Types of Wheels, Wheel dimensions	1	09.05.2022		TLM1/ TLM2	CO4	T1,T2	
7.	Tyre- Types of Tyres, Carcasstypes, Tyre Materials, Tyre designations.	1	12.05.2022		TLM1/ TLM2	CO4	T1,T2	
No. of classes required to complete UNIT-I:07					No. of classes taken:			

UNIT-V: FRONT AXLE AND STEERING, SUSPENSION SYSTEM, BRAKING SYSTEM

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.	Front Axle and Steering- Front Axle, Types of stub axle, Wheel alignment, Steeringgeometry- Camber- Kingpin inclination	2	13.05.2022 16.05.2022		TLM1/ TLM2	CO5	T1,T2	
2.	Combined angle and scrub radius- Castor- Toe in and Toe out,	1	19.05.2022		TLM1/ TLM2	CO5	T1,T2	
3.	Understeer and Oversteer, Power steering, Steering Linkages, Steering gears.	1	20.05.2022		TLM1/ TLM2	CO5	T1,T2	
4.	**SUSPENSION SYSTEM:** Introduction, Types of Suspension springs,Leaf springs, Coil springs,Torsion bars,	1	25.05.2022		TLM1/ TLM2	CO5	T1,T2	
5.	Shock Absorbers, Independent suspension- Types,	1	26.05.2022		TLM1/ TLM2	CO5	T1,T2	
6.	Air-suspension, **BRAKING SYSTEM:** Braking Requirements	1	27.05.2022		TLM1/ TLM2	CO5	T1,T2	
7.	Types of Brakes, Drum brakes and Disc Brakes,	1	30.05.2022		TLM1/ TLM2	CO5	T1,T2	
8.	Hydraulic Brakes, Air brakes, Anti-lock braking systems.	1	02.06.2022		TLM1/ TLM2	CO5	T1,T2	
No. of classes required to complete UNIT-I: 09					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
1.	Advanced Topics inall Units	1	03.06.2022		TLM1/ TLM2	CO1 - CO5	T1, T2, R1 to R5	

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

ACADEMIC CALENDAR:

Description	From	To	Weeks
Commencement of Class Work: 21.02.2022			
I Phase of Instructions	21.02.2022	09.04.2022	7
I Mid Examinations	11.04.2022	16.04.2022	1
II Phase of Instructions	18.04.2022	04.06.2022	7
II Mid Examinations	06.06.2022	11.06.2022	1
Preparation and Practical	13.06.2022	18.06.2022	1
Semester End Examinations	20.06.2022	02.07.2022	2

Part - C

EVALUATION PROCESS:

Evaluation Task	COs	Marks
Assignment/Quiz – 1	1	A1=05
Assignment/Quiz – 2	2	A2=05
I-Mid Examination	1,2	B1=20
I-Online Mid Examination	1,2	C1=10
Assignment/Quiz – 3	3	A3=05
Assignment/Quiz – 4	4	A4=05
Assignment/Quiz – 5	5	A5=05
II-Mid Examination	3,4,5	B2=20
II-Online Mid 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,B2)	1,2,3,4,5	**B=20**
Evaluation of Online Mid Marks: C=75% of Max(C1,C2)+25% of Min(C1,C	1,2,3,4,5	**C=10**
Attendance: D (≥95% =**5M**; 90%≤A<95%=**4M;** 85%≤A<90%=**3M;** 80%≤A<85%=**2M;** 75%≤A<80%=**1M; <75%=0M)**	-	**D=05**
Cumulative Internal Examination: A+B+C+D	**1,2,3,4,5**	**A+B+C+D=40**
Semester End Examinations: E	**1,2,3,4,5**	**E=60**
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 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.

Position	***Course Instructor***	***Course Coordinator***	***Module Coordinator***	***HOD***
Name	Mr. K. Lakshmi Prasad	Mr. K. Lakshmi Prasad	Dr. P.Vijay Kumar	**Dr. S. PICHI REDDY**
Signature				

COURSE HANDOUT

PROGRAM : B.Tech., VI-Sem., MECH (A,B&C)

ACADEMIC YEAR : 2021-22

COURSE NAME & CODE : **MODERN MACHING PROCESSES - 17ME26**

STRUCTURE : 3-0-0

COURSE CREDITS : 3

COURSE INSTRUCTOR : **DR.MURAHARI KOLLI**

COURSE COORDINATOR : **DR.MURAHARI KOLLI**

PRE-REQUISITE: PRODUCTION TECHNOLOGY, MACHINE TOOLS&METAL CUTTING

COURSE OBJECTIVE: The main objective of this course is to familiarize with unconventional machining processes and rapid prototyping.

COURSE OUTCOMES (CO)

CO1: Assort appropriate unconventional machining processes for machining materials and to develop relevant industrial solutions for machining hard materials.
CO2: Understand the principles of Electro Chemical Machining Process for machining of hard materials.
CO3: Apply Electrical Discharge Machining principles for machining intricate components.
CO4: Comprehend the basic principles and applications of thermal machining processes like EBM, LBM and PAM.
CO5: Identify the need of Rapid Prototyping in manufacturing sectors.

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	**2**	**2**	**2**		**3**									**2**	
CO2	**3**	**2**	**3**		**3**									**3**	
CO3	**3**	**2**	**3**		**3**								**2**	**3**	
CO4	**3**	**2**	**3**		**3**								**2**	**3**	
CO5	**3**	**2**	**3**		**3**									**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 Pandey P.C. and shah H.S, Modern machining processes /TMH.
T2 Chua C.K, Leong K.F, and Lim C.S, Rapid prototyping principles and applications, second edition, world scientific publishers, and 2003.

BOS APPROVED REFERENCE BOOKS:

R1 M K Singh, Unconventional machining process / New age international.

R2 V K Jain, Advanced machining processes /Allied publishers.

R3 N.Hopkinson ,R.J.MHaque &P.M. Dickens Rapid Manufacturing, John Wiley &sons,2006.

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

UNIT-I : INTRODUCTION & MECHANICAL PROCESSES

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 of MMP and Course Co's and Po's	1	21.02.2022		TLM1/TLM2	CO1	T1/R1	
2.	Need for unconventional machining methods	1	24.02.2022		TLM1/TLM2	CO1	T1/R1	
3.	Classification of unconventional machining processes	1	25.02.2022		TLM1/TLM2	CO1	T1/R1	
4.	Considerations in process selection	1	28.02.2022		TLM1/TLM2	CO1	T1/R1	
5.	Basic principle of ultrasonic machining, equipment setup and procedure,	1	03.03.2022		TLM1/TLM2	CO1	T1/R1	
6.	Process variables and applications	1	04.03.2022		TLM1/TLM2	CO1	T1/R1	
7.	Basic principle of Abrasive jet machining, equipment setup and procedure.	1	07.03.2022		TLM3/TLM6	CO1	T1/R1	
8.	Water jet machining Basic principle, equipment setup and procedure	1	10.03.2022		TLM1/TLM2	CO1	T1/R1	
9.	Process variables and applications	1	11.03.2022		TLM1/TLM2	CO1	T1/R1	
No. of classes required to complete UNIT-I		9			No. of classes taken:			

UNIT-II : ELECTRO CHEMICAL PROCESSES &CHEMICAL MACHINING

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
10.	Electrochemical Process Introduction	1	14.03.2022		TLM1/TLM2	CO2	T1/R1	
11.	ECM Process, and principles	1	17.03.2022		TLM1/TLM2	CO2	T1/R1	
12.	Equipment and material removal rate	1	21.03.2022		TLM1/TLM2	CO2	T1/R1	
13.	Electrochemical machining	1	24.03.2022		TLM1/TLM2	CO2	T1/R1	
14.	Electrochemical grinding	1	25.03.2022		TLM1/TLM2	CO2	T1/R1	
15.	Electrochemical deburring, Electrochemical honing	1	28.03.2022		TLM1/TLM2	CO2	T1/R1	

16.	Chemical machining-principle	1	31.03.2022		TLM1/TLM2	CO2	T1/R1	
17.	Maskants –Etchants, Advantages and Applications.	1	01.04.2022		TLM1/TLM2	CO2	T1/R1	
No. of classes required to complete UNIT-II		8			No. of classes taken:			

UNIT-III: ELECTRICAL DISCHARGE MACHINING

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
18.	EDM Principle	1	04.04.2022		TLM1/TLM2	CO3	T1/R1	
19.	Process	1	07.04.2022		TLM1/TLM2	CO3	T1/R1	
20.	Power circuits for EDM	1	08.04.2022		TLM1/TLM2	CO3	T1/R1	
21.	Mechanics of metal removal in EDM	1	18.04.2022		TLM1/TLM2	CO3	T1/R1	
22.	Process parameters	1	21.04.2022		TLM1/TLM2	CO3	T1/R1	
23.	selection of tool electrode and dielectric fluid	1	22.04.2022		TLM1/TLM2	CO3	T1/R1	
24.	Electric discharge wire cutting principle and	1	25.04.2022		TLM1/TLM2	CO3	T1/R1	
25.	Applications of EDM and Wire EDM	1	26.04.2022		TLM1/TLM2	CO3	T1/R1	
No. of classes required to complete UNIT-III		8			No. of classes taken:			

UNIT-IV : ELECTRON BEAM, LASER BEAM AND PLASMA ARC MACHINING

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome Cos	Text Book followed	HOD Sign Weekly
26.	Electron Beam Machining, Principle, process	1	29.04.2022		TLM1/TLM2	CO4	T2/R3	
27.	EBM Applications and Advantages	1	02.05.2022		TLM1/TLM2	CO4	T2/R3	
28.	laser beam machining, Principle, process	1	05.05.2022		TLM1/TLM2	CO4	T2/R3	
29.	LBM Applications and Advantages	1	06.05.2022		TLM1/TLM2	CO4	T2/R3	
30.	Plasma arc machining, Principle, process	1	09.05.2022		TLM1/TLM2	CO4	T2/R3	
31.	PAM Applications and Advantages	1	12.05.2022		TLM1/TLM2	CO4	T2/R3	
32.	Hot machining, Process, equipment, applications	1	13.05.2022		TLM1/TLM2	CO4	T2/R3	
No. of classes required to complete UNIT-IV		7			No. of classes taken:			

UNIT-V : RAPID PROTOTYPING

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
33.	Introduction to RP fundamentals	1	16.05.2022		TLM1/TLM2	CO5	T2/R3	
34.	Elements, Advantages of Rapid Prototyping	1	19.05.2022		TLM1/TLM2	CO5	T2/R3	
35.	historical development, fundamentals of Rapid Prototyping	1	20.05.2022		TLM1/TLM2	CO5	T2/R3	
36.	classification of Rapid prototyping	1	23.05.2022		TLM1/TLM2	CO5	T2/R3	
37.	Rapid Prototyping process chain	1	26.05.2022		TLM1/TLM2	CO5	T2/R3	
38.	Stereo Lithography Apparatus (SLA)	1	27.05.2022		TLM1/TLM2	CO5	T2/R3	
39.	solid Ground Curing (SGC)	1	30.05.2022		TLM1/TLM2	CO5	T2/R3	
40.	EOS's EOSINT Systems	1	02.06.2022		TLM3/TLM2	CO5	T2/R3	
41.	Applications of Rapid Prototyping	1	03.06.2022		TLM3/TLM6			
No. of classes required to complete UNIT-V		9			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
42.	Abrasive water jet aerospace applications	1						
43.	EDM process parameters	1						
44.	Rapid prototyping case study	1						
45.	Medical case study	1						

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

ACADEMIC CALENDAR:

Description	From	To	Weeks
I Phase of Instructions	21-02-2022	09-04-2022	7W
I Mid Examinations	11-04-2022	16-04-2022	1W
II Phase of Instructions	18-04-2022	04-06-2022	7W
II Mid Examinations	06-06-2022	11-06-2022	1W
Preparation and Practicals	13-06-2022	18-06-2022	1W
Semester End Examinations	20-06-2022	02-07-2022	2W

EVALUATION PROCESS:

Evaluation Task	COs	Marks
Assignment–1	1	A1=5
Assignment–2	2	A2=5
I-Mid Examination	1,2	B1=20
Online Quiz-Q1	1,2	Q1-10
Assignment – 3	3	A3=5
Assignment– 4	4	A4=5
Assignment – 5	5	A5=5
II-Mid Examination	3,4,5	B2=20
Online Quiz-Q2	3,4,5	Q2-10
Evaluation of Assignment Marks: A=(A1+A2+A3+A4+A5)/5	1,2,3,4,5	A=5
Evaluation of Online Quiz Marks: Q=(Q1+Q2)/2	1,2,3,4,5	Q=10
Evaluation of Mid Marks: B=75% of Max(B1,B2)+25% of Min(B1,B2)	1,2,3,4,5	B=20
Attendance		C= 5
Cumulative Internal Examination : A+Q+B+C	**1,2,3,4,5**	**40**
Semester End Examinations	**1,2,3,4,5**	**60**
Total Marks: 40+60	**1,2,3,4,5**	**100**

PROGRAMME EDUCATIONAL OBJECTIVES:

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

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

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

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

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

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

COURSE HANDOUT

PART-A

Name of Course Instructor : Mr.A.Dhanunjay Kumar
Course Name & Code : Design of Experiments &17ME91
L-T-P Structure : 3-0-0 Credits : 3
Program/Sem/Sec : B.Tech., ME., VI-Sem., Section- A A.Y : 2021-22

PRE-REQUISITE: Mathematics courses, Probability and Statistics
COURSE EDUCATIONAL OBJECTIVES (CEOs): This course provides the concepts design and analysis of experiments. It covers the basic principles and different methods of experimental design and analyzing the experimental data.

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

CO 1	Identify the need for the strategies of design of experiments.
CO 2	Analyze the vast experimental data using the sampling criteria.
CO 3	Analyze and validate the data using ANOVA.
CO 4	Design the experiments with single factor and several factors.
CO 5	Apply the statistical process control methods for various quality control problems.

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

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

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

TEXT BOOKS

1. Montgomery D.C., Design and Analysis of Experiments, John Wiley.
2. Montgomery D.C., Runger G. C., Applied Statics and Probability for Engineers, John Wiley

REFERENCES:

1. Robert L. Mason, Richard F. Gunst, James L. Hess, Statistical Design and Analysis of Experiments: With Applications to Engineering and Science, John Wiley.
2. Montgomery D.C., Peck E.A., Vining G.G., Introduction to Linear Regression Analysis, John Wiley.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to the Course and COs	1	23-02-22		TLM1	
2.	Strategy of experimentation and application	1	24-02-22		TLM1	
3.	Basic principles and Guidelines for designing experiments	1	25-02-22		TLM1	
4.	Brief history of statistical design, using statistical techniques in experimentation	1	02-03-22		TLM2	
5.	Problems		03-03-22		TLM3	
6.	Basics of probability	1	04-03-22		TLM1	
7.	Axioms of probability, conditional probability	1	09-03-22		TLM1	
8.	Probability rules, Bayes theorem	1	10-03-22		TLM1	
No. of classes required to complete UNIT-I: 08				No. of classes taken:		

UNIT-II: Random Variables, Discrete Random Variables, Continuous Random Variables

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.	Random Variables: Attributes ,types and examples	1	11-03-22		TLM1	
2.	Discrete Random Variables: Introduction, probability distributions and probability mass functions.	1	16-03-22		TLM2	
3.	Cumulative distribution function, mean and variance of a discrete random variable	1	17-03-22		TLM1	

4.	Binomial and Poisson distribution	1	18-03-22		TLM2	
5.	Continuous Random Variables: Introduction, probability distributions and probability density functions,	1	23-03-22		TLM2	
6.	Cumulative distribution function, mean and variance of a continuous random variable, normal distribution.	1	24-03-22		TLM1	
7.	Problems	1	25-03-22		TLM3	
No. of classes required to complete UNIT-II:7				No. of classes taken:		

UNIT-III: Simple Comparative Experiments

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction	1	30-03-22		TLM1	
2.	Basic statistical concepts	1	31-03-22		TLM1	
3.	Sampling and Sampling Distribution	1	01-04-22		TLM1	
4.	Inferences about the Differences in means	1	06-04-22		TLM1	
5.	randomized designs	1	07-04-22		TLM1	
6.	paired comparison Designs	1	08-04-22		TLM2	
7.	Examples	1	20-04-22		TLM1	
8.	Problems	1	21-04-22		TLM3	
No. of classes required to complete UNIT-III:8				No. of classes taken:		

UNIT-IV : Design And Analysis Of Experiments With Single Factor And Multiple Factors

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Basic principles and guidelines of design of experiments	1	22-04-22		TLM1	
2.	Single factor experiments	1	27-04-22		TLM1	
3.	Analysis Of Variance (ANOVA)	1	28-04-22		TLM1	
4.	Examples	1	29-04-22		TLM1	
5.	Design And Analysis of Experiments With Multiple Factors: Introduction To Factorial Design	1	04-05-22		TLM2	
6.	The two factor ANOVA	1	05-05-22		TLM1	
7.	2^k factorial designs	1	06-05-22		TLM1	
8.	Examples	1	11-05-22		TLM1	

9.	Problems	1	12-05-22		TLM3	
No. of classes required to complete UNIT-IV:9				No. of classes taken:		

UNIT-V : Regression Analysis And Optmization

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	Regression Analysis: Introduction, simple linear regression analysis	1	13-05-22		TLM2	
2	Multiple linear regression analysis	1	18-05-22		TLM1	
3	Goodness of the regression fit: correlation coefficient.	1	19-05-22		TLM1	
4	Problems	1	20-05-22		TLM3	
5	Problems	1	25-05-22		TLM3	
6	OPTMIZATION: Introduction, General representation of an optimization problem, Classification of optimization problems,	1	26-05-22		TLM2	
7	Optimization of single and multiple variable problems using calculus methods,	1	27-05-22		TLM1	
8	Representation of feasible domain for the objective function on graphical plot.	1	01-06-22		TLM1	
9	Summary of Unit I,II &III	1	02-06-22		TLM2	
10	Summary of Unit IV & V	1	03-06-22		TLM2	
No. of classes required to complete UNIT-V:10				No. of classes taken:		

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

PART-C

EVALUATION PROCESS (R17 Regulations):

Evaluation Task	**Marks**

Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20
I-Quiz Examination (Units-I & II)	Q1=10
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10
Attendance	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	40
Semester End Examination (SEE)	60
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 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.

Mr.A.Dhanunjay Kumar	Dr M B S Sreekara Reddy	J.Subba Reddy	Dr.S.Pichi Reddy
Course Instructor	Course Coordinator	Module Coordinator	HOD

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING (AUTONOMOUS)
LB Reddy Nagar, Mylavarm, Krishna District, Andhra Pradesh-521230
Affiliated to JNTUK, Kakinada & Approved by AICTE, NewDelhi.
Accredited by**NAAC,NBA** Tier-I for CSE,IT,ECE,EEE & ME and "**CPE**" status by UGC.
Department of Mechanical Engineering

COURSE HANDOUT

PROGRAM : B.Tech, VI-Sem., MECH–A Section
ACADEMIC YEAR : 2021-2022
COURSE NAME & CODE : PROJECT MANAGEMENT – 17MB81
L-T-P STRUCTURE : 3-0-0
COURSE CREDITS : 3
COURSE INSTRUCTOR : Mr. JONNALA SUBBA REDDY, Associate Professor
COURSE COORDINATOR : Mr. SEELAM SRINIVASA REDDY, Associate Professor
PRE-REQUISITE:

COURSE OBJECTIVE: The objective of the course is to lay an important foundation to students in managing projects with a special focus on every phase such as project planning, execution, monitoring and evaluation.

COURSE OUTCOMES (CO)
CO1: Understand the concept of project management.
CO2: Awareness on organization strategy and structure and culture
CO3: Knowledge on defining the project and its controlling process.
CO4: Ability in executing and evaluating the project.
CO5: Understand the importance of a team and achieving cross functional cooperation.

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

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

BOS APPROVED TEXTBOOKS:
T1 Gray, Larson: Project Management-Tata McGraw Hill-2008
T2 Jeffery K. Pinto: Project Management- Pearson Education 2009

BOS APPROVED REFERENCE BOOKS:
R1 Enzo Frigenti: Project Management-Kogan, 2008
R2 Larry Richman: Project Management-PHI,2008
R3 Scott Berkun: Project Management-SPD,2008
R4Thomas M Cappels: Financially Focused Project Management , SPD,2008
R5 Anita Rosen: Effective IT Project Management-PHI, 2008

COURSE DELIVERY PLAN (LESSON PLAN): B.Tech – VI Sem - Section-A

UNIT-I : Introduction to Project Management

S.No.	Topics to be covered	No. of Classes Required	TentativeDate of Completion	ActualDate of Completion	Teachinglearning Methods	LearningOutcome COs	Textbook followed	HOD Sign Weekly
1.	CEO's and CO's of Project Management	1	21.02.2022		-	-	-	
2.	Introduction to Project Management	1	23.02.2022		TLM1/TLM2	CO1	T1,T2/R4	
3.	What is Project Management	1	26.02.2022		TLM1/TLM2	CO1	T1,T2/R4	
4.	Why Project Management	1	28.02.2022		TLM1/TLM2	CO1	T1,T2/R4	
5.	Project Lifecycle	1	02.03.2022		TLM1/TLM2	CO1	T1,T2/R4	
6.	Project Management Research in brief	1	05.03.2022		TLM1/TLM2	CO1	T1,T2/R4	
7.	Project Management Research in brief	1	07.03.2022		TLM1/TLM2	CO1	T1,T2/R4	
8.	Project Management today	1	09.03.2022		TLM1/TLM2	CO1	T1,T2/R4	
9.	Future trends in Project Management	1	12.03.2022		TLM1/TLM2	CO1	T1,T2/R4	
No. of classes required to complete UNIT-I		9			**No. of classes taken:**			

UNIT-II: ORGANIZATION STRATEGIES

S.No.	Topics to be covered	No. of Classes Required	TentativeDate of Completion	ActualDate of Completion	Teaching learning Methods	LearningOutcome COs	Textbook followed	HOD Sign Weekly
10.	Organization Strategies	1	14.03.2022		TLM1/TLM2	CO2	T1/R1	
11.	Structures and cultures	1	16.03.2022		TLM1/TLM2	CO2	T1/R1	
12.	Structures and cultures	1	19.03.2022		TLM1/TLM2	CO2	T1/R1	
13.	Form of Organization Structure	1	21.03.2022		TLM1/TLM2	CO2	T2	
14.	Stake holder management	1	23.03.2022		TLM1/TLM2	CO2	T2	
15.	Organization Culture	1	26.03.2022		TLM1/TLM2	CO2	T1	
16.	Creating a Culture for PM	1	28.03.2022		TLM1/TLM2	CO2	T1/R1	
No. of classes required to complete UNIT-II		7			No. of classes taken:			

UNIT-III: PROJECT PLANNING

S.No.	Topics to be covered	No. ofClasses Required	TentativeDate of Completion	ActualDate of Completion	Teaching learning Methods	LearningOutcomeCOs	Textbook followed	HODSign Weekly
17.	Project Planning	1	30.03.2022		TLM1/TLM2	CO3	T1/R1	
18.	Project Planning definitions	1	04.04.2022		TLM1/TLM2	CO3	T1/R1	
19.	Approaches to Project Screening	1	06.04.2022		TLM1/TLM2	CO3	T1/R1	
20.	Approaches to Project Selection	1	09.04.2022		TLM1/TLM2	CO3	T1/R1	
21.	Work breakdown Structure	1	18.04.2022		TLM1/TLM2	CO3	T1/R1	
22.	Financial Module	1	20.04.2022		TLM3/TLM6	CO3	T1/R1	
23.	Getting Approval and Compiling a project charter	1	23.04.2022		TLM1/TLM2	CO3	T1/R1	
24.	Setting up a Monitoring and controlling	1	25.04.2022		TLM1/TLM2	CO3	T1/R1	
No. of classes required to complete UNIT-III		8			No. of classes taken:			

