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.P.Ravindra 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 :2019-20

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 componentsand 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.Necati Ozisik, 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 AgeInternational 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	25.11.2019		TLM1	
2.	Introduction of five Units importance	1	26.11.2019		TLM1	
3.	Introduction to heat transfer and its applications, Basic modes and its physical mechanisms in heat transfer.	1	28.11.2019		TLM1, TLM2 TLM5	
4.	Steady, unsteady and periodic heat transfer and significance of thermal conductivity in heat conduction.	1	29.11.2019		TLM1, TLM4	
5.	General heat conduction equation in Cartesian coordinate system and its simplifications.	1	02.12.2019		TLM1	
6.	Fourier's law of heat conduction; Numerical Problems.	1	03.12.2019		TLM1, TLM2	
7.	General heat conduction equation in cylindrical coordinate system and its simplifications.	1	05.12.2019		TLM1	
8.	**Tutorial-1**	1	06.12.2019		TLM3	
9.	General heat conduction equation in spherical coordinate system and its simplifications.	1	09.12.2019		TLM1, TLM2	
10.	Heat conduction through plane wall and cylinder with constant thermal conductivity– Numerical Problems.	1	10.12.2019		TLM1, TLM2	
11.	Electrical analogy, thermal resistance and overall heat transfer coefficient.	1	12.12.2019		TLM1, TLM2 TLM5	
12.	Numerical Problems on thermal resistance and overall heat transfer coefficient	1	13.12.2019		TLM1, TLM2	
13.	Heat transfer through composite slab and cylinder, Numerical Problems.	1	16.12.2019		TLM1, TLM2	
14.	Critical radius of insulation for cylinder and Applications.	1	17.12.2019		TLM1, TLM4	
15.	Numerical Problems on critical radius of insulation, **Assignment-1 Questions.**	1	19.12.2019		TLM1 TLM6	
16.	**Tutorial-2**	1	20.12.2019		TLM3	
No. of classes required to complete UNIT-I: 16				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	23.12.2019		TLM1	
2.	Heat flow through the cylinder with variable thermal conductivity, Numerical Problems.	1	24.12.2019		TLM1	
3.	Derivation on Uniform Internal heat generation in slabs and cylinders	1	26.12.2019		TLM1, TLM2	
4.	Numerical Problems on Uniform Internal heat generation in slabs.	1	27.12.2019		TLM1	