UNIT-IV: PROJECT EXECUTION

S.No.	Topics to be covered	No. ofClasses Required	TentativeDate of Completion	ActualDate of Completion	Teaching learning Methods	LearningOutcomeCOs	Textbook followed	HODSign Weekly
25.	Project Execution Initiating the Project	1	27.04.2022		TLM1/TLM2	CO4	T2/R3	
26.	Controlling and Reporting objectives	1	30.04.2022		TLM1/TLM2	CO4	T2/R3	
27.	Conducting project Evaluation	1	02.05.2022		TLM1/TLM2	CO4	T2/R3	
28.	Managing RISKs	1	04.05.2022		TLM1/TLM2	CO4	T2/R3	
29.	Four Stage Process	1	07.05.2022		TLM1/TLM2	CO4	T2/R3	
30.	Risk Management an integrated approach	1	09.05.2022		TLM1/TLM2	CO4	T2/R3	
31.	Cost management	1	11.05.2022		TLM1/TLM2	CO4	T2/R3	
32.	Creating a Project Budget	1	14.05.2022		TLM1/TLM2	CO4	T2/R3	
No. of classes required to complete UNIT-IV		8			No. of classes taken:			

UNIT-V : PROJECT TEAM BUILDING

S.No.	Topics to be covered	No. of Classes Required	TentativeDate of Completion	ActualDate of Completion	Teaching learning Methods	LearningOutcome COs	Textbook followed	HOD Sign Weekly
33.	Leading Project Teams Building a Project Team	1	16.05.2022		TLM1/TLM2	CO5	T2/R3	
34.	Characteristics of Effective Project Team	1	18.05.2022		TLM1/TLM2	CO5	T2/R3	
35.	Achieving cross functional	1	21.05.2022		TLM1/TLM2	CO5	T2/R3	
36.	Functional cooperation	1	23.05.2022		TLM1/TLM2	CO5	T2/R3	
37.	Virtual Project teams	1	25.05.2022		TLM1/TLM2	CO5	T2/R3	
38.	Conflicts Management	1	28.05.2022		TLM1/TLM2	CO5	T2/R3	
39.	Management Negotiations	1	30.05.2022		TLM1/TLM2	CO5	T2/R3	
40.	Case Studies	1	01.06.2022		TLM1/TLM2	CO5	T2/R3	
41.	Case Studies	1	04.06.2022		TLM1/TLM2	CO5	T2/R3	
No. of classes required to complete UNIT-V		9			**No. of classes taken:**			

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

ACADEMIC CALENDAR:

Description	From	To	Weeks
I Phase of Instructions	21.02.2022	09.04.2022	7W
I Mid Examinations	11.04.2022	16.04.2022	1W
II Phase of Instructions	18.04.2022	04.06.2022	7W
II Mid Examinations	06.05.2022	11.06.2022	1W
Preparation and Practicals	13.06.2022	18.06.2022	1W
Semester End Examinations	20.06.2022	02.07.2022	2W

EVALUATION PROCESS:

Evaluation Task	COs	Marks
Assignment–1	1	A1=5
Assignment–2	2	A2=5
I-Mid Examination	1,2	B1=20
Online Quiz-Q1	1,2	Q1-10
Assignment – 3	3	A3=5
Assignment– 4	4	A4=5
Assignment – 5	5	A5=5
II-Mid Examination	3,4,5	B2=20
Online Quiz-Q2	3,4,5	Q2-10
Evaluation of Assignment Marks: A=(A1+A2+A3+A4+A5)/5	1,2,3,4,5	A=5
Evaluation of Online Quiz Marks: Q=(Q1+Q2)/2	1,2,3,4,5	Q=10
Evaluation of Mid Marks: B=75% of Max(B1,B2)+25% of Min(B1,B2)	1,2,3,4,5	B=20
Attendance		C= 5
Cumulative Internal Examination: A+Q+B+C	**1,2,3,4,5**	**40**
Semester End Examinations	**1,2,3,4,5**	**60**
Total Marks: 40+60	**1,2,3,4,5**	**100**

PROGRAMME EDUCATIONAL OBJECTIVES:

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

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

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

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

Signature				
Name	**Mr. J. Subba Reddy**	**Mr. S. Srinivasa Reddy**	**J. Subba Reddy**	**Dr. S. Pichi Reddy**
Designation	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**HOD**

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING (AUTONOMOUS)

L B Reddy Nagar, Mylavarm, Krishna District, Andhra Pradesh-521230

Affiliated to JNTUK, Kakinada & Approved by AICTE, New Delhi.

Accredited by **NAAC, NBA** Tier-1 for CSE, IT, ECE, EEE & ME and "**CPE**" status by UGC.

Department of Mechanical Engineering

Laboratory Name	**: CAD / CAM Lab**	**Lab Code: 17ME70 (R 17 Reg)**
A.Y.	**: 2021-2022**	**Class: B. Tech – VI Semester (Section –A)**
Lab/Practicals	**: 2 hrs/ Week**	**Continuous Internal Assessment : 40**
Credits	**: 01**	**Semester End Examination : 60**
Name of the Faculty	**: Mr. J. Subba Reddy, Associate Professor / Ms. S. Snigdha, Assistant Professor**	

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

PRE-REQUISITES: CAD/CAM, Computer Aided Engineering Drawing, Computer Aided Machine Drawing

COURSE EDUCATIONAL OBJECTIVES:

The main objective of this course is to model assemble and manufacture engineering components using computer aided tools.

COURSE OUTCOMES:

After completion of the course student will be able to:

CO1. Design and assemble of the components using geometric modeling software

CO2. Apply the finite element analysis for components design.

CO3. Develop NC code for different part profiles and perform machining on CNC Machines.

CO4. Manipulate the robot by writing programs and executing them

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 – CAD / CAM Lab (17ME70)															
		POs												**PSOs**	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO 1**	**PSO 2**	**PSO 3**
COs	CO1	3	-	**3**	**1**	3	2	-	-	**3**	-	-	3	-	2	3
	CO2	3	**2**	**3**	**2**	3	3	3	-	**3**	-	-	3	-	-	3
	CO3	3	2	3	**2**	3	-	-	-	**3**	-	-	3	-	**3**	2
	CO4	3	3	2	**3**	3	-	-	-	**3**	-	-	3	-	**3**	2
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)																

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

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**

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING (AUTONOMOUS)
L B Reddy Nagar, Mylavarm, Krishna District, Andhra Pradesh-521230
Affiliated to JNTUK, Kakinada & Approved by AICTE, New Delhi.
Accredited by **NAAC, NBA** Tier-1 for CSE, IT, ECE, EEE & ME and "**CPE**" status by UGC.
Department of Mechanical Engineering

Laboratory Name	**: CAD / CAM Lab**	**Lab Code: 17ME70 (R 17 Reg)**
A.Y.	**: 2021-2022**	**Class: B. Tech – VI Semester (Section –A)**
Lab/Practicals	**: 2 hrs/ Week**	**Continuous Internal Assessment : 40**
Credits	**: 01**	**Semester End Examination : 60**
Name of the Faculty	**: Mr. J. Subba Reddy, Associate Professor / Ms. S. Snigdha, Assistant Professor**	

LIST OF EXPERIMENTS

At least 10 Experiments from each laboratory and 12 overall should be conducted

LIST OF EXPERIMENTS:

1. Assembly Modeling (At least three examples)
2. Analysis of trusses
3. Analysis of Beams
4. Plane stress, plane strain analysis
5. Analysis of Axi-symmetric solids
6. Analysis of 3D solids
7. Estimation of natural frequencies and mode shapes for simple problems
8. Steady state heat transfer Analysis
9. Development of NC code using CAM packages
10. Machining of simple components on NC lathe and Mill by transferring NC Code from a CAM package
11. Machining of Simple components on NC-Mill by transferring NC Code/from a CAM Package
12. Robot programming, simulation and execution.

REFERENCE BOOKS: CAD / CAM Lab Manual

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

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING (AUTONOMOUS)

L B Reddy Nagar, Mylavarm, Krishna District, Andhra Pradesh-521230

Affiliated to JNTUK, Kakinada & Approved by AICTE, New Delhi.

Accredited by **NAAC, NBA** Tier-1 for CSE, IT, ECE, EEE & ME and "**CPE**" status by UGC.

Department of Mechanical Engineering

Laboratory Name	**: CAD / CAM Lab**	**Lab Code: 17ME70 (R 17 Reg)**
A.Y.	**: 2021-2022**	**Class: B. Tech – VI Semester (Section –A)**
Lab/Practicals	**: 2 hrs/ Week**	**Continuous Internal Assessment : 40**
Credits	**: 01**	**Semester End Examination : 60**
Name of the Faculty	**: Mr. J. Subba Reddy, Associate Professor / Ms. S. Snigdha, Assistant Professor**	

Notification of Cycles (Section –A)

Cycle – I:

1. Assembly Modeling (At least three examples)
2. Analysis of trusses
3. Analysis of Beams
4. Plane stress, plane strain analysis
5. Analysis of Axi-symmetric solids
6. Analysis of 3D solids

Cycle – II:

7. Estimation of natural frequencies and mode shapes for simple problems
8. Steady state heat transfer Analysis
9. Development of NC code using CAM packages
10. Machining of simple components on NC lathe and Mill by transferring NC Code from a CAM package
11. Machining of Simple components on NC-Mill by transferring NC Code/from a CAM Package
12. Robot programming, simulation and execution.

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

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING (AUTONOMOUS)

L B Reddy Nagar, Mylavarm, Krishna District, Andhra Pradesh-521230

Affiliated to JNTUK, Kakinada & Approved by AICTE, New Delhi.

Accredited by **NAAC, NBA** Tier-1 for CSE, IT, ECE, EEE & ME and "**CPE**" status by UGC.

Department of Mechanical Engineering

Laboratory Name	**: CAD / CAM Lab**	**Lab Code: 17ME70 (R 17 Reg)**
A.Y.	**: 2021-2022**	**Class: B. Tech – VI Semester (Section –A)**
Lab/Practicals	**: 2 hrs/ Week**	**Continuous Internal Assessment : 40**
Credits	**: 01**	**Semester End Examination : 60**
Name of the Faculty	**: Mr. J. Subba Reddy, Associate Professor / Ms. S. Snigdha, Assistant Professor**	

Occupancy Time Table (B.Tech Mech Engg- VI Sem: Section – A)

↓Day/Date→	*9.00 AM – 10.00 AM*	*10.00 AM - 11.00 AM*	*11.10 AM - 12.10 PM*	*12.10 PM - 01.10 PM*	*01.10 PM - 02.10 PM*	*02.10 PM - 03.10 PM*	*03.10 PM - 04.10 PM*
Monday	*CAD / CAM Lab (B_1)*			*Lunch Break*			
Tuesday							
Wednesday							
Thursday							
Friday	*CAD / CAM Lab (B_2)*						
Saturday							

Faculty – In Charges:

S.No	Class	Section	Lab Instructors	Faculty – In Charge
1	B.Tech – VI Semester	*A / S*	Mr. P. Guna Sundar Reddy Mr. B. Ramesh	Mr. J. Subba Reddy Ms. S. Snigdha

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

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING (AUTONOMOUS)

L B Reddy Nagar, Mylavarm, Krishna District, Andhra Pradesh-521230

Affiliated to JNTUK, Kakinada & Approved by AICTE, New Delhi.

Accredited by **NAAC, NBA** Tier-1 for CSE, IT, ECE, EEE & ME and "**CPE**" status by UGC.

Department of Mechanical Engineering

Laboratory Name	**: CAD / CAM Lab**	**Lab Code: 17ME70 (R 17 Reg)**
A.Y.	**: 2021-2022**	**Class: B. Tech – VI Semester (Section –A)**
Lab/Practicals	**: 2 hrs/ Week**	**Continuous Internal Assessment : 40**
Credits	**: 01**	**Semester End Examination : 60**
Name of the Faculty	**: Mr. J. Subba Reddy, Associate Professor / Ms. S. Snigdha, Assistant Professor**	

Batches (Section – A)

S.No	Batches	Regd.Nos	Total No. of Students
1	B. Tech – VI Sem - A/S	18761A0301, 18761A03G1, 19761A0301 – 303, 305 – 319, 321 – 324, 326 – 345, 347, 20765A0301 – 315	60
2	Batch 1 (A1)	18761A0301, 18761A03G1, 19761A0301 – 303, 305 – 319, 321 – 324, 326 – 331	30
3	Batch 2 (A2)	19761A0332 – 345, 347, 20765A0301 – 315	30

Sub Batch of A11:
18761A0301, 18761A03G1,
19761A0301 – 303, 305 – 314 (15)

S. No	Batch	Registered Nos	Total
1	A111	18761A0301, 18761A03G1, 19761A0301	03
2	A112	19761A0302 – 303, 305	03
3	A113	19761A0306 – 308	03
4	A114	19761A0309 – 311	03
5	A115	19761A0312 – 314	03
Total (A11)			15

Sub Batch of A12:
19761A0315 – 319, 321 – 324, 326 – 331(15)

S. No	Batch	Registered Nos	Total
1	A121	19761A0315– 317	03
2	A122	19761A0318– 319, 321	03
3	A123	19761A0322– 324	03
4	A124	19761A0326– 328	03
5	A125	18761A0329– 331	03
Total (A12)			15

Sub Batches of A21:
19761A0332— 345, 347 (15)

S. No	Batch	Registered Nos	Total
1	A211	19761A0332– 334	03
2	A212	19761A0335– 337	03
3	A213	19761A0338– 340	03
4	A214	19761A0341– 343	03
5	A215	18761A0344– 345, 347	03
Total (A21)			15

Sub Batches of A22:
20765A0301 – 315 (15)

S. No	Batch	Registered Nos	Total
1	A221	20765A0301 – 303	03
2	A222	20765A0304 – 306	02
3	A223	20765A0307 – 309	03
4	A224	20765A0310 – 312	03
5	A225	20765A0313 – 315	03
Total (A22)			15

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

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING (AUTONOMOUS)

L B Reddy Nagar, Mylavarm, Krishna District, Andhra Pradesh-521230

Affiliated to JNTUK, Kakinada & Approved by AICTE, New Delhi.

Accredited by **NAAC, NBA** Tier-1 for CSE, IT, ECE, EEE & ME and "**CPE**" status by UGC.

Department of Mechanical Engineering

Laboratory Name	**: CAD / CAM Lab**	**Lab Code: 17ME70 (R 17 Reg)**
A.Y.	**: 2021-2022**	**Class: B. Tech – VI Semester (Section –A)**
Lab/Practicals	**: 2 hrs/ Week**	**Continuous Internal Assessment : 40**
Credits	**: 01**	**Semester End Examination : 60**
Name of the Faculty	**: Mr. J. Subba Reddy, Associate Professor / Ms. S. Snigdha, Assistant Professor**	

Schedule of Experiments (Section – A: A1 Batch)

S.No	Batches	Regd. Nos	Total No. of Students
1	**Batch A1**	**18761A0301, 18761A03G1, 19761A0301 – 303, 305 – 319, 321 – 324, 326 – 331**	**30**

S.No.	Name of the experiment	No. of Classes Required	Tentative Date of Completion	Teaching Learning Methods
1	**Introduction to CAD/CAM Lab, Demonstration of all experiments, CEOs, and COs of the Laboratory**	2	21-02-2022	TLM4
2	Knuckle joint - Part drawing	2	28-02-2022	TLM4
3	Knuckle joint - Assembly	2	07-03-2022	TLM4
4	Universal coupling - Part drawing	2	14-03-2022	TLM4
5	Universal coupling - Assembly	2	21-03-2022	TLM4
6	Piston-Connecting rod - Part drawing	2	28-03-2022	TLM4
7	Piston-Connecting rod - Assembly	2	04-04-2022	TLM4
	I Mid Exams	**11-04-2022 to 16-04-2022**		
8	Cantilever beam structural analysis	2	18-04-2022	TLM4
9	Truss structural analysis	2	25-04-2022	TLM4
10	Knuckle joint structural analysis	2	02-05-2022	TLM4
11	Spring-mass system modal analysis	2	09-05-2022	TLM4
12	Pin Fin heat transfer analysis	2	16-05-2022	TLM4
13	Linear and circular interpolation using XL mill, XL Turning	2	23-05-2022	TLM4
14	Internal Exam	2	30-05-2022	TLM4
	II Mid Exams	**06-06-2022 to 11-06-2022**		
	Preparation and Practicals	**13-06-2022 to 18-06-2022**		
	Semester End Exams	**20-06-2022 to 02-07-2022**		

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

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING (AUTONOMOUS)

L B Reddy Nagar, Mylavarm, Krishna District, Andhra Pradesh-521230

Affiliated to JNTUK, Kakinada & Approved by AICTE, New Delhi.

Accredited by **NAAC, NBA** Tier-1 for CSE, IT, ECE, EEE & ME and "**CPE**" status by UGC.

Department of Mechanical Engineering

Laboratory Name : **CAD / CAM Lab** **Lab Code: 17ME70 (R 17 Reg)**
A.Y. : **2021-2022** **Class: B. Tech – VI Semester (Section –A)**
Lab/Practicals : **2 hrs/ Week** **Continuous Internal Assessment** : **40**
Credits : **01** **Semester End Examination** : **60**
Name of the Faculty : **Mr. J. Subba Reddy, Associate Professor / Ms. S. Snigdha, Assistant Professor**

Schedule of Experiments (Section – A: A2 Batch)

S.No	Batches	Regd. Nos	Total No. of Students
1	**Batch A2**	**19761A0332 – 345, 347, 20765A0301 – 315**	**30**

S.No.	Name of the experiment	No. of Classes Required	Tentative Date of Completion	Teaching Learning Methods
1	**Introduction to CAD/CAM Lab, Demonstration of all experiments, CEOs, and COs of the Laboratory**	2	25-02-2022	TLM4
2	Knuckle joint - Part drawing	2	04-03-2022	TLM4
3	Knuckle joint - Assembly	2	11-03-2022	TLM4
4	Universal coupling - Part drawing	2	18-03-2022	TLM4
5	Universal coupling - Assembly	2	25-03-2022	TLM4
6	Piston-Connecting rod - Part drawing	2	01-04-2022	TLM4
7	Piston-Connecting rod - Assembly	2	08-04-2022	TLM4
	I Mid Exams	**11-04-2022 to 16-04-2022**		
8	Cantilever beam structural analysis	2	22-04-2022	TLM4
9	Truss structural analysis	2	29-04-2022	TLM4
10	Knuckle joint structural analysis	2	06-05-2022	TLM4
11	Spring-mass system modal analysis	2	13-05-2022	TLM4
12	Pin Fin heat transfer analysis	2	20-05-2022	TLM4
13	Linear and circular interpolation using XL mill, XL Turning	2	27-05-2022	TLM4
14	Internal Exam	2	03-06-2022	TLM4
	II Mid Exams	**06-06-2022 to 11-06-2022**		
	Preparation and Practicals	**13-06-2022 to 18-06-2022**		
	Semester End Exams	**20-06-2022 to 02-07-2022**		

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

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING (AUTONOMOUS)
L B Reddy Nagar, Mylavarm, Krishna District, Andhra Pradesh-521230
Affiliated to JNTUK, Kakinada & Approved by AICTE, New Delhi.
Accredited by **NAAC, NBA** Tier-1 for CSE, IT, ECE, EEE & ME and "**CPE**" status by UGC.
Department of Mechanical Engineering

Laboratory Name	**: CAD / CAM Lab**	**Lab Code: 17ME70 (R 17 Reg)**	
A.Y.	**: 2021-2022**	**Class: B. Tech – VI Semester (Section –A)**	
Lab/Practicals	**: 2 hrs/ Week**	**Continuous Internal Assessment**	**: 40**
Credits	**: 01**	**Semester End Examination**	**: 60**
Name of the Faculty	**: Mr. J. Subba Reddy, Associate Professor / Ms. S. Snigdha, Assistant Professor**		

Evaluation Criterion for Laboratory

EVALUATION PROCESS:

Evaluation Task	COs	Max. Marks
Day – to – Day Evaluation	**1,2,3,4**	**A=20**
Mid Examination	**1,2,3,4**	**B=10**
Viva-Voce	**1,2,3,4**	**C=05**
Attendance: D (≥95% =**5M**; 90%≤A<95%=**4M;** 85%≤A<90%=**3M;** 80%≤A<85%=**2M;** 75%≤A<80%=**1M; <75%=0M)**	-	**D=05**
Cumulative Internal Examination (CIE): A+B+C+D	**1,2,3,4**	**A+B+C+D=40**
Semester End Examinations (SEE): E	**1,2,3,4**	**E=60**
Total Marks: CIE + SEE = A+B+C+D+E	**1,2,3,4**	**100**

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

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

Name of Course Instructor : Dr.V.Dhana Raju
Course Name & Code : 17ME20
L-T-P Structure : 3-1-0 Credits : 3
Program/Sem/Sec : B.Tech., Mech Engg., VI-Sem.,Section-B A.Y : 2021-22

PRE-REQUISITE: Applied Mathematics, Thermodynamics, Thermal Engineering and Fluid Mechanics.

COURSE EDUCATIONAL OBJECTIVES (CEOs):
To learn the physical mechanisms on modes of heat transfer, differential equations in heat transfer and the significance of Non Dimensional Numbers in heat transfer applications.

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

CO1	**Understand** the basic heat transfer principles in Planes, Cylinders &Spherical components and can **Apply**conservation of mass and energy to a control volume or control surface to solve general heat conduction equation for planes, cylindrical surfaces.
CO2	**Analyze**steady and unsteady state heat transfer concepts and can solve the heat and temperature distribution in fins, time taken in cooling/heating of thermal components.
CO3	**Identify**the suitable empirical correlations to solve free and forced convection problems related to external and internal flows**.**
CO4	**Apply**the concepts of heat transfer in boiling, condensation and radiation thermal systems.
CO5	**Design** the heat exchanger for engineering applications.

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

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

TEXT BOOKS:

T1 R.C.Sachdeva - Fundamentals of Engineering Heat and Mass Transfer —New Age Science Publishers, 3rd Edition, 2009.

T2 Yunus. A. Cengel, Heat & Mass Transfer-A Practical Approach – Tata McGraw Hill, 4th Edition, 2012

REFERENCE BOOKS:

R1	M.NecatiOzisik, Heat Transfer- A basic Approach,4th Edition, McGraw-Hill book company, 1985
R2	J.P.Holman, Heat transfer - Tata McGraw-Hill, 9th Edition, 2010 P.K.Nag, Heat and Mass Transfer- TMH 2nd Edition, 2007 P.S.Ghoshdastidar Heat Transfer - Oxford Higher Education 6th Edition 2011. C.P.Kothandaraman and Subramanian, Heat and Mass Transfer, New Age International Publications 7th Edition 2010.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: INTRODUCTION,ONE- DIMENSIONAL STEADY STATE CONDUCTION

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to Course and Course Outcomes (COs) and POs articulation matrix.	1	22.02.2022		TLM1	
2.	Introduction to heat transfer and its applications, Basic modesand its physical mechanisms in heat transfer.	1	23.02.2022		TLM1	
3.	Steady, unsteady and periodic heat transfer and significance of thermal conductivity in heat conduction.	1	24.02.2022		TLM1, TLM2 TLM5	
4.	General heat conduction equation in Cartesian coordinate system and its simplifications.	1	26.02.2022		TLM1, TLM4	
5.	Fourier's law of heat conduction; Numerical Problems. **Tutorial-1**	1	02.03.2022		TLM1	
6.	General heat conduction equation in cylindrical coordinate system and its simplifications.	1	03.03.2022		TLM1, TLM2	
7.	General heat conduction equation in spherical coordinate system and its simplifications.	1	05.03.2022		TLM1	
8.	Heat conduction through plane wall and cylinder with constant thermal conductivity– Numerical Problems.	1	08.03.2022		TLM1, TLM2	
9.	Electrical analogy, thermal resistance and overall heat transfer coefficient.	1	09.03.2022		TLM1, TLM2	
10.	Numerical Problems on thermal resistance and overall heat transfer coefficient	1	10.03.2022		TLM1, TLM2 TLM5	
11.	Heat transfer through composite slab and cylinder, Numerical Problems. Critical radius of insulation for cylinder and Applications.	1	15.03.2022		TLM1, TLM2	
12.	Numerical Problems on critical radius of insulation, **Tutorial-2**	1	16.03.2022		TLM1, TLM2	
No. of classes required to complete UNIT-I: 12				No. of classes taken:		

UNIT-II: ONE DIMENSIONAL STEADY AND TRANSIENT STATE HEAT CONDUCTION:

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.	Heat flow through a plane wall with variable thermal conductivity, Numerical Problems.	1	17.03.2022		TLM1	
2.	Heat flow through the cylinder with variable thermal conductivity, Numerical Problems.	1	19.03.2022		TLM1	
3.	Derivation on Uniform Internal heat generation in slabsand cylinders	1	22.03.2022		TLM1, TLM2	
4.	Numerical Problems on Uniform Internal heat generation in slabs.	1	24.03.2022		TLM1	
5.	Numerical Problems on Uniform Internal heat generation in cylinders.**Tutorial-3**	1	26.03.2022		TLM1, TLM2	
6.	Extended surfaces and their applications;Thermal analysis of long	1	29.03.2022		TLM3	

	Fins					
7.	Thermal analysis of short fins with insulated tip, Fin efficiency and effectiveness	1	30.03.2022		TLM1, TLM4	
8.	Systems with negligible internal Resistance (Lumped Heat Analysis), Significance of Biot and Fourier Numbers	1	31.03.2022		TLM1, TLM2	
9.	Plane wall with finite surface and Internal Resistance using Heisler Charts, **A**	1	05.04.2022		TLM1, TLM2	
10.	Numerical Problems,**Tutorial-4**	1	06.04.2022		TLM2	
No. of classes required to complete UNIT-II: 10				No. of classes taken:		

UNIT-III: CONVECTION

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.	Basics of convective (Forced and Natural) heat transfer and Applications.	1	07.04.2022		TLM1, TLM2	
2.	Dimensional analysis and Buckingham Pi theorem applied to Forced Convection.	1	09.04.2022		TLM1, TLM2	
3.	Significance of Non Dimensional Numbers.	1	19.04.2022		TLM1, TLM2	
4.	The concept of boundary layer; Velocity and Thermal Boundary Layers, Numerical Problems.	1	20.04.2022		TLM1, TLM2 TLM5	
5.	Forced convection analysis in external flows (Flow over a Flat Plate): Laminar and turbulent flows.	1	21.04.2022		TLM3	
6.	Forced convection analysis in internal flows (Flow through circular pipe): Laminar and turbulent flows.	1	23.04.2022		TLM1, TLM2	
7.	Numerical Problems on Forced Convection. **Tutorial-6**	1	26.04.2022		TLM1, TLM2	
8.	Reynolds Colburn Analogy,Natural convection: Development of Hydrodynamicand thermal boundary layer along vertical plate..	1	27.04.2022		TLM1, TLM2	
9.	Natural convection: empirical correlations for vertical and horizontal plate and numerical problems	1	28.04.2022		TLM3	
10.	Natural convection: empirical correlations for vertical and horizontal cylinders, and numerical problems **Tutorial-7**	1	30.04.2022		TLM1	
No. of classes required to complete UNIT-III:10				No. of classes taken:		

UNIT-IV:BOILING AND CONDENSATION,THERMAL RADIATION

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to boiling heat transfer and applications.	1	03.05.2022		TLM1, TLM2	
2.	Pool Boiling, Different regimes of	1	4.05.2022		TLM1,	

	boiling; Critical heat flux.				TLM2 TLM5	
3.	Numerical problems on nucleate boiling and critical heat flux conditions.	1	05.05.2022		TLM1, TLM2	
4.	Condensation: Film wise and Drop wise condensation	1	07.05.2022		TLM1, TLM2	
5.	Laminar film wise condensation on Vertical plate, Numerical Problems**Tutorial-8**	1	10.05.2022		TLM1, TLM2	
6.	Introduction and applications of Thermal Radiation	1	11.05.2022		TLM3	
7.	Emissive Power, Absorption, Reflection and Transmission and Definitions related to Radiation	1	12.05.2022		TLM1, TLM2	
8.	Concept of black and non-black Emissivity, Kirchhoff's law and Shape Factorsbodies; Laws of black body radiation	1	17.05.2022		TLM1, TLM2 TLM4	
9.	Radiation heat exchange between two black isothermal surfaces, nonblack infinite parallel plates; Derivation on Radiation shields,	1	18.05.2022		TLM1, TLM2 TLM5	
10.	Numerical problems on Radiation shields, Tutorial-**9**	1	19.05.2022		TLM1, TLM2	
No. of classes required to complete UNIT-IV:10				No. of classes taken:		

UNIT-V:HEAT EXCHANGERS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction-Classification of heat exchangers -Flow arrangement, Temperature distribution, Applications of Heat Exchangers	1	21.05.2022		TLM1, TLM2 TLM6	
2.	Overall heat transfer coefficient-Fouling factor	1	24.05.2022		TLM1, TLM2	
3.	LMTD method of Heat exchanger analysis- Parallel flow, Numerical Problems	1	25.05.2022		TLM1, TLM2 TLM4	
4.	LMTD method of Heat exchanger analysis- Counter flow, Numerical Problems	1	26.05.2022		TLM1, TLM2	
5.	Correction factor for LMTD for use with Multi pass and Cross flow Heat Exchangers**Tutorial -10**	1	28.05.2022		TLM1, TLM2	
6.	Effectiveness - NTU method of Heat Exchanger analysis –Parallel flow& Counter flow	1	31.05.2022		TLM3	
7.	Effectiveness - NTU method of Heat Exchanger analysis –Counter flow	1	01.06.2022		TLM1, TLM2	
8.	Numerical Problems on Effectiveness-NTU analysis		02.06.2022			
9.	**Content beyond the syllabus** – Design of helical coil heat exchangers, Radiation shields		04.06.2022			
No. of classes required to complete UNIT-V: 09				No. of classes taken:		

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)

TLM2	PPT	**TLM5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM3	Tutorial	**TLM6**	Group Discussion/Project

PART-C

EVALUATION PROCESS (R17 Regulations):

Evaluation Task	**Marks**
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20
I-Quiz Examination (Units-I & II)	Q1=10
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10
Attendance	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	40
Semester End Examination (SEE)	60
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 SPECIFC 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.

Course Instructor	Course Coordinator	Module Coordinator	HOD
(Dr.V.DhanaRaaju)	(Dr.P.Ravindra Kumar)	(Dr.P.Vijay Kumar)	(Dr.S.Pichi Reddy)

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

Name of Course Instructor : Mr.V.Sankararao
Course Name & Code : 17ME21, Mechanical Engineering Design-II
L-T-P Structure : 2-2-0 Credits: 3
Program/Sem/Sec : B.Tech., ME.,VI-Sem., Section- B A.Y: 2021-22

PRE-REQUISITE: Mechanics of Solids, Mechanical Engineering Design-I, Dynamics of Machines.

COURSE EDUCATIONAL OBJECTIVES (CEOs):
The main objective of this course is to understand and apply the standard procedure available for the design of machine elements and components of IC engine.

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

CO1	Design hydrodynamic journal bearings and selection of the antifriction bearings for given load, speed and life conditions
CO2	Design the internal combustion engine components for safe and continuous operation.
CO3	Select the belt and rope drives for elevators, cranes and hoisting machinery.
CO4	Design the springs under static and dynamic loads and combinations.
CO5	Design different types of gears for the given power transmission conditions for safe and continuous operation

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**	**3**									**1**			**3**
CO2	**3**	**2**	**3**		**1**							**1**			**3**
CO3	**3**	**2**	**3**									**1**			**3**
CO4	**3**	**3**	**3**									**1**			**3**
CO5	**3**	**2**	**3**									**1**			**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 Bhandari V.B., Design of Machine Elements, 3rd edition, TMG 2010
T2 Sundarajamoorthy T.V, Shanmugam N., Machine Design, Anuradha Publications

BOS APPROVED REFERENCE BOOKS:

R1 Norton R.L, Design of Machinery, TMG-2004

R2 Shigley J.E. and Mischke C.R., Mechanical Engineering Design, TMG-2003

R3 Ugural A.C, Mechanical Design-An Integral Approach, TMG-2004

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Bearings

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	Introduction to Subject, Pos, PEOs and CO's of the course	1	21-02-2022		TLM1	
2	Introduction to Unit-1, **Bearings** –Introduction, theory of lubrication, Types, materials	1	22-02-2022		TLM1 TLM2	
3	**Journal Bearings** – Types, Important dimensionless parameters,	1	23-02-2022		TLM1 TLM2	
4	Design procedure of journal bearing	1	25-02-2022		TLM1	
5	Journal bearings - problems	1	28-02-2022		TLM4	
6	Heat generated and heat dissipated in the bearing design – problems	1	01-03-2022		TLM4	
7	**Tutorial-I**	1	02-03-2022		TLM3	
8	**Rolling contact bearings-**types, bearing life, Materials and designation	1	04-03-2022		TLM3	
9	Static load and dynamic load capacity, equivalent bearing load	1	07-03-2022		TLM1 TLM2	
10	Selection of ball bearing - problems	1	08-03-2022		TLM1	
11	Selection of roller bearing - problems	1	09-03-2022		TLM4	
12	**Tutorial-II**	1	11-03-2022		TLM3	
13	Cubic mean load derivation, Reliability of bearings - problems	1	14-03-2022		TLM3	
14	Problem on roller bearings	1	15-03-2022		TLM4	
15	**Assignment -I/ Quiz-I**	1	16-03-2022		TLM6	
No. of classes required to complete UNIT-I: 15			No. of classes taken:			

UNIT-II: Design of IC Engine Components

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	Introduction to Unit-II, **Cylinder:**Cylinder liners, Design Procedure of Cylinder	1	18-03-2022		TLM1 TLM2	
2	Cylinder design - problems	1	21-03-2022		TLM4	
3	Problems on cylinder design	1	22-03-2022		TLM1	
4	**PISTON** : Piston design, -design	1	23-03-2022		TLM1	

					TLM2	
5	Problems on piston design	1	25-03-2022		TLM3	
6	Problems on Piston	1	28-03-2022		TLM2	
7	**Tutorial-III**	1	29-03-2022		TLM3	
8	**CONNECTING ROD**: Thrust in C.R, buckling load	1	30-03-2022		TLM1 TLM2	
9	Stresses due to whipping action on connecting rod ends- problems	1	01-04-2022		TLM4	
10	**CRANK SHAFT:** Design of crank and crank shaft	1	04-04-2022		TLM1 TLM2	
11	Strength of overhung shaft, center crank shaft -problem	1	05-04-2022		TLM4	
12	**Tutorial-IV**	1	06-04-2022		TLM3	
13	**Assignment-II/Quiz-2**	1	08-04-2022		TLM6	
No. of classes required to complete UNIT-II: 13			No. of classes taken:			

UNIT-III: Belt & Rope Drives

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	**Introduction to Unit-III** **PULLEYS:** Introduction, Design of flat belts	1	18-04-2022		TLM1 TLM2	
2	Design of pulleys(mild steel & cast iron)	1	19-04-2022		TLM1	
3	V-belts –designation, design and selection	1	20-04-2022		TLM1 TLM2	
4	Design of V- grooved pulley	1	22-04-2022		TLM1	
5	Design of V belts - problems	1	25-04-2022		TLM4	
6	Problems on design of belts	1	26-04-2022		TLM1	
7	**Tutorial-V**	1	27-04-2022		TLM3	
8	**WIRE ROPES: I**ntroduction**,** designation classification	1	29-04-2022		TLM1 TLM2	
9	Selection of wire ropes, Stresses in hoisting ropes	1	02-05-2022		TLM1	
10	Design of wire ropes-problems	1	03-05-2022		TLM4	
11	**Tutorial-VI**	1	04-05-2022		TLM3	
12	**Assignment-III/Quiz-III**	1	06-05-2022		TLM6	
No. of classes required to complete UNIT-III: 12			No. of classes taken:			

UNIT-IV: Springs

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	**Introduction to Unit-IV** **SPRINGS:** Introduction,	1	09-05-2022		TLM1 TLM2	

	classification					
2	Stresses, deflection and stiffness in springs and their derivations	1	10-05-2022		TLM1 TLM2	
3	Design of springs-problems	1	11-05-2022		TLM4	
4	Springs for fatigue loading	1	13-05-2022		TLM1	
5	**Tutorial-VII**	1	16-05-2022		TLM3	
6	Spring failures, design of helical springs	1	17-05-2022		TLM1	
7	Natural frequency of helical spring Energy storage capacity in springs Tension and torsion springs	1	18-05-2022		TLM1	
8	Co-axial springs design- Problems	1	20-05-2022		TLM4	
9	Design of leaf springs- Problems	1	23-05-2022		TLM4	
10	**Tutorial-VIII**	1	24-05-2022		TLM3	
11	**Assignment-IV/Quiz-IV**	1	25-05-2022		TLM6	
No. of classes required to complete UNIT-V: 11			No. of classes taken:			

UNIT-V: Gears

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	**Introduction to Unit-V** **GEARS**: Introduction and terminology, Types of gears, design formulae	1	27-05-2022		TLM1 TLM2	
2	Design Analysis of gears, Estimation of centre distance, module & face width	1	27-05-2022		TLM1 TLM2	
3	Design procedure of spur gears, Check for dynamic and wear considerations	1	30-05-2022		TLM1 TLM2	
4	Design of spur gears - problems.	1	30-05-2022		TLM4	
5	Design procedure of helical gears.	1	31-05-2022		TLM1	
6	**Tutorial-IX**	1	31-05-2022		TLM3	
7	**GEAR BOX**: Functions, Progress ratio, Speed diagram, Kinematic arrangement	1	01-06-2022		TLM1	
8	Gear box design procedure - problems		01-06-2022		TLM4	
9	**Tutorial-X**	1	03-06-2022		TLM3	
10	**Assignment-V/Quiz-V**	1	03-06-2022		TLM6	
No. of classes required to complete UNIT-V: 10			No. of classes taken:			

Contents beyond the Syllabus:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	HOD Sign Weekly
1	Design of flywheels	1	04-06-2022		TLM1 TLM2		
2	Design of epicycle gear train	1	04-06-2022		TLM1 TLM2		

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

PART-C

EVALUATION PROCESS:

Evaluation Task	Marks
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20
I-Quiz Examination (Units-I & II)	Q1=10
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10
Attendance	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	40
Semester End Examination (SEE)	60
Total Marks = CIE + SEE	100

PART-D

PROGRAM OUTCOMES:

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):

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.

Course Instructor	Course Coordinator	Module Coordinator	HoD
Mr.V.Sankararao	Mr.S.Srinivasa Reddy (Jr)	Mr.B.Sudheer Kumar	Dr.S.Pichi Reddy

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

Name of Course Instructor : A Nageswara Rao
Course Name & Code : CAD/CAM & 17ME22
L-T-P Structure : 3-0-0 Credits : 3
Program/Sem/Sec : B.Tech., MECH., VI-Sem., Sections- B A.Y : 2021-22

PRE-REQUISITE: Machine Drawing, Machine Design, Machine Tools

COURSE EDUCATIONAL OBJECTIVES (CEOs): The main objective of this course is to familiarize the principles of geometric modelling, numerical control and part programming.

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

CO 1	Comprehend the principles of CAD/CAM for design and manufacturing
CO 2	Formulate mathematical equations for geometrical entities like curves, surface, and solids.
CO 3	Program for part profiles to accomplish numerical control machining
CO 4	Develop a pseudo codes for different parts using GT codes and apply in automated manufacturing systems.
CO 5	Become cognizant about CAQC techniques that are to be applied in manufacturing industry and able to comprehend the applications of Computer Integrated Manufacturing.

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

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

TEXT BOOKS:

BOS APPROVED TEXT BOOKS:

T1 MikelP.Groover and Emory W.Zimmers, CAD/CAM-prentice Hall of India private Ltd.New Delhi, 20thedition, May 2010.

T2 Ibrahim Zeid, Mastering CAD/CAM, TATA McGraw-Hill publishing Co.Ltd, New Delhi2011.

T3 P N Rao, CAD/CAM Principle and applications, Tata McGraw Hill Education Private Ltd,New Delhi,8th edition 2013.

BOS APPROVED REFERENCE BOOKS:

R1 P.Radhakrishnan, S.Subramanyam &V.Raju, CAD/CAM/CIM, New Age International Publishers,3rd edition 2010.

R2 MikelP.Groover, Automaiton, Production Systems and Computer Integrated Manufacturing, Prentice Hall of India private Ltd.New Delhi, 3rd edition, May 2008.

R3 Ibrahim Zeid and R. Sivasubramanian, CAD/CAM theory and practice, Tata McGraw Hill publishing Co. Ltd,New Delhi 2009.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction CAD/CAM, Computer Graphics

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
13.	Introduction to CAD/CAM	1	24.02.2022			
14.	Product Cycle Revised with CAD/CAM	1	25.02.2022			
15.	Reasons for implementing CAD	1	26.02.2022			
16.	Creating Manufacturing database & Benefits of CAD	1	03.03.2022			
17.	Computer Graphics- Introduction , Database structure	1	04.03.2022			
18.	Functions of a graphics package	1	05.03.2022			
19.	Raster scan graphics	1	10.03.2022			
20.	Concatenated transformations.	1	11.03.2022			
21.	Translation, scaling, reflection, rotation	1	12.03.2022			
22.	Problems on Transformations	1	12.03.2022			
No. of classes required to complete UNIT-I:				No. of classes taken:		

UNIT-II: Geometric Modeling

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
11.	Geometric Modelling: Introduction		17.03.2022			
12.	Wireframe Modelling: Entities wireframe models		19.03.2022			
13.	Parametric representation of analytical curves		24.03.2022			
14.	Hermite cubic spline curve		25.03.2022			

15.	Bezier and B-spline curves		26.03.2022			
16.	Characteristics of Curves, Problems		31.03.2022			
17.	Surface representation: Entities		01.04.2022			
18.	Solid modelling		07.04.2022			
19.	B-Rep		08.04.2022			
20.	CSG		08.04.2022			
No. of classes required to complete UNIT-II:				No. of classes taken:		

UNIT-III: NC Programming

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
11.	Numerical control: Introduction, NC Modes	1	09.04.2022			
12.	NC elements, N C Coordinate systems	1	16.04.2022			
13.	Structure of CNC machine tools	1	21.04.2022			
14.	Spindle design and spindle drives,	1	22.04.2022			
15.	Feed drives, actuation systems	1	23.04.2022			
16.	CNC Part programming: fundamentals	1	28.04.2022			
17.	Manual part programming	1	28.04.2022			
18.	Computer Aided part programming	1	29.04.2022			
19.	Part programming examples	1	30.04.2022			
20.	examples	1	30.04.2022			
No. of classes required to complete UNIT-III:				No. of classes taken:		

UNIT-IV : Group Technology, FMS, CAPP

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
11.	Group Technology	1	05.05.2022			
12.	Coding and classification schemes-OPITZ	1	06.05.2022			
13.	MICLASS, example for coding	1	07.05.2022			
14.	CODE Systems, examples for coding	1	12.05.2022			
15.	Production Flow Analysis, Advantages and limitations, GT Machine cells, Benefits of GT	1	13.05.2022			
16.	CAPP- Retrieval and Generative	1	14.05.2022			
17.	Flexible Manufacturing System: Introduction,	1	14.05.2022			
18.	FMS equipment, FMS layouts, benefits	1	19.05.2022			

19.	FMS Planning and implementation,	1	19.05.2022			
No. of classes required to complete UNIT-IV:				No. of classes taken:		

UNIT-V : CAQC, CIM, Lean Manufacturing

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
10.	CAQC: Introduction, The computers in QC	1	20.05.2022			
11.	Contact inspection methods	1	21.05.2022			
12.	Non-Contact inspection methods: Optical	1	26.05.2022			
13.	Non-Contact inspection methods: non optical	1	27.05.2022			
14.	Computer aided testing, CAQC with CAD/CAM	1	27.05.2022			
15.	CIM Introduction	1	28.05.2022			
16.	CIM integration, Implementation	1	02.07.2022			
17.	Benefits of CIM	1	03.05.2022			
18.	Lean manufacturing	1	04.05.2022			
No. of classes required to complete UNIT-V:				No. of classes taken:		

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

PART-C

EVALUATION PROCESS (R17 Regulations):

Evaluation Task	**Marks**
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20
I-Quiz Examination (Units-I & II)	Q1=10

Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10
Attendance	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	40
Semester End Examination (SEE)	60
Total Marks = CIE + SEE	100

PART-D

PROGRAMME OUTCOMES (POs):

PO 1	An ability to apply knowledge of Mathematics, Sciences and Engineering fundamentals to find the solution to real time Mechanical Engineering problems.
PO 2	An ability to identify and formulate mathematical models to analyze complex engineering problems.
PO 3	An ability to design a mechanical systems/ processes to meet the desired needs within realistic constraints such as economic, environmental, societal, health & safety .
PO 4	An ability to design and conduct experiments, perform analysis, interpretation of data and synthesis of information to provide valid conclusions.
PO 5	An ability to develop the model and analyze the Mechanical systems using modern software tools.
PO 6	An ability to understand societal, health, safety, legal, cultural issues and the consequent responsibilities relevant to engineering practice.
PO 7	An ability to understand the impact of engineering solutions in societal, environmental context and demonstrate the knowledge for sustainable development.
PO 8	An ability to understand the professional ethics to follow the norms of engineering practice.
PO 9	An ability to function effectively as an individual and as a member / leader in diverse technical teams.
PO 10	An ability to communicate effectively with the engineering community and society through reports & presentations.
PO 11	An ability to apply management principles to organise the multidisciplinary projects.
PO 12	An ability to understand the need of independent and lifelong learning so as to address day to day technological changes.

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.

Course Instructor	**Course Coordinator**	**Module Coordinator**	**HOD**
A NAGESWARA RAO REDDY	A NAGESWARA RAO	J SUBBA REDDY	Dr S PICHI

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

COURSE HANDOUT

PART-A

Name of Course Instructor: B. SUDHEER KUMAR

COURSE NAME & CODE : FINITE ELEMENT ANALYSIS – 17ME23

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

Program /Sem/Sec : B.Tech. MECH., VI-Sem., Section -B A.Y: 2021-22

COURSE COORDINATOR : B. SUDHEER KUMAR

PRE-REQUISITE: Mechanics of Materials, Machine Design, Numerical Methods & Heat Transfer

COURSE EDUCATIONAL OBJECTIVES (CEOs): The main objective of this course is to introduce the mathematical concepts of the Finite Element Method for obtaining an approximate solution of ordinary and partial differential equations and to understand the use of the basic finite elements for structural applications using beam, plane elements and use of the FE method for heat transfer problems.

COURSE OUTCOMES (CO):

CO1	Identify mathematical model for solution of common engineering problems.
CO2	Solve the flexure elements subjected to loading and plane stress problems.
CO3	Solve the 2-D structures with isoparametric elements and axi-symmetric problem.
CO4	Analyze complex cases involving heat transfer with the applications of fem.
CO5	Formulate the finite element model for stepped bar & beam and perform the simulation.