5.	Numerical Problems on Uniform Internal heat generation in cylinders.	1	30.12.2019		TLM1, TLM2	
6.	**Tutorial-3**	1	31.12.2019		TLM3	
7.	Extended surfaces and their applications; Thermal analysis oflong Fins	1	02.01.2020		TLM1, TLM4	
8.	Thermal analysis of short fins with insulated tip, Numerical Problems	1	03.01.2020		TLM1, TLM2	
9.	Fin efficiency and effectiveness, Numerical Problems	1	06.01.2020		TLM1, TLM2	
10.	Systems with negligible internal Resistance (Lumped HeatAnalysis), Significance of Biot and Fourier Numbers	1	07.01.2020		TLM1	
11.	Plane wall with finite surface and Internal Resistance using Heisler Charts, **Assignment-2 Questions,**		09.01.2020		TLM1, TLM6	
12.	**Tutorial-4**		10.01.2020		TLM3	
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	27.01.2020		TLM1, TLM2	
2.	Dimensional analysis and Buckingham Pi theorem applied to ForcedConvection.	1	28.01.2020		TLM1, TLM2	
3.	Significance of Non Dimensional Numbers.	1	30.01.2020		TLM1, TLM2	
4.	The concept of boundary layer; Velocity and Thermal Boundary Layers, Numerical Problems.	1	31.01.2020		TLM1, TLM2 TLM5	
5.	**Tutorial-5**	1	03.02.2020		TLM3	
6.	Forced convection analysis in external flows (Flow over a Flat Plate): Laminar and turbulentflows.	1	04.02.2020		TLM1, TLM2	
7.	Forced convection analysis in internal flows (Flow through circular pipe): Laminar and turbulentflows.	1	06.02.2020		TLM1, TLM2	
8.	Numerical Problems on Forced Convection.	1	07.02.2020		TLM1, TLM2	
9.	**Tutorial-6**	1	10.02.2020		TLM3	
10.	Reynolds Colburn Analogy.	1	11.02.2020		TLM1	
11.	Natural convection: Development of Hydrodynamic and thermal boundary layer along vertical plate.	1	13.02.2020		TLM1, TLM2 TLM4	
12.	Natural convection: empirical correlations for vertical and horizontal plate andnumerical problems	1	14.02.2020		TLM1, TLM2	
13.	Natural convection: empirical correlations for vertical and horizontal cylinders, and numerical problems **Assignment-3 Questions**	1	17.02.2020		TLM1, TLM6	
14.	**Tutorial-7**	14	18.02.2020		TLM3	
No. of classes required to complete UNIT-III:14				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	20.02.2020		TLM1, TLM2	
2.	Pool Boiling, Different regimes of boiling; Critical heat flux.	1	21.02.2020		TLM1, TLM2 TLM5	
3.	Numerical problems on nucleate boiling and critical heat flux conditions.	1	24.02.2020		TLM1, TLM2	
4.	Condensation: Film wise and Drop wise condensation	1	25.02.2020		TLM1, TLM2	
5.	Laminar film wise condensation on Vertical plate, Numerical Problems	1	27.02.2020		TLM1, TLM2	
6.	**Tutorial-8**	1	28.02.2020		TLM3	
7.	Introduction and applications of Thermal Radiation	1	02.03.2020		TLM1, TLM2	
8.	Emissive Power, Absorption, Reflection and Transmission and Definitions related to Radiation	1	03.03.2020		TLM1, TLM2 TLM4	
9.	Concept of black and non-black bodies; Laws of black bodyradiation	1	05.03.2020		TLM1, TLM2 TLM5	
10.	Emissivity, Kirchhoff's law and Shape Factors	1	06.03.2020		TLM1, TLM2	
11.	Radiation heat exchange between two black isothermal surfaces, nonblack infinite parallel plates;	1	09.03.2020		TLM1, TLM2	
12.	Derivation on Radiation shields,	1	10.03.2020		TLM1	
13.	Numerical problems on Radiation shields, Assignment-4 Questions	1	12.03.2020		TLM1, TLM6	
14.	**Tutorial-9**	1	13.03.2020		TLM3	
No. of classes required to complete UNIT-IV:14				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	16.03.2020		TLM1, TLM2 TLM6	
2.	Overall heat transfer coefficient- Fouling factor	1	17.03.2020		TLM1, TLM2	
3.	LMTD method of Heat exchanger analysis- Parallel flow, Numerical Problems	1	19.03.2020		TLM1, TLM2 TLM4	
4.	LMTD method of Heat exchanger analysis- Counter flow, Numerical Problems	1	20.03.2020		TLM1, TLM2	
5.	Correction factor for LMTD for use with Multi pass and Cross flow Heat Exchangers	1	23.03.2020		TLM1, TLM2	
6.	**Tutorial -10**	1	24.03.2020		TLM3	
7.	Effectiveness - NTU method of Heat	1	26.03.2020		TLM1,	

	Exchanger analysis –Parallel flow				TLM2	
8.	Effectiveness - NTU method of Heat Exchanger analysis –Counter flow	1	27.03.2020		TLM1, TLM2 TLM4	
9.	Numerical Problems on Effectiveness-NTU analysis	1	30.03.2020		TLM1, TLM2	
10.	**Tutorial -11**	1	31.03.2020		TLM3	
11.	Content beyond the syllabus – Design of helical coil heat exchangers	1	02.04.2020		TLM1, TLM2 TLM5	
12.	Innovations on radiation shields	1	03.04.2020		TLM1, TLM5	
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 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.

Course Instructor	Course Coordinator	Module Coordinator	HOD
(Name)	(Name)	(Name)	(Name)

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DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Mr. S.Srinivasa reddy
Course Name & Code : 17ME21, MECHANICAL ENGINEERING DESIG-II
L-T-P Structure : 2-2-0 Credits : 3
Program/Sem/Sec : B.Tech., ME.,VI-Sem., Sections- A A.Y : 2019-20

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	25-11-2019		TLM1	
2	Introduction to Unit-1, **Bearings** –Introduction, theory of lubrication, Types, materials	1	27-11-2019		TLM1 TLM2	
3	**Journal Bearings** – Types, Important dimensionless parameters,	1	28-11-2019		TLM1 TLM2	
4	Design procedure of journal bearing	1	30-11-2019		TLM1	
5	Journal bearings - problems	1	02-12-2019		TLM4	
6	Heat generated and heat dissipated in the bearing design – problems	1	04-12-2019		TLM4	
7	**Tutorial-1**	1	05-12-2019			
8	**Rolling contact bearings**-types, bearing life, Materials and designation	1	07-12-2019		TLM3	
9	Static load and dynamic load capacity, equivalent bearing load	1	09-12-2019		TLM1 TLM2	
10	Selection of ball bearing - problems	1	11-12-2019		TLM1	
11	Selection of roller bearing - problems	1	12-12-2019		TLM4	
12	**Tutorial-2**	1	14-12-2019		TLM4	
13	Cubic mean load derivation, Reliability of bearings - problems	1	16-12-2019		TLM3	
14	Problem on roller bearings	1	18-12-2019		TLM4	
15	**Assignment -1/ Quiz-1**	1	19-12-2019		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	21-12-2019		TLM1 TLM2	
2	Cylinder design - problems	1	23-12-2019		TLM4	
3	Problems on cylinder design	1	26-12-2019			
4	**PISTON** : Piston design, -design	1	2812-2019		TLM1 TLM2	
5	Problems on piston design	1	30-12-2019		TLM3	
6	Problems on Piston	1	01-01-2020			
7	**Tutorial-3**	1	02-01-2020			
8	**CONNECTING ROD**: Thrust in C.R, buckling load	1	04-01-2020		TLM1 TLM2	
9	Stresses due to whipping action on connecting rod ends- problems	1	06-01-2020		TLM4	
10	**CRANK SHAFT:** Design of crank and crank shaft	1	08-01-2020		TLM1 TLM2	
11	Strength of overhung shaft, center crank	1	09-01-2020		TLM4	

	shaft -problem					
12	**Tutorial-4**	1	10-01-2020		TLM3	
13	**Assignment-2/Quiz-2**	1	11-01-2020		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	27-01-2020		TLM1 TLM2	
2	Design of pulleys(mild steel & cast iron)	1	29-01-2020		TLM1	
3	V-belts –designation, design and selection	1	30-01-2020		TLM1 TLM2	
4	Design of V- grooved pulley	1	01-02-2020		TLM1	
5	Design of V belts - problems	1	03-02-2020		TLM4	
6	Problems on design of belts	1	05-02-2020			
7	**Tutorial-5**	1	06-02-2020		TLM3	
8	**WIRE ROPES: I**ntroduction**,** designation classification	1	10-02-2020		TLM1 TLM2	
9	Selection of wire ropes, Stresses in hoisting ropes	1	12-02-2020		TLM1	
10	Design of wire ropes-problems	1	13-02-2020		TLM4	
11	**Tutorial-6**	1	15-02-2020		TLM3	
12	**Assignment-4/Quiz-4**	1	17-02-2020		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	19-02-2020		TLM1 TLM2	
2	Stresses, deflection and stiffness in springs and their derivations	1	20-02-2020		TLM1 TLM2	
3	Design of springs-problems	1	22-02-2020		TLM4	
4	Springs for fatigue loading	1	24-02-2020		TLM1	
5	**Tutorial-7**	1	26-02-2020		TLM3	
6	Spring failures, design of helical springs	1	27-02-2020		TLM1	
7	Natural frequency of helical spring	1	29-02-2020		TLM1	
8	Energy storage capacity in springs	1	02-03-2020		TLM1	
9	Tension and torsion springs	1	04-03-2020		TLM1	
10	Co-axial springs design- Problems	1	05-03-2020		TLM4	
11	Design of leaf springs- Problems	1	07-03-2020		TLM4	
12	**Tutorial-8**	1	09-03-2020		TLM3	
13	**Assignment-4/Quiz-4**	1	11-03-2020		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	12-03-2020		TLM1 TLM2	
2	Design Analysis of gears, Estimation of centre distance, module & face width	1	16-03-2020		TLM1 TLM2	
3	Design procedure of spur gears, Check for dynamic and wear considerations	1	18-03-2020		TLM1 TLM2	
4	Design of spur gears - problems.	1	19-03-2020		TLM4	
5	Design procedure of helical gears.	1	21-03-2020		TLM1	
6	**Tutorial-9**	1	23-03-2020		TLM3	
7	**GEAR BOX**: Functions, Progress ratio	1	26-03-2020		TLM1	
8	Speed diagram, Kinematic arrangement	1	28-03-2020		TLM1	
9	Gear box design procedure -problems		30-03-2020		TLM4	
10	Problems	1	01-04-2020		TLM4	
11	**Tutorial-10**	1	02-04-2020		TLM3	
12	**Assignment-5/Quiz-5**	1	04-04-2020		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	09-02-2020		TLM1 TLM2		
2	Design of epicycle gear train	1	31-03-2020		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	Dr.Y.AppalaNaidu	Dr.Y.AppalaNaidu	Dr.S.Pichi Reddy

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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- A A.Y : 2019-20