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	3	2	3		3					3	2			3
CO2	2	2	2	3	3	3					3	2			3
CO3	2	3	2	2	3	3					3	2			3
CO4	3	2	2	3		3					3	2			3
CO5	2	2	2	3	3	3					3	2			3

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

TEXT BOOKS:

T1 Chandraputla, Ashok and Belegundu, Introduction to Finite Elements in Engineering, 3rd edition,Prentice-Hall,2008

T2 S.S Rao, The Finite Element Methods in Engineering4th edition,B.H.Pergamon.2010

REFERENCE BOOKS:

R1 JN.Reddy, An introduction to Finite Element Method, 3rd edition, Mc Graw Hill, 2011.
R2 George R. Buchanan and R.RudraMoorthy, Finite Element Analysis, Tata Mc Graw Hill, 2006

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: ONE DIMENSIONAL PROBLEM

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to Finite Element Method	1	21-2-22		**TLM1, TLM2**	
2.	Equilibrium equations in elasticity, Stresses in typical element, Stresses& equilibrium	1	22-2-22		**TLM1,**	
3.	Strain displacement relations, Stress strain relations	1	26-2-22		**TLM1**	
4.	Plane stress and plane strain problems. Potential energy and equilibrium method	1	28-2-22		**TLM1**	
5.	FE Formulation from governing differential equations. One dimensional Problem, FE Modeling	1	05-3-22		**TLM1**	
6.	Shape functions & coordinates of shape functions	1	07-3-22		**TLM1**	
7.	Assembly of GSM & Load vector, Finite element equations and treatment of boundary conditions	1	08-3-22		**TLM1**	
8.	Problems	1	11-3-22		**TLM1**	
9.	Problems Assignment/Quiz-1	1	12-3-22		**TLM1 TLM6**	
No. of classes required to complete: 9				No. of classes taken:		

UNIT-II: ANALYSIS OF BEAMS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Analysis of Beams: Beam elements	1	14-3-22		**TLM1**	
2.	Types loading, DOF, Boundary conditions	1	15-3-22		**TLM1**	
3.	Hermite shape functions	1	19-3-22		**TLM1**	

4.	Stiffness matrix for two node DOF per node	1	21-3-22		**TLM1**	
5.	Problems	1	22-3-22		**TLM1**	
6.	2-D elements (CST), Boundary Conditions.	1	26-3-22		**TLM1**	
7.	Jacobian, Shape functions, Area of triangles	1	28-3-22		**TLM1**	
8.	Problems	1	29-3-22		**TLM1**	
9.	Assignment/Quiz-2	1	02-4-22		**TLM6**	
No. of classes required to complete:9				No. of classes taken:		

UNIT-III: AXISYMMETRIC LOADING AND NUMERICAL INTEGRATION

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.	Axisymmetric solids , Axisymmetric loading	1	09-4-22		**TLM1 TLM2**	
2.	Finite element modeling	1	18-4-22		**TLM1**	
3.	Axisymmetric loading with triangular elements	1	19-4-22		**TLM1**	
4.	Problems	1	23-4-22		**TLM1**	
5.	2-D four nodded isoparametric elements, Jacobian, shape functions,	1	25-4-22		**TLM1**	
6.	Problems	1	26-4-22		**TLM1**	
7.	Isoparametric formulation of 4- node quadrilateral element	1	30-4-22		**TLM1**	
8.	Problems Assignment/Quiz-3	1	02-5-22		**TLM1 TLM6**	
No. of classes required to complete:8				No. of classes taken:		

UNIT-IV: HEAT TRANSFER ANALYSIS

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.	One dimensional analysis of HT problems		07-5-22		**TLM1, TLM2**	
2.	Conductivity matrix, boundary conditions		09-5-22		**TLM1**	
3.	1-D analysis of a fin, Conductivity matrix boundary conditions, Problems	1	10-5-22		**TLM1**	
4.	Problems	1	14-5-22		**TLM1**	
5.	Problems	1	16-5-22		**TLM1**	
6.	Two dimensional	1	17-5-22		**TLM1**	

	analysis of thin plate &Conductivity matrix, boundary conditions					
7.	Convection matrix, Heat rate vector Problems. Assignment/Quiz-4.	1	21-5-22		**TLM1 TLM6**	
No. of classes required to complete: 08				No. of classes taken:		

UNIT-V: DYNAMIC ANALYSIS

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.	Dynamic analysis introduction, Formulation	1	23-5-22		**TLM1**	
2.	Mass matrices, consistent Mass Matrices, Lumped Mass Matrices	1	24-5-22		**TLM1**	
3.	Evaluation of Eigen values & Eigen vectors	1	28-7-22		**TLM1**	
4.	Problems	1	30-5-22		**TLM1**	
5.	Problems	1	31-5-22		**TLM1**	
6.	Assignment/Quiz-5	1	4-6-22		**TLM6**	
No. of classes required to complete:06				No. of classes taken:		

Contents beyond the Syllabus

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
10.	Analysis of beams for Uniformly variable loads Evaluation of Eigen values &Eigenvectors for beams	1	4-6-22		**TLM1**	

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 Regulations):

Evaluation Task	**Marks**
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20
I-Quiz Examination (Units-I & II)	Q1=10
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10
Attendance	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	40
Semester End Examination (SEE)	60
Total Marks = CIE + SEE	100

PART-D

PROGRAMME OUTCOMES (POs):

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

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.

B.Sudheer Kumar	**B.Sudheer Kumar**	**B.Sudheer Kumar**	**Dr.S.Pichi Reddy**
Course Instructor	**Course Coordinator**	**Module Coordinator**	**HOD**

DEPARTMENT OF MECHANICAL ENGINEERING
COURSE HANDOUT

Part-A

PROGRAM : B.Tech, VI Sem., Mechanical Engineering
ACADEMIC YEAR : 2021-22
COURSE NAME & CODE : **Automobile Engineering-17ME24**
L-T-P STRUCTURE : 3 (L) – 0 (T) –0(P)
COURSE CREDITS : 3
COURSE INSTRUCTOR : **Mr. K Lakshmi Prasad**
COURSE COORDINATOR : **Mr. K Lakshmi Prasad**
RE-REQUISITES : **Thermodynamics, Internal Combustion Engines**

COURSE EDUCATIONAL OBJECTIVES (CEOs): The objective of this course is to make students learn about automobile layout, Engine Emissions, working of Transmission system, Steering system, Suspension system, Braking system, Fuel system and different Electrical systems.

COURSE OUTCOMES (COs)

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

CO1 : Acquire the basic knowledge of anatomy of an Automobile and its components.
CO2 : Comprehend the fuel supply system in petrol and Diesel Engines.
CO3 : Realize the functions of various electrical systems used in automobiles.
CO4 : Distinguish various transmission systems used in automobiles.
CO5 : Compare various types of Steering systems, Braking systems and Suspension systems.

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	2		
CO2						2	3	2		1		2	2		
CO3			2			2	2						2		1
CO4	1	1				2	2					2	2		2
CO5		2				2	2					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 Dr.Kirpal Singh, Automobile Engineering-Vol I& II, 13thEdition, Standard Publishers Distributors, 2014.
T2 R.B.Gupta, Automobile Engineering, 8th edition, Tech India publication series, 2013.

BOS APPROVED REFERENCE BOOKS:

R1 V.A.W Hillier and David R.Rogers, Hillier's Fundamentals of Motor Vehicle Technology, Book1, 5th edition- 2007.
R2 Heinz Heisler, Advanced Vehicle Technology, 2ndedition, Butterworth-Heinemann Series, 2002.
R3 David A Crolla, Automotive Engineering,1st edition, Butterworth-Heinemann series, 2009.

Part-B

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

UNIT-I: INTRODUCTION, ENGINE AND AUTOMOBILE POLLUTION

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
23.	Introduction to CO's and PO's	1	21.02.2022		TLM1/ TLM2	CO1	T1,T2	
24.	**Introduction-** Components of an Automobile, classification of automobiles	1	24.02.2022		TLM1/ TLM2	CO1	T1,T2	
25.	Chassis, Frame-Types, Specifications of Automobiles, Types of Automobiles	1	25.02.2022		TLM1/ TLM2	CO1	T1,T2	
26.	Rear wheel drive, front wheel drive and four wheel drive	1	28.02.2022		TLM1/ TLM2	CO1	T1,T2	
27.	**ENGINE:** Basic terminology and working of engines	1	03.03.2022		TLM1/ TLM2	CO1	T1,T2	
28.	Engine construction Details- Cylinder Blockand Crankcase- Cylinder Head- Oil Pan- Manifolds- Gaskets- Cylinder Liners- Piston- Connecting Rod- Engine Valves,	2	04.03.2022 07.03.2022		TLM1/ TLM2	CO1	T1,T2	
29.	Firing Order, Turbo charging.	1	10.03.2022		TLM1/ TLM2	CO1	T1,T2	
30.	**AUTOMOBILE POLLUTION:** Emissions from Automobiles, Nitrogen oxides, Soot, Carbonmonoxide, Hydrocarbons, Particulates, Emission Regulations	1	11.03.2022		TLM1/ TLM2	CO1	T1,T2	
No. of classes required to complete UNIT-I: 08					No. of classes taken:			

UNIT-II: ENGINE SERVICING, FUEL SUPPLY SYSTEM IN PETROL& DIESEL 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
1.	**ENGINE SERVICING:** Engine Removal, Cylinder Head, Gaskets, Valves, Piston-connecting Rod Assembly.	2	14.03.2022 17.03.2022		TLM1/ TLM2	CO2	T1,T2	
2.	Fuel Supply system in petrol engines-Fuel pump, fuel gauge, simple carburetor-defects	1	21.03.2022		TLM1/ TLM2	CO2	T1,T2	
3.	**Zenith carburetor, SU carburetor**	1	24.03.2022		TLM1/ TLM2	CO2	T1,T2	
4.	Petrol Injection- Types, Mechanical and Electronic injection systems.	1	25.03.2022		TLM1/ TLM2	CO2	T1,T2	
5.	Types of Injection systems in Diesel Engines-Fuel filters, Air filters, Air cleaners	1	28.03.2022		TLM1/ TLM2	CO2	T1,T2	
6.	**Fuel injection pumps-Jerk type pump**	1	31.03.2022		TLM1/ TLM2	CO2	T1,T2	
7.	Governors-Types	1	01.04.2022		TLM1/ TLM2	CO2	T1,T2	
No. of classes required to complete UNIT-II: 8					No. of classes taken:			

UNIT-III: IGNITION SYSTEM, CHARGING SYSTEM & STARTING SYTEMS

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.	**IGNITION SYSTEM:** Types of Ignition systems	1	04.04.2022		TLM1/ TLM2	CO3	T1,T2	
2.	Battery Ignition system- Components of Battery Ignition system, Ignition timing, Spark plug,	1	07.04.2022		TLM1/ TLM2	CO3	T1,T2	
3.	Magneto Ignition system,	1	08.04.2022		TLM1/ TLM2	CO3	T1,T2	
4.	Electronic Ignition system-Capacitive discharge Ignition system.	1	18.04.2022		TLM1/ TLM2	CO3	T1,T2	
5.	**CHARGING SYSTEM & STARTING SYTEMS:** Batteries- Types-Lead acid battery	1	21.04.2022		TLM1/ TLM2	CO3	T1,T2	
6.	Charging system- Introduction- Principle of Generator and constructional details, Generator output control	1	22.04.2022		TLM1/ TLM2	CO3	T1,T2	
7.	Starting Motor, Starting drives, Bendix rives, Solenoid switch.	1	25.04.2022		TLM1/ TLM2	CO3	T1,T2	
No. of classes required to complete UNIT-I: 07					No. of classes taken:			

UNIT-IV: TRANSMISSION SYSTEM, WHEELS AND TYRES

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.	**TRANSMISSION SYSTEM:** Clutches- Introduction, Types, Single plate clutch,	1	28.04.2022		TLM1/ TLM2	CO4	T1,T2	
2.	Multi plateClutch,Centrifugal clutch, Fluid Fly wheel,	1	29.04.2022		TLM1/ TLM2	CO4	T1,T2	
3.	Necessity of Transmission , Types of Transmission, Sliding Mesh Gear Box.	1	02.05.2022		TLM1/ TLM2	CO4	T1,T2	
4.	Constant Mesh gear box, Torque convertor, Propeller shaft,	1	05.05.2022		TLM1/ TLM2	CO4	T1,T2	
5.	Final drive,Differential, Rear axle drives.	1	06.05.2022		TLM1/ TLM2	CO4	T1,T2	
6.	**WHEELS AND TYRES:** Types of Wheels, Wheel dimensions	1	09.05.2022		TLM1/ TLM2	CO4	T1,T2	
7.	Tyre- Types of Tyres, Carcasstypes, Tyre Materials, Tyre designations.	1	12.05.2022		TLM1/ TLM2	CO4	T1,T2	
No. of classes required to complete UNIT-I:07					No. of classes taken:			

UNIT-V: FRONT AXLE AND STEERING, SUSPENSION SYSTEM, BRAKING SYSTEM

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.	Front Axle and Steering- Front Axle, Types of stub axle, Wheel alignment, Steeringgeometry- Camber- Kingpin inclination	2	13.05.2022 16.05.2022		TLM1/ TLM2	CO5	T1,T2	
2.	Combined angle and scrub radius- Castor- Toe in and Toe out,	1	19.05.2022		TLM1/ TLM2	CO5	T1,T2	
3.	Understeer and Oversteer, Power steering, Steering Linkages, Steering gears.	1	20.05.2022		TLM1/ TLM2	CO5	T1,T2	
4.	**SUSPENSION SYSTEM:** Introduction, Types of Suspension springs,Leaf springs, Coil springs,Torsion bars,	1	25.05.2022		TLM1/ TLM2	CO5	T1,T2	
5.	Shock Absorbers, Independent suspension- Types,	1	26.05.2022		TLM1/ TLM2	CO5	T1,T2	
6.	Air-suspension, **BRAKING SYSTEM:** Braking Requirements	1	27.05.2022		TLM1/ TLM2	CO5	T1,T2	
7.	Types of Brakes, Drum brakes and Disc Brakes,	1	30.05.2022		TLM1/ TLM2	CO5	T1,T2	
8.	Hydraulic Brakes, Air brakes, Anti-lock braking systems.	1	02.06.2022		TLM1/ TLM2	CO5	T1,T2	
No. of classes required to complete UNIT-I: 09					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
1.	Advanced Topics inall Units	1	03.06.2022		TLM1/ TLM2	CO1 - CO5	T1, T2, R1 to R5	

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

ACADEMIC CALENDAR:

Description	From	To	Weeks
Commencement of Class Work: 21.02.2022			
I Phase of Instructions	21.02.2022	09.04.2022	7
I Mid Examinations	11.04.2022	16.04.2022	1
II Phase of Instructions	18.04.2022	04.06.2022	7
II Mid Examinations	06.06.2022	11.06.2022	1
Preparation and Practical	13.06.2022	18.06.2022	1
Semester End Examinations	20.06.2022	02.07.2022	2

Part - C

EVALUATION PROCESS:

Evaluation Task	COs	Marks
Assignment/Quiz – 1	1	A1=05
Assignment/Quiz – 2	2	A2=05
I-Mid Examination	1,2	B1=20
I-Online Mid Examination	1,2	C1=10
Assignment/Quiz – 3	3	A3=05
Assignment/Quiz – 4	4	A4=05
Assignment/Quiz – 5	5	A5=05
II-Mid Examination	3,4,5	B2=20
II-Online Mid 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,B2)	1,2,3,4,5	**B=20**
Evaluation of Online Mid Marks: C=75% of Max(C1,C2)+25% of Min(C1,C	1,2,3,4,5	**C=10**
Attendance: D (≥95% =**5M**; 90%≤A<95%=**4M;** 85%≤A<90%=**3M;** 80%≤A<85%=**2M;** 75%≤A<80%=**1M; <75%=0M)**	-	**D=05**
Cumulative Internal Examination: A+B+C+D	**1,2,3,4,5**	**A+B+C+D=40**
Semester End Examinations: E	**1,2,3,4,5**	**E=60**
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 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.

Position	***Course Instructor***	***Course Coordinator***	***Module Coordinator***	***HOD***
Name	Mr. K. Lakshmi Prasad	Mr. K. Lakshmi Prasad	Dr. P.Vijay Kumar	**Dr. S. PICHI REDDY**
Signature				

COURSE HANDOUT

PROGRAM : B.Tech., VI-Sem., MECH (A,B&C)

ACADEMIC YEAR : 2021-22

COURSE NAME & CODE : **MODERN MACHING PROCESSES - 17ME26**

STRUCTURE : 3-0-0

COURSE CREDITS : 3

COURSE INSTRUCTOR : **DR.MURAHARI KOLLI**

COURSE COORDINATOR : **DR.MURAHARI KOLLI**

PRE-REQUISITE: PRODUCTION TECHNOLOGY, MACHINE TOOLS&METAL CUTTING

COURSE OBJECTIVE: The main objective of this course is to familiarize with unconventional machining processes and rapid prototyping.

COURSE OUTCOMES (CO)

CO1: Assort appropriate unconventional machining processes for machining materials and to develop relevant industrial solutions for machining hard materials.
CO2: Understand the principles of Electro Chemical Machining Process for machining of hard materials.
CO3: Apply Electrical Discharge Machining principles for machining intricate components.
CO4: Comprehend the basic principles and applications of thermal machining processes like EBM, LBM and PAM.
CO5: Identify the need of Rapid Prototyping in manufacturing sectors.

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	2	2	2		3									2	
CO2	3	2	3		3									3	
CO3	3	2	3		3								2	3	
CO4	3	2	3		3								2	3	
CO5	3	2	3		3									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 Pandey P.C. and shah H.S, Modern machining processes /TMH.
T2 Chua C.K, Leong K.F, and Lim C.S, Rapid prototyping principles and applications, second edition, world scientific publishers, and 2003.

BOS APPROVED REFERENCE BOOKS:

R1 M K Singh, Unconventional machining process / New age international.

R2 V K Jain, Advanced machining processes /Allied publishers.

R3 N.Hopkinson ,R.J.MHaque &P.M. Dickens Rapid Manufacturing, John Wiley &sons,2006.

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

UNIT-I : INTRODUCTION & MECHANICAL PROCESSES

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
31.	Introduction of MMP and Course Co's and Po's	1	21.02.2022		TLM1/TLM2	CO1	T1/R1	
32.	Need for unconventional machining methods	1	24.02.2022		TLM1/TLM2	CO1	T1/R1	
33.	Classification of unconventional machining processes	1	25.02.2022		TLM1/TLM2	CO1	T1/R1	
34.	Considerations in process selection	1	28.02.2022		TLM1/TLM2	CO1	T1/R1	
35.	Basic principle of ultrasonic machining, equipment setup and procedure,	1	03.03.2022		TLM1/TLM2	CO1	T1/R1	
36.	Process variables and applications	1	04.03.2022		TLM1/TLM2	CO1	T1/R1	
37.	Basic principle of Abrasive jet machining, equipment setup and procedure.	1	07.03.2022		TLM3/TLM6	CO1	T1/R1	
38.	Water jet machining Basic principle, equipment setup and procedure	1	10.03.2022		TLM1/TLM2	CO1	T1/R1	
39.	Process variables and applications	1	11.03.2022		TLM1/TLM2	CO1	T1/R1	
No. of classes required to complete UNIT-I		9			No. of classes taken:			

UNIT-II : ELECTRO CHEMICAL PROCESSES &CHEMICAL MACHINING

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
40.	Electrochemical Process Introduction	1	14.03.2022		TLM1/TLM2	CO2	T1/R1	
41.	ECM Process, and principles	1	17.03.2022		TLM1/TLM2	CO2	T1/R1	
42.	Equipment and material removal rate	1	21.03.2022		TLM1/TLM2	CO2	T1/R1	
43.	Electrochemical machining	1	24.03.2022		TLM1/TLM2	CO2	T1/R1	
44.	Electrochemical grinding	1	25.03.2022		TLM1/TLM2	CO2	T1/R1	
45.	Electrochemical deburring, Electrochemical honing	1	28.03.2022		TLM1/TLM2	CO2	T1/R1	

46.	Chemical machining-principle	1	31.03.2022		TLM1/TLM2	CO2	T1/R1	
47.	Maskants –Etchants, Advantages and Applications.	1	01.04.2022		TLM1/TLM2	CO2	T1/R1	
No. of classes required to complete UNIT-II		8			No. of classes taken:			

UNIT-III: ELECTRICAL DISCHARGE MACHINING

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
48.	EDM Principle	1	04.04.2022		TLM1/TLM2	CO3	T1/R1	
49.	Process	1	07.04.2022		TLM1/TLM2	CO3	T1/R1	
50.	Power circuits for EDM	1	08.04.2022		TLM1/TLM2	CO3	T1/R1	
51.	Mechanics of metal removal in EDM	1	18.04.2022		TLM1/TLM2	CO3	T1/R1	
52.	Process parameters	1	21.04.2022		TLM1/TLM2	CO3	T1/R1	
53.	selection of tool electrode and dielectric fluid	1	22.04.2022		TLM1/TLM2	CO3	T1/R1	
54.	Electric discharge wire cutting principle and	1	25.04.2022		TLM1/TLM2	CO3	T1/R1	
55.	Applications of EDM and Wire EDM	1	26.04.2022		TLM1/TLM2	CO3	T1/R1	
No. of classes required to complete UNIT-III		8			No. of classes taken:			

UNIT-IV : ELECTRON BEAM, LASER BEAM AND PLASMA ARC MACHINING

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome Cos	Text Book followed	HOD Sign Weekly
56.	Electron Beam Machining, Principle, process	1	29.04.2022		TLM1/TLM2	CO4	T2/R3	
57.	EBM Applications and Advantages	1	02.05.2022		TLM1/TLM2	CO4	T2/R3	
58.	laser beam machining, Principle, process	1	05.05.2022		TLM1/TLM2	CO4	T2/R3	
59.	LBM Applications and Advantages	1	06.05.2022		TLM1/TLM2	CO4	T2/R3	
60.	Plasma arc machining, Principle, process	1	09.05.2022		TLM1/TLM2	CO4	T2/R3	
61.	PAM Applications and Advantages	1	12.05.2022		TLM1/TLM2	CO4	T2/R3	
62.	Hot machining, Process, equipment, applications	1	13.05.2022		TLM1/TLM2	CO4	T2/R3	
No. of classes required to complete UNIT-IV		7			No. of classes taken:			

UNIT-V : RAPID PROTOTYPING

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
63.	Introduction to RP fundamentals	1	16.05.2022		TLM1/TLM2	CO5	T2/R3	
64.	Elements, Advantages of Rapid Prototyping	1	19.05.2022		TLM1/TLM2	CO5	T2/R3	
65.	historical development, fundamentals of Rapid Prototyping	1	20.05.2022		TLM1/TLM2	CO5	T2/R3	
66.	classification of Rapid prototyping	1	23.05.2022		TLM1/TLM2	CO5	T2/R3	
67.	Rapid Prototyping process chain	1	26.05.2022		TLM1/TLM2	CO5	T2/R3	
68.	Stereo Lithography Apparatus (SLA)	1	27.05.2022		TLM1/TLM2	CO5	T2/R3	
69.	solid Ground Curing (SGC)	1	30.05.2022		TLM1/TLM2	CO5	T2/R3	
70.	EOS's EOSINT Systems	1	02.06.2022		TLM3/TLM2	CO5	T2/R3	
71.	Applications of Rapid Prototyping	1	03.06.2022		TLM3/TLM6			
No. of classes required to complete UNIT-V		9			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
72.	Abrasive water jet aerospace applications	1						
73.	EDM process parameters	1						
74.	Rapid prototyping case study	1						
75.	Medical case study	1						

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

ACADEMIC CALENDAR:

Description	From	To	Weeks
I Phase of Instructions	21-02-2022	09-04-2022	7W
I Mid Examinations	11-04-2022	16-04-2022	1W
II Phase of Instructions	18-04-2022	04-06-2022	7W
II Mid Examinations	06-06-2022	11-06-2022	1W
Preparation and Practicals	13-06-2022	18-06-2022	1W
Semester End Examinations	20-06-2022	02-07-2022	2W

EVALUATION PROCESS:

Evaluation Task	COs	Marks
Assignment–1	1	A1=5
Assignment–2	2	A2=5
I-Mid Examination	1,2	B1=20
Online Quiz-Q1	1,2	Q1-10
Assignment – 3	3	A3=5
Assignment– 4	4	A4=5
Assignment – 5	5	A5=5
II-Mid Examination	3,4,5	B2=20
Online Quiz-Q2	3,4,5	Q2-10
Evaluation of Assignment Marks: A=(A1+A2+A3+A4+A5)/5	1,2,3,4,5	A=5
Evaluation of Online Quiz Marks: Q=(Q1+Q2)/2	1,2,3,4,5	Q=10
Evaluation of Mid Marks: B=75% of Max(B1,B2)+25% of Min(B1,B2)	1,2,3,4,5	B=20
Attendance		C= 5
Cumulative Internal Examination : A+Q+B+C	**1,2,3,4,5**	**40**
Semester End Examinations	**1,2,3,4,5**	**60**
Total Marks: 40+60	**1,2,3,4,5**	**100**

PROGRAMME EDUCATIONAL OBJECTIVES:

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

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

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

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

Dr. Murahari Kolli	Dr. Murahari Kolli	Mr.J.Subba Reddy	Dr.S.Pichi Reddy
Course Instructor	**Course Coordinator**	**Module Coordinator**	**HOD**

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

COURSE HANDOUT

PART-A

Name of Course Instructor : Dr M B S Sreekara Reddy
Course Name & Code : Design of Experiments &17ME91
L-T-P Structure : 3-0-0 Credits : 3
Program/Sem/Sec : B.Tech., ME., VI-Sem., Section- B A.Y : 2021-22

PRE-REQUISITE: Mathematics courses, Probability and Statistics

COURSE EDUCATIONAL OBJECTIVES (CEOs): This course provides the concepts design and analysis of experiments. It covers the basic principles and different methods of experimental design and analyzing the experimental data.

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

CO 1	Identify the need for the strategies of design of experiments.
CO 2	Analyze the vast experimental data using the sampling criteria.
CO 3	Analyze and validate the data using ANOVA.
CO 4	Design the experiments with single factor and several factors.
CO 5	Apply the statistical process control methods for various quality control problems.

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

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

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

TEXT BOOKS

1. Montgomery D.C., Design and Analysis of Experiments, John Wiley.
2. Montgomery D.C., Runger G. C., Applied Statics and Probability for Engineers, John Wiley

REFERENCES:

1. Robert L. Mason, Richard F. Gunst, James L. Hess, Statistical Design and Analysis of Experiments: With Applications to Engineering and Science, John Wiley.
2. Montgomery D.C., Peck E.A., Vining G.G., Introduction to Linear Regression Analysis, John Wiley.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
76.	Introduction to the Course and COs	1	23-02-22		TLM1	
77.	Strategy of experimentation and application	1	24-02-22		TLM1	
78.	Basic principles and Guidelines for designing experiments	1	25-02-22		TLM1	
79.	Brief history of statistical design, using statistical techniques in experimentation	1	02-03-22		TLM2	
80.	Problems		03-03-22		TLM3	
81.	Basics of probability	1	04-03-22		TLM1	
82.	Axioms of probability, conditional probability	1	09-03-22		TLM1	
83.	Probability rules, Bayes theorem	1	10-03-22		TLM1	
No. of classes required to complete UNIT-I: 08				No. of classes taken:		

UNIT-II: Random Variables, Discrete Random Variables, Continuous Random Variables

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
21.	Random Variables: Attributes ,types and examples	1	11-03-22		TLM1	
22.	Discrete Random Variables: Introduction, probability distributions and probability mass functions.	1	16-03-22		TLM2	
23.	Cumulative distribution function, mean and variance of a discrete random variable	1	17-03-22		TLM1	
24.	Binomial and Poisson distribution	1	18-03-22		TLM2	
25.	Continuous Random Variables: Introduction, probability	1	23-03-22		TLM2	

	distributions and probability density functions,					
26.	Cumulative distribution function, mean and variance of a continuous random variable, normal distribution.	1	24-03-22		TLM1	
27.	Problems	1	25-03-22		TLM3	
No. of classes required to complete UNIT-II:7				No. of classes taken:		

UNIT-III: Simple Comparative Experiments

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
21.	Introduction	1	30-03-22		TLM1	
22.	Basic statistical concepts	1	31-03-22		TLM1	
23.	Sampling and Sampling Distribution	1	01-04-22		TLM1	
24.	Inferences about the Differences in means	1	06-04-22		TLM1	
25.	randomized designs	1	07-04-22		TLM1	
26.	paired comparison Designs	1	08-04-22		TLM2	
27.	Examples	1	20-04-22		TLM1	
28.	Problems	1	21-04-22		TLM3	
No. of classes required to complete UNIT-III:8				No. of classes taken:		

UNIT-IV : Design And Analysis Of Experiments With Single Factor And Multiple Factors

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
20.	Basic principles and guidelines of design of experiments	1	22-04-22		TLM1	
21.	Single factor experiments	1	27-04-22		TLM1	
22.	Analysis Of Variance (ANOVA)	1	28-04-22		TLM1	
23.	Examples	1	29-04-22		TLM1	
24.	Design And Analysis of Experiments With Multiple Factors: Introduction To Factorial Design	1	04-05-22		TLM2	
25.	The two factor ANOVA	1	05-05-22		TLM1	
26.	2^k factorial designs	1	06-05-22		TLM1	
27.	Examples	1	11-05-22		TLM1	
28.	Problems	1	12-05-22		TLM3	
No. of classes required to complete UNIT-IV:9				No. of classes taken:		

UNIT-V : Regression Analysis And Optmization

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	Regression Analysis: Introduction, simple linear regression analysis	1	13-05-22		TLM2	
2	Multiple linear regression analysis	1	18-05-22		TLM1	
3	Goodness of the regression fit: correlation coefficient.	1	19-05-22		TLM1	

4	Problems	1	20-05-22		TLM3	
5	Problems	1	25-05-22		TLM3	
6	OPTMIZATION: Introduction, General representation of an optimization problem, Classification of optimization problems,	1	26-05-22		TLM2	
7	Optimization of single and multiple variable problems using calculus methods,	1	27-05-22		TLM1	
8	Representation of feasible domain for the objective function on graphical plot.	1	01-06-22		TLM1	
9	Summary of Unit I,II &III	1	02-06-22		TLM2	
10	Summary of Unit IV & V	1	03-06-22		TLM2	
No. of classes required to complete UNIT-V:10				No. of classes taken:		

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

PART-C

EVALUATION PROCESS (R17 Regulations):

Evaluation Task	**Marks**
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20
I-Quiz Examination (Units-I & II)	Q1=10
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10
Attendance	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	40

Semester End Examination (SEE)	60
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 principles of thermal sciences to design and develop various thermal systems.
PSO 2	To apply the principles of manufacturing technology, scientific management towards improvement of quality and optimization of engineering systems in the design, analysis and manufacturability of products.
PSO 3	To apply the basic principles of mechanical engineering design for evaluation of performance of various systems relating to transmission of motion and power, conservation of energy and other process equipment.

Dr.M B S Sreekara Reddy	Dr M B S Sreekara Reddy	J.Subba Reddy	Dr.S.Pichi Reddy
Course Instructor	Course Coordinator	Module Coordinator	HOD

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING (AUTONOMOUS)

LB Reddy Nagar, Mylavaram, Krishna District, Andhra Pradesh-521230

Affiliated to JNTUK, Kakinada & Approved by AICTE, New Delhi.

Accredited by **NAAC,NBA** Tier-1 for CSE,IT,ECE,EEE & ME and "**CPE**"status by UGC.

Department of Mechanical Engineering

COURSE HANDOUT

PROGRAM : B.Tech, VI-Sem., MECH–B Section
ACADEMIC YEAR : 2021-2022
COURSE NAME & CODE : PROJECT MANAGEMENT – 17MB81
L-T-P STRUCTURE : 3-0-0
COURSE CREDITS : 3
COURSE INSTRUCTOR : KAMALA PRIYA B, Assistant Professor
COURSE COORDINATOR : Mr. SEELAM SRINIVASA REDDY, Associate Professor
PRE-REQUISITE:

COURSE OBJECTIVE: The objective of the course is to lay an important foundation to students in managing projects with a special focus on every phase such as project planning, execution, monitoring and evaluation.

COURSE OUTCOMES (CO)

CO1: Understand the concept of project management.
CO2: Awareness on organization strategy and structure and culture
CO3: Knowledge on defining the project and its controlling process.
CO4: Ability in executing and evaluating the project.
CO5: Understand the importance of a team and achieving cross functional cooperation.

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	2	1						3	3	3	3			3	
CO2	2	2						2	3	3	3	2		3	

CO3	2	3	3	3		3	3	3	3	3	3	3		3	
CO4	3	3	3	3		3			3	3		3		3	
CO5	3	2		2			3	3	3	3				1	

Note: Enter Correlation Levels **1** or **2** or **3.** If there is no correlation, **put '-'**

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

BOS APPROVED TEXTBOOKS:

T1 Gray, Larson: Project Management-Tata McGraw Hill-2008

T2 Jeffery K. Pinto: Project Management- Pearson Education 2009

BOS APPROVED REFERENCE BOOKS:

R1 Enzo Frigenti: Project Management-Kogan, 2008

R2 Larry Richman: Project Management-PHI,2008

R3 Scott Berkun: Project Management-SPD,2008

R4Thomas M Cappels: Financially Focused Project Management , SPD,2008

R5 Anita Rosen: Effective IT Project Management-PHI, 2008

COURSE DELIVERY PLAN (LESSON PLAN): B.Tech – VI Sem - Section-B

UNIT-I : Introduction to Project Management

S.No.	Topics to be covered	No. of Classes Required	TentativeDate of Completion	ActualDate of Completion	Teachinglearning Methods	LearningOutcome COs	Textbook followed	HOD Sign Weekly
84.	CEO's and CO's of Project Management	1	23.02.2022		-	-	-	
85.	Introduction to Project Management	1	25.02.2022		TLM1/TLM2	CO1	T1,T2/R4	
86.	What is Project Management	1	26.02.2022		TLM1/TLM2	CO1	T1,T2/R4	
87.	Why Project Management	1	02.03.2022		TLM1/TLM2	CO1	T1,T2/R4	
88.	Project Lifecycle	1	04.03.2022		TLM1/TLM2	CO1	T1,T2/R4	
89.	Project Management Research in brief	1	05.03.2022		TLM1/TLM2	CO1	T1,T2/R4	
90.	Project Management today	1	09.03.2022		TLM1/TLM2	CO1	T1,T2/R4	
91.	Future trends in Project Management	1	11.03.2022		TLM1/TLM2	CO1	T1,T2/R4	
No. of classes required to complete UNIT-I		8			**No. of classes taken:**			

UNIT-II: ORGANIZATION STRATEGIES

S.No.	Topics to be covered	No. of Classes Required	TentativeDate of Completion	ActualDate of Completion	Teaching learning Methods	LearningOutcome COs	Textbook followed	HOD Sign Weekly
92.	Organization Strategies	1	16.03.2022		TLM1/TLM2	CO2	T1/R1	
93.	Structures and cultures	1	19.03.2022		TLM1/TLM2	CO2	T1/R1	
94.	Form of Organization Structure	1	23.03.2022		TLM1/TLM2	CO2	T2	
95.	Stake holder management	1	25.03.2022		TLM1/TLM2	CO2	T2	
96.	Organization Culture	1	26.03.2022		TLM1/TLM2	CO2	T1	
97.	Creating a Culture for PM	1	30.03.2022		TLM1/TLM2	CO2	T1/R1	
No. of classes required to complete UNIT-II		6			No. of classes taken:			

UNIT-III: PROJECT PLANNING

S.No.	Topics to be covered	No. ofClasses Required	TentativeDate of Completion	ActualDate of Completion	Teaching learning Methods	LearningOutcomeCOs	Textbook followed	HODSign Weekly
98.	Project Planning	1	01.04.2022		TLM1/TLM2	CO3	T1/R1	
99.	Project Planning definitions	1	06.04.2022		TLM1/TLM2	CO3	T1/R1	
100.	Approaches to Project Screening and selection	1	08.04.2022		TLM1/TLM2	CO3	T1/R1	
101.	Work breakdown Structure	1	20.04.2022		TLM1/TLM2	CO3	T1/R1	
102.	Financial Module	1	22.04.2022		TLM3/TLM6	CO3	T1/R1	
103.	Getting Approval and Compiling a project charter	1	23.04.2022		TLM1/TLM2	CO3	T1/R1	
104.	Setting up a Monitoring and controlling	1	27.04.2022		TLM1/TLM2	CO3	T1/R1	
No. of classes required to complete UNIT-III		7			No. of classes taken:			

UNIT-IV: PROJECT EXECUTION

S.No.	Topics to be covered	No. ofClasses Required	TentativeDate of Completion	ActualDate of Completion	Teaching learning Methods	LearningOutcomeCOs	Textbook followed	HODSign Weekly
105.	Project Execution Initiating the Project	1	29.04.2022		TLM1/TLM2	CO4	T2/R3	
106.	Controlling and Reporting objectives	1	30.04.2022		TLM1/TLM2	CO4	T2/R3	
107.	Conducting project Evaluation	1	04.05.2022		TLM1/TLM2	CO4	T2/R3	
108.	Managing RISKs	1	06.05.2022		TLM1/TLM2	CO4	T2/R3	
109.	Four Stage Process	1	07.05.2022		TLM1/TLM2	CO4	T2/R3	
110.	Risk Management an integrated approach	1	11.05.2022		TLM1/TLM2	CO4	T2/R3	
111.	Cost management	1	13.05.2022		TLM1/TLM2	CO4	T2/R3	
112.	Creating a Project Budget	1	18.05.2022		TLM1/TLM2	CO4	T2/R3	
No. of classes required to complete UNIT-IV		8			No. of classes taken:			

UNIT-V : PROJECT TEAM BUILDING

S.No.	Topics to be covered	No. of Classes Required	TentativeDate of Completion	ActualDate of Completion	Teaching learning Methods	LearningOutcome COs	Textbook followed	HOD Sign Weekly
113.	Leading Project Teams Building a Project Team	1	20.05.2022		TLM1/TLM2	CO5	T2/R3	
114.	Characteristics of Effective Project Team	1	21.05.2022		TLM1/TLM2	CO5	T2/R3	
115.	Achieving cross functional	1	25.05.2022		TLM1/TLM2	CO5	T2/R3	
116.	Functional cooperation	1	27.05.2022		TLM1/TLM2	CO5	T2/R3	
117.	Virtual Project teams	1	28.05.2022		TLM1/TLM2	CO5	T2/R3	
118.	Conflicts Management	1	01.06.2022		TLM1/TLM2	CO5	T2/R3	
119.	Management Negotiations	1	03.06.2022		TLM1/TLM2	CO5	T2/R3	
120.	Case Studies	1	04.06.2022		TLM1/TLM2	CO5	T2/R3	
No. of classes required to complete UNIT-V		8			**No. of classes taken:**			

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

ACADEMIC CALENDAR:

Description	From	To	Weeks
I Phase of Instructions	21.02.2022	09.04.2022	7W
I Mid Examinations	11.04.2022	16.04.2022	1W
II Phase of Instructions	18.04.2022	04.06.2022	7W
II Mid Examinations	06.06.2022	11.06.2022	1W
Preparation and Practicals	13.06.2022	18.06.2022	1W
Semester End Examinations	20.06.2022	02.07.2022	2W

EVALUATION PROCESS:

Evaluation Task	COs	Marks
Assignment–1	1	A1=5
Assignment–2	2	A2=5
I-Mid Examination	1,2	B1=20
Online Quiz-Q1	1,2	Q1-10
Assignment – 3	3	A3=5
Assignment– 4	4	A4=5
Assignment – 5	5	A5=5
II-Mid Examination	3,4,5	B2=20
Online Quiz-Q2	3,4,5	Q2-10
Evaluation of Assignment Marks: A=(A1+A2+A3+A4+A5)/5	1,2,3,4,5	A=5
Evaluation of Online Quiz Marks: Q=(Q1+Q2)/2	1,2,3,4,5	Q=10
Evaluation of Mid Marks: B=75% of Max(B1,B2)+25% of Min(B1,B2)	1,2,3,4,5	B=20
Attendance		C= 5
Cumulative Internal Examination: A+Q+B+C	**1,2,3,4,5**	**40**
Semester End Examinations	**1,2,3,4,5**	**60**
Total Marks: 40+60	**1,2,3,4,5**	**100**

PROGRAMME EDUCATIONAL OBJECTIVES:

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

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

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

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

Signature				
Name	**Kamala Priya B**	**Mr. S. Srinivasa Reddy**	**J. Subba Reddy**	**Dr. S. Pichi Reddy**
Designation	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**HOD**

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

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : A Nageswara Rao / P. Mounika
Course Name & Code : CAD/CAM LAB & 17ME70
L-T-P Structure : 0-0-2 **Credits :** 1
Program/Sem/Sec : B.Tech., MECH., VI-Sem., Section- B **A.Y :** 2021-22

PRE-REQUISITE: CAD/CAM

COURSE EDUCATIONAL OBJECTIVES (CEOs): The main objective of this course is to model, assemble and manufacture engineering components using computer aided tools.

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

CO 1	Design and assemble of the components using geometric modeling software
CO 2	Apply the finite element analysis for components design.
CO 3	Develop NC code for different part profiles and perform machining on CNC Machines.
CO 4	Manipulate the robot by writing programs and executing them

MATERIAL:
T1 Lab Manual

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

Batch-I

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	Introduction	2	22.02.2022		TLM4	
2	Knuckle joint - Part drawing	2	08.03.2022		TLM4	
3	Knuckle joint - Assembly		08.03.2022		TLM4	
4	Universal coupling - Part drawing	2	15.03.2022		TLM4	
5	Universal coupling - Assembly		15.03.2022		TLM4	
6	Piston-Connecting rod - Part drawing	2	22.03.2022		TLM4	
7	Piston-Connecting rod - Assembly		22.03.2022		TLM4	
8	Cantilever beam structural analysis	2	29.03.2022		TLM4	
9	Truss structural analysis	2	12.04.2022		TLM4	
10	Knuckle joint structural analysis	2	19.04.2022		TLM4	
11	Spring-mass system modal analysis	2	26.04.2022		TLM4	
12	Pin Fin heat transfer analysis	2	10.05.2022		TLM4	
13	Linear and circular interpolation using XL mill	2	17.05.2022		TLM4	
14	CNC programming for turning operation	2	24.05.2022		TLM4	
15	Advanced Experiment	2	24.05.2022			
15	Internal Exam	2	31.05.2022		TLM4	
No. of classes required to complete				No. of classes taken:		

Batch-II

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	Introduction	2	24.02.2022		TLM4	
2	Knuckle joint - Part drawing	2	03.03.2022		TLM4	
3	Knuckle joint - Assembly		03.03.2022		TLM4	
4	Universal coupling - Part drawing	2	10.03.2022		TLM4	
5	Universal coupling - Assembly		10.03.2022		TLM4	
6	Piston-Connecting rod - Part drawing	2	17.03.2022		TLM4	
7	Piston-Connecting rod - Assembly		17.03.2022		TLM4	
8	Cantilever beam structural analysis	2	24.03.2022		TLM4	
9	Truss structural analysis	2	31.03.2022		TLM4	
10	Knuckle joint structural analysis	2	07.04.2022		TLM4	
11	Spring-mass system modal analysis	2	21.04.2022		TLM4	
12	Pin Fin heat transfer analysis	2	28.04.2022		TLM4	
13	Linear and circular interpolation using XL mill	2	05.05.2022		TLM4	
14	CNC programming for turning operation	2	12.05.2022		TLM4	
15	Advanced Experiment	2	19.05.2022			
15	Internal Exam	2	26.05.2022		TLM4	
No. of classes required to complete				No. of classes taken:		

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

PART-C

PROGRAMME OUTCOMES (POs):

PO 1	An ability to apply knowledge of Mathematics, Sciences and Engineering fundamentals to find the solution to real time Mechanical Engineering problems.
PO 2	An ability to identify and formulate mathematical models to analyze complex engineering problems.
PO 3	An ability to design a mechanical systems/ processes to meet the desired needs within realistic constraints such as economic, environmental, societal, health & safety .
PO 4	An ability to design and conduct experiments, perform analysis, interpretation of data and synthesis of information to provide valid conclusions.
PO 5	An ability to develop the model and analyze the Mechanical systems using modern software tools.
PO 6	An ability to understand societal, health, safety, legal, cultural issues and the consequent responsibilities relevant to engineering practice.
PO 7	An ability to understand the impact of engineering solutions in societal, environmental context and demonstrate the knowledge for sustainable development.
PO 8	An ability to understand the professional ethics to follow the norms of engineering practice.
PO 9	An ability to function effectively as an individual and as a member / leader in diverse technical teams.
PO 10	An ability to communicate effectively with the engineering community and society through reports & presentations.
PO 11	An ability to apply management principles to organise the multidisciplinary projects.
PO 12	An ability to understand the need of independent and lifelong learning so as to address day to day technological changes.

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.

Course Instructor	Course Coordinator	Module Coordinator	HOD
A.Nageswara Rao/P. Mounika	A.Nageswara Rao	J.Subba reddy	Dr.S.Pichi Reddy

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(AUTONOMOUS)

Accredited by NAAC & NBA (CSE, IT, ECE, EEE & ME) under Tier - I

Approved by AICTE and Permanently Affiliated to JNTUK, Kakinada

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

Part-A

PROGRAM : B.Tech.VI Semester, Mechanical Engineering (Section-B)
ACADEMIC YEAR : 2021-22
COURSE NAME & CODE : Employability Enhancement Skills-II – 17PD08
L-T-P STRUCTURE : 1 (L) – 0 (T) -0
COURSE CREDITS : NIL
COURSE INSTRUCTOR : **Mr. T. Bala Krishna, Assistant Professor;**
Mrs. K. Samaikya, Assistant Professor
COURSE COORDINATOR : **Mrs. K. Samaikya, Assistant Professor**
PRE-REQUISITES : Nil

COURSE EDUCATIONAL OBJECTIVES (CEOs):

To develop language & communication skills to augment professional development

To inculcate industry-readiness skills among professional students

To familiarize students with elements of Quantitative techniques, Reasoning required for placement tests.

To acquaint the students with concepts and tools that will serve as building blocks for analytical thinking

To help students in career planning and professional development

COURSE OUTCOMES (COs)

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

CO 1	To identify, analyze and apply quantitative techniques related to qualify in Placement tests.
CO 2	To effectively utilize verbal ability & communication skills to qualify in Placement tests.
CO 3	To effectively communicate in professional as well as social contexts.
CO 4	To apply key soft skills effectively in Job Interviews as well in other professional contexts.
CO 5	Inculcate lifelong learning through personal effectiveness as well as leadership.

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

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

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

SYLLABUS

UNIT – I:
Verbal Ability: Tenses& Conditional Clauses
Quantitative Aptitude: Alligation or Mixture, Simple Interest and Compound Interest

UNIT – II:
Verbal Ability: Sentence Completions
Quantitative Aptitude: Time and work, Pipes and Cistern, Permutations and Combinations, Probability

UNIT – III:
Verbal Ability: Spot the Errors
Quantitative Aptitude: Time and Distance, Problems on trains, Boats and Streams, Races and Games of Skill

UNIT – IV:
Verbal Ability: Jumbled Sentences, Cloze Tests
Quantitative Aptitude: Area, Volume and Surface Areas, Progressions

UNIT – V:
Verbal Ability: Advanced Reading Comprehension
Quantitative Aptitude: Clocks and Calendars, Cubes and Dice

BOS APPROVED TEXT BOOKS:

1. Objective Arithmetic, S. CHAND Publishers.
2. R.S.AGGARWAL, *Verbal & Non-Verbal Reasoning*, S. CHAND Publishers
3. Objective English. Edgar Thorpe, Pearson Education, New Delhi.2009
4. Sanjay Kumar, Pushpa Lata: Communication skills. Oxford, Delhi, 2012
5. Vocabulary Builder for Students of Engineering and Technology (A self – study manual for vocabulary Enhancement) Y.Saloman Raju, Maruthi Publishers

BOS APPROVED REFERENCE BOOKS:

1. Meenakshi Raman, Sangeetha: Technical Communication, Oxford University Press, 2008
2. Baron's Guide on GRE
3. Vocabulary Builder for Students of Engineering and Technology (A self – study manual for vocabulary Enhancement) Y.Saloman Raju, Maruthi Publishers

4. Dinesh Khattar, *The Pearson Guide to Quantitative Aptitude*, Pearson Education
5. M. Tyra, *Magical Book on Quicker Maths*, BSC Publishers Quantitative Aptitude by Arun Sharma

Part-B
COURSE DELIVERY PLAN (LESSON PLAN): Section-B

UNIT-I:

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 –Alligation or Mixture	1	21-02-2022		**TLM1**	CO1	T1, T2	
2.	Introduction to course- Tenses	1	22-02-2022		**TLM1**	CO1	T1, T2	
3.	Problems on Alligation or Mixture	1	28-02-2022		**TLM1**	CO1	T1, T2	
4.	Simple Interest & Compound Interest	1	7-03-2022		**TLM1**	CO1	T1, T2	
5.	Tenses worksheet	1	8-03-2022		**TLM1**	CO1	T1, T2	
6.	Problems on Simple Interest & Compound Interest	1	14-03-2022		**TLM1**	CO1	T1, T2	
7.	Conditional Clauses	1	15-03-2022		**TLM1**	CO1	T1, T2	
No. of classes required to complete UNIT-I:		7			No. of classes taken:			

UNIT-II:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
8.	Time and Work, Pipes and Cistern	1	21-03-2022		**TLM1**	CO2	T1, T2	
9.	Sentence Completion	1	22-03-2022		**TLM1**	CO2	T1, T2	
10.	Permutations and Combinations	1	28-03-2022		**TLM1**	CO2	T1, T2	
11.	Sentence Completion worksheet	1	29-03-2022		**TLM1**	CO2	T1, T2	
12.	Probability	1	04-04-2022		**TLM1**	CO2	T1, T2	
13.	**I Mid Examinations**	6 days	11-04-2022 to 16-04-2022					
No. of classes required to complete UNIT-II:		5			No. of classes taken:			

UNIT-III:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
14.	Time and Distance	1	18-04-2022		**TLM1**	CO3	T1, T2	
15.	Error spotting	1	19-04-2022		**TLM1**	CO3	T1, T2	
16.	Problems on Trains, Boats and Streams	1	25-04-2022		**TLM1**	CO3	T1, T2	
17.	Error spotting worksheet	1	26-04-2022		**TLM1**	CO3	T1, T2	
18.	Races and Games of Skill	1	02-05-2022		**TLM1**	CO3	T1, T2	
No. of classes required to complete UNIT-III		5			No. of classes taken:			

UNIT-IV:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
19.	Jumbled sentences	1	09-05-2022		**TLM1**	CO4	T1, T2	
20.	Area, Volumes and Surface Area	1	10-05-2022		**TLM1**	CO4	T1, T2	
21.	Jumbled sentences worksheet	1	16-05-2022		**TLM1**	CO4	T1, T2	
22.	Progressions	1	17-05-2022		**TLM1**	CO4	T1, T2	
No. of classes required to complete UNIT-IV		4			No. of classes taken:			

UNIT-V:

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
23.	Advanced Reading Comprehension passages	1	23-05-2022		**TLM1**	CO5	T1, T2	
24.	Clocks & Calendars	1	24-05-2022		**TLM1**	CO5	T1, T2	
25.	Advanced Reading Comprehension passages	1	30-05-2022		**TLM1**	CO5	T1, T2	
26.	Cubes and Dice	1	31-05-2022		**TLM1**	CO5	T1, T2	
27.	**II Mid Examinations**	6 days	6-6-2022 to 11-6-2022					
No. of classes required to complete UNIT-V : 4					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
1.	Advanced Topics in Unit I	1			**TLM1**	CO1	T1, T2, R1 to R5	
2.	Advanced Topics in Unit II	1			**TLM1**	CO2		
3.	Advanced Topics in Unit III	1			**TLM1**	CO3		
4.	Advanced Topics in Unit IV	1			**TLM1**	CO4		
5.	Advanced Topics in Unit V	1			**TLM1**	CO5		

PART-B

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

ACADEMIC CALENDAR:

Description	From	To	Weeks
Commencement of Class Work: 21-02-2022			
I Phase of Instructions	21-02-2022	09-04-2022	7 W
I Mid Examinations	11-04-2022	16-04-2022	1 W
II Phase of Instructions	18-04-2022	04-06-2022	7 W
II Mid Examinations	06-06-2022	11-06-2022	1 W
Preparation and Practical's	13-06-2022	18-06-2022	1 W
Semester End Examinations	20-06-2022	02-07-2022	2 W

Part - C

EVALUATION PROCESS: R17 Regulation

Evaluation Task	**Marks**
Cumulative Internal Examination (CIE) :	100
Total Marks = CIE	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 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.

Position	***Course Instructor***	***Course Coordinator***	***Module Coordinator***	***HOD***
Name	**K.SAMAIKYA/** **T. BALA KRSIHNA**	**K.SAMAIKYA**	**Dr. SUJITH KUMAR RATH**	**Dr. SUJITH KUMAR RATH**
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

Name of Course Instructor : V.Venkatrami Reddy
Course Name & Code : CAD/CAM & 17ME22
L-T-P Structure : 3-0-0 Credits : 3
Program/Sem/Sec : B.Tech., MECH., VI-Sem., Sections- C A.Y : 2021-22

PRE-REQUISITE: Machine Drawing, Machine Design, Machine Tools

COURSE EDUCATIONAL OBJECTIVES (CEOs): The main objective of this course is to familiarize the principles of geometric modelling, numerical control and part programming.

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

CO 1	Comprehend the principles of CAD/CAM for design and manufacturing
CO 2	Formulate mathematical equations for geometrical entities like curves, surface, and solids.
CO 3	Program for part profiles to accomplish numerical control machining
CO 4	Develop a pseudo codes for different parts using GT codes and apply in automated manufacturing systems.
CO 5	Become cognizant about CAQC techniques that are to be applied in manufacturing industry and able to comprehend the applications of Computer Integrated Manufacturing.

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

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

TEXT BOOKS:

BOS APPROVED TEXT BOOKS:

T1 MikelP.Groover and Emory W.Zimmers, CAD/CAM-prentice Hall of India private Ltd.New Delhi, 20thedition, May 2010.

T2 Ibrahim Zeid, Mastering CAD/CAM, TATA McGraw-Hill publishing Co.Ltd, New Delhi2011.

T3 P N Rao, CAD/CAM Principle and applications, Tata McGraw Hill Education Private Ltd,New Delhi,8th edition 2013.

BOS APPROVED REFERENCE BOOKS:

R1 P.Radhakrishnan, S.Subramanyam &V.Raju, CAD/CAM/CIM, New Age International

Publishers,3rd edition 2010.

R2 MikelP.Groover, Automaiton, Production Systems and Computer Integrated Manufacturing, Prentice Hall of India private Ltd.New Delhi, 3rd edition, May 2008.

R3 Ibrahim Zeid and R. Sivasubramanian, CAD/CAM theory and practice, Tata McGraw Hill publishing Co. Ltd,New Delhi 2009.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction CAD/CAM, Computer Graphics

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction to CAD/CAM, Product Cycle Revised with CAD/CAM	1	21-02-2022		**TLM1**	
2.	Creating Manufacturing database & Benefits of CAD	1	23.02.2022		**TLM1**	
3.	Computer Graphics- Introduction , Database structure	1	25.02.2022		**TLM1**	
4.	Functions of a graphics package	1	28-02-2022		**TLM1**	
5.	Raster scan graphics	1	02-03-2022		**TLM1**	
6.	Concatenated transformations.	1	04-03-2022		**TLM1**	
7.	Translation, scaling, reflection, rotation	1	07-03-2022		**TLM1**	
8.	Problems on Transformations	1	9-03-2022		**TLM1**	
No. of classes required to complete UNIT-I:08				No. of classes taken:		

UNIT-II: Geometric Modeling

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.	Geometric Modelling: Introduction		11-03-2022		**TLM1**	
2.	Wireframe Modelling: Entities wireframe models		14-03-2022		**TLM1**	
3.	Parametric representation of analytical curves		16-03-2022		**TLM1**	
4.	Hermite cubic spline curve		18.03.2022		**TLM1**	
5.	Bezier and B-spline curves		21.03.2022		**TLM1**	
6.	Characteristics of Curves, Problems		23.03.2022		**TLM1**	
7.	Surface representation: Entities		25.03.2022		**TLM1**	
8.	Solid modelling		28.03.2022		**TLM1**	
9.	B-Rep, CSG		30.03.2022		**TLM1**	
No. of classes required to complete UNIT-II:9				No. of classes taken:		

UNIT-III: NC Programming

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.	Numerical control: Introduction, NC Modes	1	01.04.2022		**TLM1**	
2.	NC elements, N C Coordinate systems	1	04.04.2022		**TLM1**	
3.	Structure of CNC machine tools	1	06.04.2022		**TLM1**	
4.	Spindle design and spindle drives,	1	08.04.2022		**TLM1**	
5.	Feed drives, actuation systems	1	18-04-2022		**TLM1**	
6.	CNC Part programming: fundamentals	1	20-04-2022		**TLM1**	
7.	Manual part programming	1	22-04-2022		**TLM1**	
8.	Computer Aided part programming	1	25-04-2022		**TLM1**	
9.	Part programming examples	1	27.04.2022		**TLM1**	
No. of classes required to complete UNIT-III:9				No. of classes taken:		

UNIT-IV : Group Technology, FMS, CAPP

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.	Group Technology	1	02.05.2022		**TLM1**	
2.	Coding and classification schemes- OPITZ	1	04.05.2022		**TLM1**	
3.	MICLASS, example for coding	1	06.05.2022		**TLM1**	
4.	CODE Systems, examples for coding	1	09.05.2022		**TLM1**	
5.	Production Flow Analysis, Advantages and limitations, GT Machine cells, Benefits of GT	1	11.05.2022		**TLM1**	
6.	CAPP- Retrieval and Generative	1	13.05.2022		**TLM1**	
7.	FMS equipment, FMS layouts, benefits	1	16.05.2022		**TLM1**	
8.	FMS Planning and implementation,	1	18.05.2022		**TLM1**	
No. of classes required to complete UNIT-IV:9				No. of classes taken:		

UNIT-V : CAQC, CIM, Lean Manufacturing

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.	CAQC: Introduction, The computers in QC	1	20.05.2022		**TLM1**	
2.	Contact inspection methods	1	23.05.2022		**TLM1**	
3.	Non-Contact inspection methods: Optical	1	25.05.2022		**TLM1**	
4.	Non-Contact inspection methods: non optical	1	27.05.2022		**TLM1**	
5.	Computer aided testing, CAQC with CAD/CAM	1	30.05.2022		**TLM1**	
6.	CIM Introduction, CIM integration, Implementation	1	01.06.2022		**TLM1**	
7.	Benefits of CIM, Lean manufacturing	1	03.06.2022		**TLM1**	

No. of classes required to complete UNIT-V:7	No. of classes taken:

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

PART-C

EVALUATION PROCESS (R17 Regulations):

Evaluation Task	**Marks**
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20
I-Quiz Examination (Units-I & II)	Q1=10
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10
Attendance	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	40
Semester End Examination (SEE)	60
Total Marks = CIE + SEE	100

PART-D

PROGRAMME OUTCOMES (POs):

PO 1	An ability to apply knowledge of Mathematics, Sciences and Engineering fundamentals to find the solution to real time Mechanical Engineering problems.
PO 2	An ability to identify and formulate mathematical models to analyze complex engineering problems.
PO 3	An ability to design a mechanical systems/ processes to meet the desired needs within realistic constraints such as economic, environmental, societal, health & safety .
PO 4	An ability to design and conduct experiments, perform analysis, interpretation of data and synthesis of information to provide valid conclusions.

PO 5	An ability to develop the model and analyze the Mechanical systems using modern software tools.
PO 6	An ability to understand societal, health, safety, legal, cultural issues and the consequent responsibilities relevant to engineering practice.
PO 7	An ability to understand the impact of engineering solutions in societal, environmental context and demonstrate the knowledge for sustainable development.
PO 8	An ability to understand the professional ethics to follow the norms of engineering practice.
PO 9	An ability to function effectively as an individual and as a member / leader in diverse technical teams.
PO 10	An ability to communicate effectively with the engineering community and society through reports & presentations.
PO 11	An ability to apply management principles to organise the multidisciplinary projects.
PO 12	An ability to understand the need of independent and lifelong learning so as to address day to day technological changes.

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.

Course Instructor	**Course Coordinator**	**Module Coordinator**	**HOD**
V.Venkatrami Reddy	A NAGESWARA RAO	J SUBBAREDDY	Dr S PICHI REDDY

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

COURSE HANDOUT

PART-A

Name of Course Instructor: Dr. Siva Sankara Babu chinka

COURSE NAME & CODE : FINITE ELEMENT ANALYSIS – 17ME23

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

Program /Sem/Sec : B.Tech. MECH., VI-Sem., Section -C A.Y:2021-22

Course Coordinator : B. Sudheer Kumar

PRE-REQUISITE: Mechanics of Materials, Machine Design, Numerical Methods & Heat Transfer

COURSE EDUCATIONAL OBJECTIVES (CEOs): The main objective of this course is to introduce the mathematical concepts of the Finite Element Method for obtaining an approximate solution of ordinary and partial differential equations and to understand the use of the basic finite elements for structural applications using beam, plane elements and use of the FE method for heat transfer problems.

COURSE OUTCOMES (CO):

CO1	Identify mathematical model for solution of common engineering problems.
CO2	Solve the flexure elements subjected to loading and plane stress problems.
CO3	Solve the 2-D structures with isoparametric elements and axi-symmetric problem.
CO4	Analyze complex cases involving heat transfer with the applications of fem.
CO5	Formulate the finite element model for stepped bar & beam and perform the simulation.

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	3	2	3		3					3	2			3
CO2	2	2	2	3	3	3					3	2			3
CO3	2	3	2	2	3	3					3	2			3
CO4	3	2	2	3		3					3	2			3
CO5	2	2	2	3	3	3					3	2			3

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

TEXT BOOKS:

T1 Chandraputla, Ashok and Belegundu, Introduction to Finite Elements in Engineering, 3rd edition,Prentice-Hall,2008

T2 S.S Rao, The Finite Element Methods in Engineering4th edition,B.H.Pergamon.2010

REFERENCE BOOKS:

R1 JN.Reddy, An introduction to Finite Element Method, 3rd edition, Mc Graw Hill, 2011.

R2 George R. Buchanan and R.RudraMoorthy, Finite Element Analysis, Tata Mc Graw Hill, 2006

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: ONE DIMENSIONAL PROBLEM

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
9.	Introduction to Finite Element Method	1	21-02-2022		**TLM1, TLM2**	
10.	Equilibrium equations in elasticity, Stresses in typical element, Stresses& equilibrium	1	22-02-2022		**TLM1**	
11.	Strain displacement relations, Stress strain relations	1	23-02-2022		**TLM1**	
12.	Plane stress and plane strain problems. Potential energy and equilibrium method	1	28-02-2022		**TLM1**	
13.	FE Formulation from governing differential equations. One dimensional Problem, FE Modeling	1	02-03-2022		**TLM1**	
14.	Shape functions & coordinates of shape functions	1	07-03-2022		**TLM1**	
15.	Assembly of GSM & Load vector, Finite element equations and treatment of boundary conditions	1	08-03-2022		**TLM1**	
16.	Problems	1	09-03-2022		**TLM1**	
17.	Problems Assignment/Quiz-1	1	14-03-2022		**TLM1 TLM6**	
No. of classes required to complete: 9				No. of classes taken:		

UNIT-II: ANALYSIS OF BEAMS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Analysis of Beams: Beam elements	1	15-03-2022		**TLM1**	
2.	Types loading, DOF, Boundary conditions	1	16-03-2022		**TLM1**	
3.	Hermite shape functions	1	21-03-2022		**TLM1**	
4.	Stiffness matrix for two node DOF per node	1	22-03-2022		**TLM1**	
5.	Problems	1	23-03-2022		**TLM1**	
6.	2-D elements (CST), Boundary Conditions.	1	28-03-2022		**TLM1**	
7.	Jacobian, Shape functions, Area of triangles	1	29-03-2022		**TLM1**	
8.	Problems	1	30-03-2022		**TLM1**	
9.	Assignment/Quiz-2	1	04-04-2022		**TLM6**	
No. of classes required to complete:9				No. of classes taken:		

UNIT-III: AXISYMMETRIC LOADING AND NUMERICAL INTEGRATION

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.	Axisymmetric solids, Axisymmetric loading	1	18-04-2022		**TLM1 TLM2**	
2.	Finite element modeling	1	19-04-2022		**TLM1**	
3.	Axisymmetric loading with triangular elements	1	20-04-2022		**TLM1**	
4.	Problems	1	25-04-2022		**TLM1**	
5.	2-D four nodded isoparametric elements, Jacobian, shape functions	1	26-04-2022		**TLM1**	
6.	Problems	1	27-04-2022		**TLM1**	
7.	Isoparametric formulation of 4-node quadrilateral element- Problems Assignment/Quiz-3	1	02-05-2022		**TLM1**	
No. of classes required to complete: 7			No. of classes taken:			

UNIT-IV: HEAT TRANSFER ANALYSIS

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.	One dimensional analysis of HT problems	1	04-05-2022		**TLM1, TLM2**	
2.	Conductivity matrix, boundary conditions	1	09-05-2022		**TLM1**	
3.	1-D analysis of a fin, Conductivity matrix boundary conditions, Problems	1	10-05-2022		**TLM1**	
4.	Problems	1	11-05-2022		**TLM1**	
5.	Problems	1	16-05-2022		**TLM1**	
6.	Two dimensional analysis of thin plate &Conductivity matrix, boundary conditions	1	17-05-2022		**TLM1**	
7.	Convection matrix, Heat rate vector Problems. Assignment/Quiz-4	1	18-05-2022		**TLM1 TLM6**	
No. of classes required to complete: 07			No. of classes taken:			

UNIT-V: DYNAMIC ANALYSIS

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.	Dynamic analysis introduction, Formulation	1	23-05-2022		**TLM1**	
2.	Mass matrices, consistent Mass Matrices, Lumped Mass Matrices	1	24-05-2022		**TLM1**	
3.	Evaluation of Eigen values & Eigen vectors	1	25-05-2022		**TLM1**	
4.	Problems	1	30-05-2022		**TLM1**	
5.	Problems	1	31-05-2022		**TLM1**	
6.	Assignment/Quiz-5	1	01-06-2022		**TLM6**	
No. of classes required to complete:06			No. of classes taken:			

Contents beyond the Syllabus

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
18.	Analysis of beams for Uniformly variable loads	1	06-04-2022		**TLM1**	
	Evaluation of Eigen values & Eigenvectors for beams	1	25-05-2022		**TLM1**	

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 Regulations):

Evaluation Task	**Marks**
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20
I-Quiz Examination (Units-I & II)	Q1=10
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10
Attendance	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	40
Semester End Examination (SEE)	60
Total Marks = CIE + SEE	100

PART-D

PROGRAMME OUTCOMES (POs):

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

Dr.Siva Sankara Babu.Ch	**B.Sudheer Kumar**	**B.Sudheer Kumar**	**Dr.S.Pichi Reddy**
Course Instructor	**Course Coordinator**	**Module Coordinator**	**HOD**

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

COURSE HANDOUT

Part-A

PROGRAM : B.Tech, VI-Sem., ME, C/S
ACADEMIC YEAR : 2021-22
COURSE NAME & CODE : Heat Transfer Lab &17ME71
L-T-P STRUCTURE : 0-0-3
COURSE CREDITS : 2
LABORATORY INSTRUCTORS : Dr. P.Ravindra Kumar/A.Pratyush
LABORATORY INCHARGE : K.Lakshmi Prasad
PREREQUISITE SUBJECT: Thermodynamics, Thermal Engineering

COURSE EDUCATIONAL OBJECTIVES:

To learn the physical mechanisms on modes of heat transfer, differential equations in heat transfer applications and the significance of Non Dimensional Numbers.

Course Outcomes:

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

CO1: Estimate the thermal conductivity of different materials and powders
CO2: Experiment both free and forced convection to predict heat transfer coefficient.
CO3: Validate the Stefan Boltzmann Constant and estimate emissivity of grey body.
CO4: Compare parallel and counter flow heat exchanger performance characteristics.

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

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

BOS APPROVED TEXT BOOKS:

Lab Manuals, Heat and Mass Transfer Data Book, 6th Edition, New Age International Publishers

Part-B

COURSE: B.Tech BRANCH: MECHANICAL ENGG. SECTION: C-Sec (Monday) BATCH: 2 A.Y:2019-20

S. No	Batch	EXP. No	0	1	2	3	4	5	6	7	8	9	10	11	12
		Date	23.02.2022	25.02.2022	02.03.2022	04.03.2022	09.03.2022	11.03.2022	16.03.2022	23.03.2022	25.03.2022	30.03.2022	01.04.2022	06.04.2022	08.04.2022
		Regd. No	CYCLE-I						CYCLE-2						
1	BATCH-I	17761A03F0	DEMO	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	REPETITION	INTERNAL LAB TEST
2		19761A0396													
3		19761A0397													
4		19761A0398													
5		19761A0399													
6		19761A03A0													
7	BATCH-2	19761A03A1	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		
8		19761A03A2													
9		19761A03A3													
10		19761A03A4													
11		19761A03A5													
12		19761A03A6													
13	BATCH-3	19761A03A7	DEMO	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2		
14		19761A03A8													
15		19761A03A9													
16		19761A03B0													
17		19761A03B1													
18		19761A03B2													

19	BATCH-4	19761A03B3	DEMO	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	REPETITION	INTERNAL LAB TEST
20		19761A03B4													
21		19761A03B5													
22		19761A03B6													
23		19761A03B7													
24		19761A03B8													
25		19761A03B9													
26	BATCH-5	19761A03C0	DEMO	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4		
27		19761A03C1													
28		19761A03C2													
29		19761A03C3													
30		19761A03C4													
31		19761A03C5													
32		19761A03C6													

LAB INCHARGE

COURSE: B.Tech **BRANCH: MECHANICAL** **SECTION: C-Sec (Friday)** **BATCH: 1** **A.Y:2019-20**

S.No	Batch	EXP. No	0	1	2	3	4	5	6	7	8	9	10	11	12
		Date	20.04.2022	22.04.2022	27.04.2022	29.04.2022	04.05.2022	06.05.2022	11.05.2022	13.05.2022	18.05.2022	25.05.2022	28.05.2022	01.06.2022	04.06.2022
		Regd. No	CYCLE-I						CYCLE-2						
1	BATCH-I	19761A03C7	DEMO	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	REPETITION	INTERNAL LAB TEST
2		19761A03C8													
3		19761A03C9													
4		19761A03D0													
5		19761A03D1													
6		19761A03D2													
7	BATCH-2	19761A03D3	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		
8		19761A03D4													
9		19761A03D5													
10		19761A03D6													
11		19761A03D7													
12		19761A03D8													
13	BATCH-3	19761A03D9	DEMO	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2		
14		19761A03E0													
15		20765A0331													
16		20765A0332													
17		20765A0333													
18		20765A0334													

19	BATCH-4	20765A0335	DEMO	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	REPETITION	INTERNAL LAB TEST
20		20765A0336													
21		20765A0337													
22		20765A0338													
23		20765A0339													
24		20765A0340													
25	BATCH-5	20765A0341	DEMO	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4		
26		20765A0342													
27		20765A0343													
28		20765A0344													

LAB INCHARGE

LAKIREDDY BALIREDDY COLLEGE OF ENGINEERING (AUTONOMOUS)
MYLAVARAM

DEPARTMENT OF MECHANICAL ENGINEERING

HEAT TRANSFER LABORATORY

LIST OF EXPERIMENTS

Course: B.Tech Branch: Mech. Sem: VI Section: A&B&C Sec Batch: 2017 A.Y: 2019-20

S.No	Cycle	Exp. Code	Name of the Experiment
1	CYCLE-I	DEMO	DEMONSTRATION
2		HT-1	Determination of Thermal Conductivity of Lagged Pipe (Glass wool).
3		HT-2	Determination of Thermal Conductivity of Insulating Powder(Asbestos)
4		HT-3	Determination of Thermal Conductivity of Metal Bar (Brass).
5		HT-4	Study of Transient Heat Conduction (Unsteady Heat Conduction).
6		HT-5	Determination of Thermal Conductivity of given Liquid
7	CYCLE-II	HT-1	Heat Pipe Demonstration.
8		HT-2	Test on Pin-Fin Apparatus.
9		HT-3	Determination of Convective Heat Transfer Co-efficient of air in Natural Convection.
10		HT-4	Test on Emissivity Measurement Apparatus.
11		HT-5	(A) Test on Tube in Tube Parallel Flow Heat Exchanger. (B) Test on Tube in Tube Counter Flow Heat Exchanger.
12		REP	REPETITION
13		INT	INTERNAL LAB TEST

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:

Evaluation Task	COs	Marks

Day to Day Evaluation	1	A=10
Record	2	B=5
Internal Examination	3	C=10
Cumulative Internal Marks : A+B+C	**1,2,3**	**A+B+C=25**
Semester End Examinations	**1,2,3**	**D=50**
Total Marks: A+B+C+D	**1,2,3**	**75**

PROGRAMME OUTCOMES (POs) & PROGRAM SPECIFIC OUTCOMES:

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

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

DEPARTMENT OF MECHANICAL ENGINEERING
COURSE HANDOUT

Part-A

PROGRAM : B.Tech, VI Sem., Mechanical Engineering
ACADEMIC YEAR : 2021-22
COURSE NAME & CODE : **Automobile Engineering-17ME24**
L-T-P STRUCTURE : 3 (L) – 0 (T) – 0 (P)
COURSE CREDITS : 3
COURSE INSTRUCTOR : **Mr. K Lakshmi Prasad**
COURSE COORDINATOR : **Mr. K Lakshmi Prasad**
RE-REQUISITES : **Thermodynamics, Internal Combustion Engines**

COURSE EDUCATIONAL OBJECTIVES (CEOs): The objective of this course is to make students learn about automobile layout, Engine Emissions, working of Transmission system, Steering system, Suspension system, Braking system, Fuel system and different Electrical systems.

COURSE OUTCOMES (COs)

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

CO1 : Acquire the basic knowledge of anatomy of an Automobile and its components.
CO2 : Comprehend the fuel supply system in petrol and Diesel Engines.
CO3 : Realize the functions of various electrical systems used in automobiles.
CO4 : Distinguish various transmission systems used in automobiles.
CO5 : Compare various types of Steering systems, Braking systems and Suspension systems.

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	2		
CO2						2	3	2		1		2	2		
CO3			2			2	2						2		1
CO4	1	1				2	2					2	2		2
CO5		2				2	2					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 Dr. Kirpal Singh, Automobile Engineering-Vol I& II, 13thEdition, Standard Publishers Distributors, 2014.
T2 R.B.Gupta, Automobile Engineering, 8th edition, Tech India publication series, 2013.

BOS APPROVED REFERENCE BOOKS:

R1 V.A.W Hillier and David R.Rogers, Hillier's Fundamentals of Motor Vehicle Technology, Book1, 5th edition- 2007.
R2 Heinz Heisler, Advanced Vehicle Technology, 2ndedition, Butterworth-Heinemann Series, 2002.
R3 David A Crolla, Automotive Engineering,1st edition, Butterworth-Heinemann series, 2009.

Part-B

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

UNIT-I: INTRODUCTION, ENGINE AND AUTOMOBILE POLLUTION

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
19.	Introduction to CO's and PO's	1	21.02.2022		TLM1/ TLM2	CO1	T1,T2	
20.	**Introduction-** Components of an Automobile, classification of automobiles	1	24.02.2022		TLM1/ TLM2	CO1	T1,T2	
21.	Chassis, Frame-Types, Specifications of Automobiles, Types of Automobiles	1	25.02.2022		TLM1/ TLM2	CO1	T1,T2	
22.	Rear wheel drive, front wheel drive and four wheel drive	1	28.02.2022		TLM1/ TLM2	CO1	T1,T2	
23.	**ENGINE:** Basic terminology and working of engines	1	03.03.2022		TLM1/ TLM2	CO1	T1,T2	
24.	Engine construction Details- Cylinder Block and Crankcase- Cylinder Head- Oil Pan- Manifolds- Gaskets- Cylinder Liners- Piston- Connecting Rod- Engine Valves,	2	04.03.2022 07.03.2022		TLM1/ TLM2	CO1	T1,T2	
25.	Firing Order, Turbo charging.	1	10.03.2022		TLM1/ TLM2	CO1	T1,T2	
26.	**AUTOMOBILE POLLUTION:** Emissions from Automobiles, Nitrogen oxides, Soot, Carbon monoxide, Hydrocarbons, Particulates, Emission Regulations	1	11.03.2022		TLM1/ TLM2	CO1	T1,T2	
No. of classes required to complete UNIT-I: 08					No. of classes taken:			

UNIT-II: ENGINE SERVICING, FUEL SUPPLY SYSTEM IN PETROL& DIESEL 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
1.	**ENGINE SERVICING:** Engine Removal, Cylinder Head, Gaskets, Valves, Piston-connecting Rod Assembly.	2	14.03.2022 17.03.2022		TLM1/ TLM2	CO2	T1,T2	
2.	Fuel Supply system in petrol engines-Fuel pump, fuel gauge, simple carburetor-defects	1	21.03.2022		TLM1/ TLM2	CO2	T1,T2	
3.	**Zenith carburetor, SU carburetor**	1	24.03.2022		TLM1/ TLM2	CO2	T1,T2	
4.	Petrol Injection- Types, Mechanical and Electronic injection systems.	1	25.03.2022		TLM1/ TLM2	CO2	T1,T2	
5.	Types of Injection systems in Diesel Engines-Fuel filters, Air filters, Air cleaners	1	28.03.2022		TLM1/ TLM2	CO2	T1,T2	
6.	**Fuel injection pumps-Jerk type pump**	1	31.03.2022		TLM1/ TLM2	CO2	T1,T2	
7.	Governors-Types	1	01.04.2022		TLM1/ TLM2	CO2	T1,T2	
No. of classes required to complete UNIT-II: 8					No. of classes taken:			

UNIT-III: IGNITION SYSTEM, CHARGING SYSTEM & STARTING SYTEMS

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.	**IGNITION SYSTEM:** Types of Ignition systems	1	04.04.2022		TLM1/ TLM2	CO3	T1,T2	
2.	Battery Ignition system- Components of Battery Ignition system, Ignition timing, Spark plug,	1	07.04.2022		TLM1/ TLM2	CO3	T1,T2	
3.	Magneto Ignition system,	1	08.04.2022		TLM1/ TLM2	CO3	T1,T2	
4.	Electronic Ignition system- Capacitive discharge Ignition system.	1	18.04.2022		TLM1/ TLM2	CO3	T1,T2	
5.	**CHARGING SYSTEM & STARTING SYTEMS:** Batteries- Types-Lead acid battery	1	21.04.2022		TLM1/ TLM2	CO3	T1,T2	
6.	Charging system- Introduction- Principle of Generator and constructional details, Generator output control	1	22.04.2022		TLM1/ TLM2	CO3	T1,T2	
7.	Starting Motor, Starting drives, Bendix rives, Solenoid switch.	1	25.04.2022		TLM1/ TLM2	CO3	T1,T2	
No. of classes required to complete UNIT-I: 07					No. of classes taken:			

UNIT-IV: TRANSMISSION SYSTEM, WHEELS AND TYRES

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.	**TRANSMISSION SYSTEM:** Clutches- Introduction, Types, Single plate clutch,	1	28.04.2022		TLM1/ TLM2	CO4	T1,T2	
2.	Multi plate Clutch, Centrifugal clutch, Fluid Fly wheel,	1	29.04.2022		TLM1/ TLM2	CO4	T1,T2	
3.	Necessity of Transmission , Types of Transmission, Sliding Mesh Gear Box.	1	02.05.2022		TLM1/ TLM2	CO4	T1,T2	
4.	Constant Mesh gear box, Torque convertor, Propeller shaft,	1	05.05.2022		TLM1/ TLM2	CO4	T1,T2	
5.	Final drive, Differential, Rear axle drives.	1	06.05.2022		TLM1/ TLM2	CO4	T1,T2	
6.	**WHEELS AND TYRES:** Types of Wheels, Wheel dimensions	1	09.05.2022		TLM1/ TLM2	CO4	T1,T2	
7.	Tyre- Types of Tyres, Carcass types, Tyre Materials, Tyre designations.	1	12.05.2022		TLM1/ TLM2	CO4	T1,T2	
No. of classes required to complete UNIT-I:-07					No. of classes taken:			

UNIT-V: FRONT AXLE AND STEERING, SUSPENSION SYSTEM, BRAKING SYSTEM

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.	Front Axle and Steering- Front Axle, Types of stub axle, Wheel alignment, Steering geometry- Camber- Kingpin inclination	2	13.05.2022 16.05.2022		TLM1/ TLM2	CO5	T1,T2	
2.	Combined angle and scrub radius- Castor- Toe in and Toe out,	1	19.05.2022		TLM1/ TLM2	CO5	T1,T2	
3.	Understeer and Oversteer, Power steering, Steering Linkages, Steering gears.	1	20.05.2022		TLM1/ TLM2	CO5	T1,T2	
4.	**SUSPENSION SYSTEM:** Introduction, Types of Suspension springs, Leaf springs, Coil springs, Torsion bars,	1	25.05.2022		TLM1/ TLM2	CO5	T1,T2	
5.	Shock Absorbers, Independent suspension- Types,	1	26.05.2022		TLM1/ TLM2	CO5	T1,T2	
6.	Air-suspension, **BRAKING SYSTEM:** Braking Requirements	1	27.05.2022		TLM1/ TLM2	CO5	T1,T2	
7.	Types of Brakes, Drum brakes and Disc Brakes,	1	30.05.2022		TLM1/ TLM2	CO5	T1,T2	
8.	Hydraulic Brakes, Air brakes, Anti-lock braking systems.	1	02.06.2022		TLM1/ TLM2	CO5	T1,T2	
No. of classes required to complete UNIT-I: 09					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
1.	Advanced Topics in all Units	1	03.06.2022		TLM1/ TLM2	CO1 - CO5	T1, T2, R1 to R5	

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

ACADEMIC CALENDAR:

Description	From	To	Weeks
Commencement of Class Work: 21.02.2022			
I Phase of Instructions	21.02.2022	09.04.2022	7
I Mid Examinations	11.04.2022	16.04.2022	1
II Phase of Instructions	18.04.2022	04.06.2022	7
II Mid Examinations	06.06.2022	11.06.2022	1
Preparation and Practical	13.06.2022	18.06.2022	1
Semester End Examinations	20.06.2022	02.07.2022	2

Part - C

EVALUATION PROCESS:

Evaluation Task	COs	Marks
Assignment/Quiz – 1	1	A1=05
Assignment/Quiz – 2	2	A2=05
I-Mid Examination	1,2	B1=20
I-Online Mid Examination	1,2	C1=10
Assignment/Quiz – 3	3	A3=05
Assignment/Quiz – 4	4	A4=05
Assignment/Quiz – 5	5	A5=05
II-Mid Examination	3,4,5	B2=20
II-Online Mid 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,B2)	1,2,3,4,5	**B=20**
Evaluation of Online Mid Marks: C=75% of Max(C1,C2)+25% of Min(C1,C	1,2,3,4,5	**C=10**
Attendance: D (≥95% =**5M**; 90%≤A<95%=**4M;** 85%≤A<90%=**3M;** 80%≤A<85%=**2M;** 75%≤A<80%=**1M; <75%=0M)**	-	**D=05**
Cumulative Internal Examination: A+B+C+D	**1,2,3,4,5**	**A+B+C+D=40**
Semester End Examinations: E	**1,2,3,4,5**	**E=60**
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 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.

Position	***Course Instructor***	***Course Coordinator***	***Module Coordinator***	***HOD***
Name	Mr. K. Lakshmi Prasad	Mr. K. Lakshmi Prasad	Dr. P.Vijay Kumar	**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

Name of Course Instructor : V.Venkatrami Reddy/K.Venkateswara Reddy

Course Name & Code : CAD/CAM LAB & 17ME70

L-T-P Structure : 0-0-2 **Credits:** 1
Program/Sem/Sec : B.Tech., MECH., VI-Sem., Section- B **A.Y** : 2021-22

PRE-REQUISITE: CAD/CAM

COURSE EDUCATIONAL OBJECTIVES (CEOs): The main objective of this course is tomodel, assemble and manufacture engineering components using computer aided tools.

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

CO 1	Design and assemble of the components using geometric modeling software
CO 2	Apply the finite element analysis for components design.
CO 3	Develop NC code for different part profiles and perform machining on CNC Machines.
CO 4	Manipulate the robot by writing programs and executing them

MATERIAL:

T1 Lab Manual

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

Batch-I

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	Introduction	2	23-02-2022		TLM4	
2	Knuckle joint - Part drawing	2	02-03-2022		TLM4	
3	Knuckle joint - Assembly		09-03-2022		TLM4	
4	Universal coupling - Part drawing	2	16-03-2022		TLM4	
5	Universal coupling - Assembly		23-03-2022		TLM4	
6	Piston-Connecting rod - Part drawing	2	30-03-2022		TLM4	
7	Piston-Connecting rod - Assembly		06-04-2022		TLM4	
8	Cantilever beam structural analysis	2	20-04-2022		TLM4	
9	Truss structural analysis		27-04-2022		TLM4	
10	Knuckle joint structural analysis	2	04-05-2022		TLM4	
11	Spring-mass system modal analysis		11-05-2022		TLM4	
12	Pin Fin heat transfer analysis		18-05-2022		TLM4	
13	Linear and circular interpolation using XL mill	2	25-05-2022		TLM4	
14	CNC programming for turning operation		01-06-2022		TLM4	
15	Internal Exam	2	03-06-2022		TLM4	
No. of classes required to complete				No. of classes taken:		

Batch-II

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	Introduction	2	25-02-2022		TLM4	
2	Knuckle joint - Part drawing	2	04-03-2022		TLM4	
3	Knuckle joint - Assembly		11-03-2022		TLM4	
4	Universal coupling - Part drawing	2	18-03-2022		TLM4	
5	Universal coupling - Assembly		25-03-2022		TLM4	
6	Piston-Connecting rod - Part drawing	2	01-04-2022		TLM4	
7	Piston-Connecting rod - Assembly		08-04-2022		TLM4	
8	Cantilever beam structural analysis	2	15-04-2022		TLM4	
9	Truss structural analysis		22-04-2022		TLM4	
10	Knuckle joint structural analysis		29-04-2022		TLM4	
11	Spring-mass system modal analysis	2	06-05-2022		TLM4	
12	Pin Fin heat transfer analysis		13-05-2022		TLM4	
13	Linear and circular interpolation using XL mill	2	20-05-2022		TLM4	
14	CNC programming for turning operation		27-05-2022		TLM4	
15	Internal Exam	2	03-06-2022		TLM4	
No. of classes required to complete:				No. of classes taken:		

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

PART-C

PROGRAMME OUTCOMES (POs):

PO 1	An ability to apply knowledge of Mathematics, Sciences and Engineering fundamentals to find the solution to real time Mechanical Engineering problems.
PO 2	An ability to identify and formulate mathematical models to analyze complex engineering problems.
PO 3	An ability to design a mechanical systems/ processes to meet the desired needs within realistic constraints such as economic, environmental, societal, health & safety .
PO 4	An ability to design and conduct experiments, perform analysis, interpretation of data and synthesis of information to provide valid conclusions.
PO 5	An ability to develop the model and analyze the Mechanical systems using modern software tools.

PO 6	An ability to understand societal, health, safety, legal, cultural issues and the consequent responsibilities relevant to engineering practice.
PO 7	An ability to understand the impact of engineering solutions in societal, environmental context and demonstrate the knowledge for sustainable development.
PO 8	An ability to understand the professional ethics to follow the norms of engineering practice.
PO 9	An ability to function effectively as an individual and as a member / leader in diverse technical teams.
PO 10	An ability to communicate effectively with the engineering community and society through reports & presentations.
PO 11	An ability to apply management principles to organise the multidisciplinary projects.
PO 12	An ability to understand the need of independent and lifelong learning so as to address day to day technological changes.

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, analysisand 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.

Course Instructor	**Course Coordinator**	**Module Coordinator**	**HOD**
V.Venkatrami Reddy K.Venkateswara Reddy	A.Nageswara Rao	J.Subba reddy	Dr.S.Pichi Reddy

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

Name of Course Instructor : B. Udaya Lakshmi
Course Name & Code : Design of Experiments&17ME91
L-T-P Structure : 3-0-0 Credits : 3
Program/Sem/Sec : B.Tech., ME., VI-Sem., Sections- C A.Y : 2021-22

PRE-REQUISITE: Mathematics courses, Probability and Statistics

COURSE EDUCATIONAL OBJECTIVES (CEOs): This course provides the concepts of analyzing the experimental data and design of experiments. It covers the basics of experimental design and analyzing the experimental data. The concepts of single and block design will be discussed.

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

CO 1	Identify the need for the strategies of design of experiments.
CO 2	Analyze the vast experimental data using the sampling criteria.
CO 3	Analyze and validate the data using ANOVA.
CO 4	Design the experiments with single factor and several factors.
CO 5	Apply the statistical process control methods for various quality control problems.

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

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

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

TEXT BOOKS

1. Montgomery D.C., Design and Analysis of Experiments, John Wiley.
2. Montgomery D.C., Runger G. C., Applied Statics and Probability for Engineers, John Wiley

REFERENCES:

1. Robert L. Mason, Richard F. Gunst, James L. Hess, Statistical Design and Analysis of Experiments: With Applications to Engineering and Science, John Wiley.
2. Montgomery D.C., Peck E.A., Vining G.G., Introduction to Linear Regression Analysis, John Wiley.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introducion

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
27.	Introduction to Course and COs	1	21-2-2022		TLM 2	
28.	Introduction to Unit-I	1	21-2-2022		TLM 2	
29.	Strategy of experimentation	2	24-2-2022		TLM 2	
30.	some typical applications of experimental design,	2	24-2-2022 25-2-2022		TLM 2	
31.	Basic principles	1	28-2-2022		TLM 2	
32.	Guidelines for designing experiments	2	3-3-2022 4-3-2022		TLM 2	
33.	a brief history of statistical design, using statistical design in experimentation	2	7-3-2022 10-3-2022		TLM 2	
No. of classes required to complete UNIT-I: 11				No. of classes taken:		

UNIT-II: SIMPLE COMPARATIVE EXPERIMENTS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
10.	Introduction	1	11-3-2022		TLM 2	
11.	Basic statistical concepts	1	11-3-2022		TLM 2	
12.	Sampling and Sampling Distribution	2	14-3-2022 17-3-2022		TLM 2	
13.	Inferences about the Differences in means Problems	1	18-3-2022		TLM 2	
14.	randomized designs	1	21-3-2022		TLM 2	
15.	paired comparison Designs	2	24-3-2022 25-3-2022		TLM 2	
16.	Inferences about the Variances of Normal Distributions	2	28-3-2022 1-4-2022		TLM 2	
17.	Numericals	1	4-4-2022 7-4-2022			
No. of classes required to complete UNIT-II:11				No. of classes taken:		

UNIT-III: EXPERIMENTS WITH A SINGLE FACTOR

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
10.	Basic principles of variance, analysis of variance	1	18-4-2022		TLM 2	
11.	Analysis of fixed effects model	2	18-4-2022 21-4-2022		TLM 2	
12.	Decomposition of the total sum of squares	1	22-4-2022		TLM 2	
13.	Statistical Analysis	1	25-4-2022		TLM 2	
14.	Estimation of model parameters, unbalanced data	1	28-4-2022		TLM 2	
15.	Nonparametric methods in the Analysis of variance	2	29-4-2022 2-5-2022		TLM 2	

No. of classes required to complete UNIT-III:08	No. of classes taken:

UNIT-IV : DESIGN OF EXPERIMENTS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
9.	The Randomized Complete Block Design	2	5-5-2022 6-5-2022		TLM 2	
10.	Statistical Analysis of the RCBD	2	9-5-2022 12-5-2022		TLM 2	
11.	Model adequacy checking	1	13-5-2022		TLM 2	
12.	Latin square design	2	16-5-2022 19-5-2022		TLM 2	
13.	Graeco-Latin Square Design	1	20-5-2022		TLM 2	
14.	Balanced incomplete block design	1	21-5-2022		TLM 2	
No. of classes required to complete UNIT-IV:09				No. of classes taken:		

UNIT-V: STATISTICAL QUALITY CONTROL

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
8.	Quality Improvement and Statistics	1	23-5-2022		TLM 2	
9.	Statistical Quality Control	1	26-5-2022		TLM 2	
10.	Statistical Process Control, Control Charts	1	27-5-2022		TLM 2	
11.	$\overline{X}$ and R chart	2	27-5-2022 30-5-2022		TLM 2	
12.	P chart, U chart	1	2-6-2022		TLM 2	
13.	Control chart performance	1	3-6-2022		TLM 2	
14.	Implementing SPC	1	4-6-2022		TLM 2	
No. of classes required to complete UNIT-V:8				No. of classes taken:		

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

PART-C

EVALUATION PROCESS (R17 Regulations):

Evaluation Task	**Marks**
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20
I-Quiz Examination (Units-I & II)	Q1=10
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10
Attendance	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	40
Semester End Examination (SEE)	60
Total Marks = CIE + SEE	100

PART-D

PROGRAMME OUTCOMES (POs):

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

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.

Course Instructor	Course Coordinator	Module Coordinator	HOD
(B.Udaya Lakshmi)	(B. Dhanunjay Kumar)	(J.Subba Reddy)	(Dr.S.Pichi Reddy)

COURSE HANDOUT

PROGRAM : B.Tech., VI-Sem., MECH (A,B&C)

ACADEMIC YEAR : 2021-22

COURSE NAME & CODE : **MODERN MACHING PROCESSES - 17ME26**

STRUCTURE : 3-0-0

COURSE CREDITS : 3

COURSE INSTRUCTOR : **DR.MURAHARI KOLLI**

COURSE COORDINATOR : **DR.MURAHARI KOLLI**

PRE-REQUISITE: PRODUCTION TECHNOLOGY, MACHINE TOOLS&METAL CUTTING

COURSE OBJECTIVE: The main objective of this course is to familiarize with unconventional machining processes and rapid prototyping.

COURSE OUTCOMES (CO)

CO1: Assort appropriate unconventional machining processes for machining materials and to develop relevant industrial solutions for machining hard materials.
CO2: Understand the principles of Electro Chemical Machining Process for machining of hard materials.
CO3: Apply Electrical Discharge Machining principles for machining intricate components.
CO4: Comprehend the basic principles and applications of thermal machining processes like EBM, LBM and PAM.
CO5: Identify the need of Rapid Prototyping in manufacturing sectors.

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	**2**	**2**	**2**		**3**									**2**	
CO2	**3**	**2**	**3**		**3**									**3**	
CO3	**3**	**2**	**3**		**3**								**2**	**3**	
CO4	**3**	**2**	**3**		**3**								**2**	**3**	
CO5	**3**	**2**	**3**		**3**									**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 Pandey P.C. and shah H.S, Modern machining processes /TMH.
T2 Chua C.K, Leong K.F, and Lim C.S, Rapid prototyping principles and applications, second edition, world scientific publishers, and 2003.

BOS APPROVED REFERENCE BOOKS:

R1 M K Singh, Unconventional machining process / New age international.

R2 V K Jain, Advanced machining processes /Allied publishers.

R3 N.Hopkinson ,R.J.MHaque &P.M. Dickens Rapid Manufacturing, John Wiley &sons,2006.

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

UNIT-I : INTRODUCTION & MECHANICAL PROCESSES

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
34.	Introduction of MMP and Course Co's and Po's	1	21.02.2022		TLM1/TLM2	CO1	T1/R1	
35.	Need for unconventional machining methods	1	24.02.2022		TLM1/TLM2	CO1	T1/R1	
36.	Classification of unconventional machining processes	1	25.02.2022		TLM1/TLM2	CO1	T1/R1	
37.	Considerations in process selection	1	28.02.2022		TLM1/TLM2	CO1	T1/R1	
38.	Basic principle of ultrasonic machining, equipment setup and procedure,	1	03.03.2022		TLM1/TLM2	CO1	T1/R1	
39.	Process variables and applications	1	04.03.2022		TLM1/TLM2	CO1	T1/R1	
40.	Basic principle of Abrasive jet machining, equipment setup and procedure.	1	07.03.2022		TLM3/TLM6	CO1	T1/R1	
41.	Water jet machining Basic principle, equipment setup and procedure	1	10.03.2022		TLM1/TLM2	CO1	T1/R1	
42.	Process variables and applications	1	11.03.2022		TLM1/TLM2	CO1	T1/R1	
No. of classes required to complete UNIT-I		9			No. of classes taken:			

UNIT-II : ELECTRO CHEMICAL PROCESSES &CHEMICAL MACHINING

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
43.	Electrochemical Process Introduction	1	14.03.2022		TLM1/TLM2	CO2	T1/R1	
44.	ECM Process, and principles	1	17.03.2022		TLM1/TLM2	CO2	T1/R1	
45.	Equipment and material removal rate	1	21.03.2022		TLM1/TLM2	CO2	T1/R1	
46.	Electrochemical machining	1	24.03.2022		TLM1/TLM2	CO2	T1/R1	
47.	Electrochemical grinding	1	25.03.2022		TLM1/TLM2	CO2	T1/R1	
48.	Electrochemical deburring, Electrochemical honing	1	28.03.2022		TLM1/TLM2	CO2	T1/R1	

49.	Chemical machining-principle	1	31.03.2022		TLM1/TLM2	CO2	T1/R1	
50.	Maskants –Etchants, Advantages and Applications.	1	01.04.2022		TLM1/TLM2	CO2	T1/R1	
No. of classes required to complete UNIT-II		8			No. of classes taken:			

UNIT-III: ELECTRICAL DISCHARGE MACHINING

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
51.	EDM Principle	1	04.04.2022		TLM1/TLM2	CO3	T1/R1	
52.	Process	1	07.04.2022		TLM1/TLM2	CO3	T1/R1	
53.	Power circuits for EDM	1	08.04.2022		TLM1/TLM2	CO3	T1/R1	
54.	Mechanics of metal removal in EDM	1	18.04.2022		TLM1/TLM2	CO3	T1/R1	
55.	Process parameters	1	21.04.2022		TLM1/TLM2	CO3	T1/R1	
56.	selection of tool electrode and dielectric fluid	1	22.04.2022		TLM1/TLM2	CO3	T1/R1	
57.	Electric discharge wire cutting principle and	1	25.04.2022		TLM1/TLM2	CO3	T1/R1	
58.	Applications of EDM and Wire EDM	1	26.04.2022		TLM1/TLM2	CO3	T1/R1	
No. of classes required to complete UNIT-III		8			No. of classes taken:			

UNIT-IV : ELECTRON BEAM, LASER BEAM AND PLASMA ARC MACHINING

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.	Electron Beam Machining, Principle, process	1	29.04.2022		TLM1/TLM2	CO4	T2/R3	
60.	EBM Applications and Advantages	1	02.05.2022		TLM1/TLM2	CO4	T2/R3	
61.	laser beam machining, Principle, process	1	05.05.2022		TLM1/TLM2	CO4	T2/R3	
62.	LBM Applications and Advantages	1	06.05.2022		TLM1/TLM2	CO4	T2/R3	
63.	Plasma arc machining, Principle, process	1	09.05.2022		TLM1/TLM2	CO4	T2/R3	
64.	PAM Applications and Advantages	1	12.05.2022		TLM1/TLM2	CO4	T2/R3	
65.	Hot machining, Process, equipment, applications	1	13.05.2022		TLM1/TLM2	CO4	T2/R3	
No. of classes required to complete UNIT-IV		7			No. of classes taken:			

UNIT-V : RAPID PROTOTYPING

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
66.	Introduction to RP fundamentals	1	16.05.2022		TLM1/TLM2	CO5	T2/R3	
67.	Elements, Advantages of Rapid Prototyping	1	19.05.2022		TLM1/TLM2	CO5	T2/R3	
68.	historical development, fundamentals of Rapid Prototyping	1	20.05.2022		TLM1/TLM2	CO5	T2/R3	
69.	classification of Rapid prototyping	1	23.05.2022		TLM1/TLM2	CO5	T2/R3	
70.	Rapid Prototyping process chain	1	26.05.2022		TLM1/TLM2	CO5	T2/R3	
71.	Stereo Lithography Apparatus (SLA)	1	27.05.2022		TLM1/TLM2	CO5	T2/R3	
72.	solid Ground Curing (SGC)	1	30.05.2022		TLM1/TLM2	CO5	T2/R3	
73.	EOS's EOSINT Systems	1	02.06.2022		TLM3/TLM2	CO5	T2/R3	
74.	Applications of Rapid Prototyping	1	03.06.2022		TLM3/TLM6			
No. of classes required to complete UNIT-V		9			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
75.	Abrasive water jet aerospace applications	1						
76.	EDM process parameters	1						
77.	Rapid prototyping case study	1						
78.	Medical case study	1						

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

ACADEMIC CALENDAR:

Description	From	To	Weeks
I Phase of Instructions	21-02-2022	09-04-2022	7W
I Mid Examinations	11-04-2022	16-04-2022	1W
II Phase of Instructions	18-04-2022	04-06-2022	7W
II Mid Examinations	06-06-2022	11-06-2022	1W
Preparation and Practicals	13-06-2022	18-06-2022	1W
Semester End Examinations	20-06-2022	02-07-2022	2W

EVALUATION PROCESS:

Evaluation Task	COs	Marks
Assignment–1	1	A1=5
Assignment–2	2	A2=5
I-Mid Examination	1,2	B1=20
Online Quiz-Q1	1,2	Q1-10
Assignment – 3	3	A3=5
Assignment– 4	4	A4=5
Assignment – 5	5	A5=5
II-Mid Examination	3,4,5	B2=20
Online Quiz-Q2	3,4,5	Q2-10
Evaluation of Assignment Marks: A=(A1+A2+A3+A4+A5)/5	1,2,3,4,5	A=5
Evaluation of Online Quiz Marks: Q=(Q1+Q2)/2	1,2,3,4,5	Q=10
Evaluation of Mid Marks: B=75% of Max(B1,B2)+25% of Min(B1,B2)	1,2,3,4,5	B=20
Attendance		C= 5
Cumulative Internal Examination : A+Q+B+C	**1,2,3,4,5**	**40**
Semester End Examinations	**1,2,3,4,5**	**60**
Total Marks: 40+60	**1,2,3,4,5**	**100**

PROGRAMME EDUCATIONAL OBJECTIVES:

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

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

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

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

1. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
2. **Problem analysis**: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
3. **Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
4. **Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.

5. **Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations.
6. **The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice.
7. **Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
8. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
9. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
10. **Communication**: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.
11. **Project management and finance**: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.
12. **Life-long learning**: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

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

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING (AUTONOMOUS)
L B Reddy Nagar, Mylavarm, Krishna District, Andhra Pradesh-521230
Affiliated to JNTUK, Kakinada & Approved by AICTE, New Delhi.
Accredited by **NAAC, NBA** Tier-1 for CSE, IT, ECE, EEE & ME and "**CPE**" status by UGC.
Department of Mechanical Engineering

COURSE HANDOUT

PROGRAM : B. Tech, VI-Sem., MECH – A Section
ACADEMIC YEAR : 2021-2022
COURSE NAME & CODE : PROJECT MANAGEMENT – 17MB81
L-T-P STRUCTURE : 3-0-0
COURSE CREDITS : 3
COURSE INSTRUCTOR : Mr. SEELAM SRINIVASA REDDY, Associate Professor
COURSE COORDINATOR : Mr. JONNALA SUBBA REDDY
, Associate Professor
PRE-REQUISITE:
COURSE OBJECTIVE: The objective of the course is to lay an important foundation to students in managing projects with a special focus on every phase such as project planning, execution, monitoring and evaluation.

COURSE OUTCOMES (CO)

CO1: Understand the concept of project management.
CO2: Awareness on organization strategy and structure and culture
CO3: Knowledge on defining the project and its controlling process.
CO4: Ability in executing and evaluating the project.
CO5: Understand the importance of a team and achieving cross functional cooperation.

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

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

BOS APPROVED TEXTBOOKS:

T1 Gray, Larson: Project Management-Tata McGraw Hill-2008
T2 Jeffery K. Pinto: Project Management- Pearson Education 2009

BOS APPROVED REFERENCE BOOKS:

R1 Enzo Frigenti: Project Management-Kogan, 2008
R2 Larry Richman: Project Management-PHI,2008
R3 Scott Berkun: Project Management-SPD,2008
R4 Thomas M Cappels: Financially Focused Project Management , SPD,2008
R5 Anita Rosen: Effective IT Project Management-PHI, 2008

COURSE DELIVERY PLAN (LESSON PLAN): B. Tech. – VI Sem - Section-A

UNIT-I : Introduction to Project Management

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching learning Methods	Learning Outcome COs	Textbook followed	HOD Sign Weekly
79.	CEO's and CO's of Project Management	1	22.02.2022		-	-	-	
80.	Introduction to Project Management	1	23.02.2022		TLM1/TLM2	CO1	T1,T2/R4	
81.	What is Project Management	1	26.02.2022		TLM1/TLM2	CO1	T1,T2/R4	
82.	Why Project Management	1	02.03.2022		TLM1/TLM2	CO1	T1,T2/R4	
83.	Project Lifecycle	1	05.03.2022		TLM1/TLM2	CO1	T1,T2/R4	
84.	Project Management Research in brief	1	08.03.2022		TLM1/TLM2	CO1	T1,T2/R4	
85.	Project Management Research in brief	1	09.03.2022		TLM1/TLM2	CO1	T1,T2/R4	
86.	Project Management today	1	12.03.2022		TLM1/TLM2	CO1	T1,T2/R4	
87.	Future trends in Project Management/Revision/Quiz	1	15.03.2022		TLM1/TLM2	CO1	T1,T2/R4	
No. of classes required to complete UNIT-I		9			**No. of classes taken:**			

UNIT-II: ORGANIZATION STRATEGIES

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching learning Methods	Learning Outcome COs	Textbook followed	HOD Sign Weekly
88.	Organization Strategies	1	16.03.2022		TLM1/TLM2	CO2	T1/R1	
89.	Structures and cultures	1	19.03.2022		TLM1/TLM2	CO2	T1/R1	
90.	Structures and cultures	1	22.03.2022		TLM1/TLM2	CO2	T1/R1	
91.	Form of Organization Structure	1	23.03.2022		TLM1/TLM2	CO2	T2	
92.	Stake holder management	1	26.03.2022		TLM1/TLM2	CO2	T2	
93.	Organization Culture	1	29.04.2022		TLM1/TLM2	CO2	T1	
94.	Creating a Culture for PM/Revision/Quiz	1	30.04.2022		TLM1/TLM2	CO2	T1/R1	
No. of classes required to complete UNIT-II		7			No. of classes taken:			

UNIT-III: PROJECT 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	Textbook followed	HOD Sign Weekly
95.	Project Planning	1	06.04.2022		TLM1/TLM2	CO3	T1/R1	
96.	Project Planning definitions	1	09.04.2022		TLM1/TLM2	CO3	T1/R1	
97.	Approaches to Project Screening	1	19.04.2022		TLM1/TLM2	CO3	T1/R1	
98.	Approaches to Project Selection	1	20.04.2022		TLM1/TLM2	CO3	T1/R1	
99.	Work breakdown Structure	1	23.04.2022		TLM1/TLM2	CO3	T1/R1	
100.	Financial Module	1	26.04.2022		TLM3/TLM6	CO3	T1/R1	
101.	Getting Approval and Compiling a project charter	1	27.04.2022		TLM1/TLM2	CO3	T1/R1	
102.	Setting up a Monitoring and controlling/Revision/Quiz	1	30.04.2022		TLM1/TLM2	CO3	T1/R1	
No. of classes required to complete UNIT-III		8			No. of classes taken:			

UNIT-IV: PROJECT EXECUTION

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching learning Methods	Learning Outcome COs	Textbook followed	HOD Sign Weekly
103.	Project Execution Initiating the Project	1	03.05.2022		TLM1/TLM2	CO4	T2/R3	
104.	Controlling and Reporting objectives	1	04.05.2022		TLM1/TLM2	CO4	T2/R3	
105.	Conducting project Evaluation	1	07.05.2022		TLM1/TLM2	CO4	T2/R3	
106.	Managing RISKs	1	10.05.2022		TLM1/TLM2	CO4	T2/R3	
107.	Four Stage Process	1	11.05.2022		TLM1/TLM2	CO4	T2/R3	
108.	Risk Management an integrated approach	1	14.05.2022		TLM1/TLM2	CO4	T2/R3	
109.	Cost management	1	17.05.2022		TLM1/TLM2	CO4	T2/R3	
110.	Creating a Project Budget/Revision/Quiz	1	18.05.2022		TLM1/TLM2	CO4	T2/R3	

No. of classes required to complete UNIT-IV	8	No. of classes taken:

UNIT-V : PROJECT TEAM BUILDING

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching learning Methods	Learning Outcome COs	Textbook followed	HOD Sign Weekly
111.	Leading Project Teams Building a Project Team	1	21.05.2022		TLM1/TLM2	CO5	T2/R3	
112.	Characteristics of Effective Project Team	1	24.05.2022		TLM1/TLM2	CO5	T2/R3	
113.	Achieving cross-functional	1	25.05.2022		TLM1/TLM2	CO5	T2/R3	
114.	Functional cooperation	1	28.05.2022		TLM1/TLM2	CO5	T2/R3	
115.	Virtual Project teams	1	31.05.2022		TLM1/TLM2	CO5	T2/R3	
116.	Conflicts Management	1	01.06.2022		TLM1/TLM2	CO5	T2/R3	
117.	Management Negotiations	1	04.06.2022		TLM1/TLM2	CO5	T2/R3	
118.	Case Studies/Revision/Quiz	1	04.06.2022		TLM1/TLM2	CO5	T2/R3	
No. of classes required to complete UNIT-V		**8**			**No. of classes taken:**			

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

ACADEMIC CALENDAR:

Description	From	To	Weeks
I Phase of Instructions	21.02.2022	09.04.2022	7W
I Mid Examinations	11.04.2022	16.04.2022	1W
II Phase of Instructions	18.04.2022	04.06.2022	7W
II Mid Examinations	06.05.2022	11.06.2022	1W
Preparation and Practical's	13.06.2022	18.06.2022	1W
Semester End Examinations	20.06.2022	02.07.2022	2W

EVALUATION PROCESS:

Evaluation Task	COs	Marks
Assignment–1	1	A1=5
Assignment–2	2	A2=5
I-Mid Examination	1,2	B1=20
Online Quiz-Q1	1,2	Q1-10
Assignment – 3	3	A3=5
Assignment– 4	4	A4=5
Assignment – 5	5	A5=5
II-Mid Examination	3,4,5	B2=20
Online Quiz-Q2	3,4,5	Q2-10
Evaluation of Assignment Marks: A=(A1+A2+A3+A4+A5)/5	1,2,3,4,5	A=5
Evaluation of Online Quiz Marks: Q=(Q1+Q2)/2	1,2,3,4,5	Q=10
Evaluation of Mid Marks: B=75% of Max(B1,B2)+25% of Min(B1,B2)	1,2,3,4,5	B=20
Attendance		C= 5
Cumulative Internal Examination: A+Q+B+C	**1,2,3,4,5**	**40**
Semester End Examinations	**1,2,3,4,5**	**60**
Total Marks: 40+60	**1,2,3,4,5**	**100**

PROGRAMME EDUCATIONAL OBJECTIVES:

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

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

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

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

13. **Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
14. **Problem analysis**: Identify, formulate, review research literature, and analyse complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
15. **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.

16. **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.
17. **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.
18. **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.
19. **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.
20. **Ethics**: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.
21. **Individual and team work**: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.
22. **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.
23. **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.
24. **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):

4. To apply the principles of thermal sciences to design and develop various thermal systems.
5. 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.
6. To apply the basic principles of mechanical engineering design for evaluation of performance of various systems relating to transmission of motion and power, conservation of energy and other process equipment.

Signature				
Name	**Mr. S. Srinivasa Reddy**	**Mr. S. Srinivasa Reddy**	**Mr J. Subba Reddy**	**Dr. S. Pichi Reddy**
Designation	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**HOD**

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

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Mr.K.Venkateswara Reddy
Course Name & Code : 17ME21, Mechanical Engineering Design-II
L-T-P Structure : 2-2-0 Credits: 3
Program/Sem/Sec : B.Tech., ME.,VI-Sem., Section- C A.Y: 2021-22

PRE-REQUISITE: Mechanics of Solids, Mechanical Engineering Design-I, Dynamics of Machines.

COURSE EDUCATIONAL OBJECTIVES (CEOs):
The main objective of this course is to understand and apply the standard procedure available for the design of machine elements and components of IC engine.

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

CO1	Design hydrodynamic journal bearings and selection of the antifriction bearings for given load, speed and life conditions
CO2	Design the internal combustion engine components for safe and continuous operation.
CO3	Select the belt and rope drives for elevators, cranes and hoisting machinery.
CO4	Design the springs under static and dynamic loads and combinations.
CO5	Design different types of gears for the given power transmission conditions for safe and continuous operation

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**	**3**									**1**			**3**
CO2	**3**	**2**	**3**		**1**							**1**			**3**
CO3	**3**	**2**	**3**									**1**			**3**
CO4	**3**	**3**	**3**									**1**			**3**
CO5	**3**	**2**	**3**									**1**			**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 Bhandari V.B., Design of Machine Elements, 3rd edition, TMG 2010

T2 Sundarajamoorthy T.V, Shanmugam N., Machine Design, Anuradha Publications

BOS APPROVED REFERENCE BOOKS:

R1 Norton R.L, Design of Machinery, TMG-2004

R2 Shigley J.E. and Mischke C.R., Mechanical Engineering Design, TMG-2003

R3 Ugural A.C, Mechanical Design-An Integral Approach, TMG-2004

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	Introduction to Subject, Pos, PEOs and CO's of the course	1	22/02/2022		TLM1	
2	Introduction to Unit-1, **Bearings** –Introduction, theory of lubrication, Types, materials	1	23/02/2022		TLM1 TLM2	
3	**Journal Bearings** – Types, Important dimensionless parameters,	1	24/02/2022		TLM1 TLM2	
4	Design procedure of journal bearing	1	26/02/2022		TLM1	
5	Journal bearings - problems	1	02/03/2022		TLM4	
6	Heat generated and heat dissipated in the bearing design – problems	1	03/03/2022		TLM4	
7	**Tutorial-I**	1	05/03/2022			
8	**Rolling contact bearings-**types, bearing life, Materials and designation	1	08/03/2022		TLM3	
9	Static load and dynamic load capacity, equivalent bearing load	1	09/03/2022		TLM1 TLM2	
10	Selection of ball bearing - problems	1	10/03/2022		TLM1	
11	Selection of roller bearing - problems	1	12/03/2022		TLM4	
12	**Tutorial-II**	1	15/03/2022		TLM4	
13	Cubic mean load derivation, Reliability of bearings - problems	1	16/03/2022		TLM3	
14	Problem on roller bearings	1	17/03/2022		TLM4	
15	**Assignment -I/ Quiz-I**	1	19/03/2022		TLM6	
No. of classes required to complete UNIT-I: 15			No. of classes taken:			

UNIT-II:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	Introduction to Unit-II, **Cylinder:**Cylinder liners, Design Procedure of Cylinder	1	22/03/2022		TLM1 TLM2	
2	Cylinder design - problems	1	23/03/2022		TLM4	
3	Problems on cylinder design	1	24/03/2022			
4	**PISTON** : Piston design, -design	1	26/03/2022		TLM1 TLM2	
5	Problems on piston design	1	29/03/2022		TLM3	
6	Problems on Piston	1	30/03/2022			
7	**Tutorial-III**	1	30/03/2022			
8	**CONNECTING ROD**: Thrust in C.R, buckling load	1	31/03/2022		TLM1 TLM2	
9	Stresses due to whipping action on connecting rod ends- problems	1	05/04/2022		TLM4	
10	**CRANK SHAFT:** Design of crank and crank shaft	1	06/04/2022		TLM1 TLM2	
11	Strength of overhung shaft, center crank shaft -problem	1	07/04/2022		TLM4	
12	**Tutorial-IV**	1	09/04/2022		TLM3	
13	**Assignment-II/Quiz-2**	1	09/04/2022		TLM6	
No. of classes required to complete UNIT-II: 13			No. of classes taken:			

UNIT-III:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	**Introduction to Unit-III PULLEYS:** Introduction, Design of flat belts	1	19/04/2022		TLM1 TLM2	
2	Design of pulleys(mild steel & cast iron)	1	19/04/2022		TLM1	
3	V-belts –designation, design and selection	1	20/04/2022		TLM1 TLM2	
4	Design of V- grooved pulley	1	21/04/2022		TLM1	
5	Design of V belts - problems	1	23/04/2022		TLM4	
6	Problems on design of belts	1	23/04/2022			
7	**Tutorial-V**	1	26/04/2022		TLM3	

8	**WIRE ROPES: I**ntroduction**,** designation classification	1	26/04/2022		TLM1 TLM2	
9	Selection of wire ropes, Stresses in hoisting ropes	1	27/04/2022		TLM1	
10	Design of wire ropes-problems	1	28/04/2022		TLM4	
11	**Tutorial-VI**	1	30/04/2022		TLM3	
12	**Assignment-III/Quiz-III**	1	30/04/2022		TLM6	
No. of classes required to complete UNIT-III: 11			No. of classes taken:			

UNIT-IV:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	**Introduction to Unit-IV SPRINGS:** Introduction, classification	1	04/05/2022		TLM1 TLM2	
2	Stresses, deflection and stiffness in springs and their derivations	1	05/05/2022		TLM1 TLM2	
3	Design of springs-problems	1	05/05/2022		TLM4	
4	Springs for fatigue loading	1	07/05/2022		TLM1	
5	**Tutorial-VII**	1	07/05/2022		TLM3	
6	Spring failures, design of helical springs	1	10/05/2022		TLM1	
7	Natural frequency of helical spring	1	11/05/2022		TLM1	
8	Energy storage capacity in springs	1	12/05/2022		TLM1	
9	Tension and torsion springs	1	14/05/2022		TLM1	
10	Co-axial springs design- Problems	1	17/05/2022		TLM4	
11	Design of leaf springs- Problems	1	18/05/2022		TLM4	
12	**Tutorial-VIII**	1	19/05/2022		TLM3	
13	**Assignment-IV/Quiz-IV**	1	19/05/2022		TLM6	
No. of classes required to complete UNIT-V: 13			No. of classes taken:			

UNIT-V:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	**Introduction to Unit-V GEARS**: Introduction and terminology, Types of gears, design formulae	1	21/05/2022		TLM1 TLM2	
2	Design Analysis of gears, Estimation of centre distance, module & face width	1	24/05/2022		TLM1 TLM2	

3	Design procedure of spur gears, Check for dynamic and wear considerations	1	25/05/2022		TLM1 TLM2	
4	Design of spur gears - problems.	1	26/05/2022		TLM4	
5	Design procedure of helical gears.	1	28/05/2022		TLM1	
6	**Tutorial-IX**	1	28/05/2022		TLM3	
7	**GEAR BOX**: Functions, Progress ratio	1	31/05/2022		TLM1	
8	Speed diagram, Kinematic arrangement	1	01/06/2022		TLM1	
9	Gear box design procedure - problems	1	02/06/2022		TLM4	
10	Problems	1	02/06/2022		TLM4	
11	**Tutorial-X**	1	04/06/2022		TLM3	
12	**Assignment-V/Quiz-V**	1	04/06/2022		TLM6	
No. of classes required to complete UNIT-V: 13			No. of classes taken:			

Contents beyond the Syllabus:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	HOD Sign Weekly
1	Design of flywheels	1	30/03/2022		TLM1 TLM2		
2	Design of epicycle gear train	1	25/05/2022		TLM1 TLM2		

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

PART-C

EVALUATION PROCESS:

Evaluation Task	**Marks**
Assignment-I (Unit-I)	A1=5
Assignment-II (Unit-II)	A2=5
I-Mid Examination (Units-I & II)	M1=20

I-Quiz Examination (Units-I & II)	Q1=10
Assignment-III (Unit-III)	A3=5
Assignment-IV (Unit-IV)	A4=5
Assignment-V (Unit-V)	A5=5
II-Mid Examination (Units-III, IV & V)	M2=20
II-Quiz Examination (Units-III, IV & V)	Q2=10
Attendance	B=5
Assignment Marks = Best Four Average of A1, A2, A3, A4, A5	A=5
Mid Marks =75% of Max(M1,M2)+25% of Min(M1,M2)	M=20
Quiz Marks =75% of Max(Q1,Q2)+25% of Min(Q1,Q2)	B=10
Cumulative Internal Examination (CIE) : A+B+M+Q	40
Semester End Examination (SEE)	60
Total Marks = CIE + SEE	100

PART-D

PROGRAM OUTCOMES:

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):

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.

Course Instructor	**Course Coordinator**	**Module Coordinator**	**HoD**
Mr.K.Venkateswara Reddy	Mr.S.Srinivasa Reddy	Mr.B.Sudheer Kumar	Dr.S.Pichi Reddy