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	25.11.2019			
2.	Product Cycle Revised with CAD/CAM	1	29.11.2019			
3.	Reasons for implementing CAD	1	30.11.2019			
4.	Creating Manufacturing database& Benefits of CAD	1	02.12.2019			
5.	Computer Graphics- Introduction , Database structure	1	06.12.2019			
6.	Functions of a graphics package	1	07.12.2019			
7.	Raster scan graphics	1	09.12.2019			
8.	Concatenated transformations.	1	13.12.2019			
9.	Translation, scaling, reflection, rotation	1	14.12.2019			
10.	Problems on Transformations	1	16.12.2019			
No. of classes required to complete UNIT-I:10				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		20.12.2019			
2.	Wireframe Modelling: Entities wireframe models		21.12.2019			
3.	Parametric representation of analytical curves		23.12.2019			
4.	Hermite cubic spline curve		27.12.2019			
5.	Bezier and B-spline curves		28.12.2019			
6.	Characteristics of Curves, Problems		30.12.2019			
7.	Surface representation: Entities		03.01.2020			
8.	Solid modelling		04.01.2020			
9.	B-Rep		06.01.2020			
10.	CSG		10.01.2020			
No. of classes required to complete UNIT-II:10				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		11.01.2020			
2.	NC elements, N C Coordinate systems		27.01.2020			
3.	Structure of CNC machine tools		31.01.2020			
4.	Spindle design and spindle drives,		01.02.2020			
5.	Feed drives, actuation systems		03.02.2020			
6.	CNC Part programming: fundamentals		07.02.2020			
7.	Manual part programming		08.02.2020			
8.	Computer Aided part programming		10.02.2020			
9.	Part programming examples		14.02.2020			
10.	examples		15.02.2020			
No. of classes required to complete UNIT-III:10				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		17.02.2020			
2.	Coding and classification schemes-OPITZ		22.02.2020			
3.	MICLASS, example for coding		24.02.2020			
4.	CODE Systems, examples for coding		28.02.2020			
5.	Production Flow Analysis, Advantages and limitations, GT Machine cells, Benefits of GT		29.02.2020			
6.	CAPP- Retrieval and Generative		02.03.2020			
7.	Flexible Manufacturing System: Introduction,		06.03.2020			
8.	FMS equipment, FMS layouts, benefits		07.03.2020			
9.	FMS Planning and implementation,		09.03.2020			

10.	FMS Planning and implementation,		13.03.2020			
No. of classes required to complete UNIT-IV:10				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		14.03.2020			
2.	Contact inspection methods		16.03.2020			
3.	Non-Contact inspection methods: Optical		20.03.2020			
4.	Non-Contact inspection methods: non optical		21.03.2020			
5.	Computer aided testing, CAQC with CAD/CAM		23.03.2020			
6.	CIM Introduction		27.03.2020			
7.	CIM integration, Implementation		28.03.2020			
8.	Benefits of CIM		30.03.2020			
9.	Lean manufacturing		03.04.2020			
10.	Lean manufacturing		04.04.2020			
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	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	A NAGESWARA RAO	J SUBBAREDDY	Dr S PICHI REDDY

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DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : SIVA SANKARA BABU CHINKA
Course Name & Code : FINITE ELEMENT ANALYSIS &17ME23
L-T-P Structure : 3-0-0 Credits : 3
Program/Sem/Sec : B.Tech., ME., VI-Sem., Sections- A A.Y : 2019-20

PRE-REQUISITE: Numerical Methods, Mechanics of Materials, Machine Design and Heat Transfer
COURSE EDUCATIONAL OBJECTIVES (CEOs): The main objective of this course is to understand the principles of finite elements and to develop Finite element models for engineering applications.

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

CO 1	Formulate the equilibrium equations for static engineering problems
CO 2	Solve the flexure elements subjected to different loading conditions
CO 3	Analyze 2-D structures with iso-parametric elements along with axisymmetric problems
CO 4	Apply the finite element techniques for solving thermal problems.
CO 5	Develop consistent mass matrices for different elements by considering the mechanical vibrations.

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

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 Engineering, 4th edition, B.H.Pergamon, 2010.

REFERENCE BOOKS:

R1 JN Reddy, An introduction to Finite Element Method, 3rd edition, McGraw Hill, 2011.
R2 Kenneth H. Huebner, Donald L. Dewhirst, Douglas E Smith and Ted G. Byron, The Finite Element Method for Engineers, 4th edition, John Wiley &Sons, 2001.
R3 David Hutton, Fundamentals of Finite Element Analysis, Tata McGraw Hill, 2005
R4 George R Buchanan and R.RudraMoorthy, Finite Element Analysis,Tata McGraw 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.	CEO, Cos of FEA, Introduction to Finite Element Analysis	1	26-11-2019		**TLM1, TLM2**	
2.	Equilibrium equations in elasticity, Stresses in typical element	1	27-11-2019		**TLM1**	
3.	Strain displacement relations, Stress strain relations	1	28-11-2019		**TLM1**	
4.	Plane stress and plane strain problems	1	29-11-2019		**TLM1**	
5.	Potential energy and equilibrium method	1	03-12-2019		**TLM1**	
6.	FE Formulation from governing differential equations	1	04-12-2019		**TLM1**	
7.	Weighted residual methods	1	05-12-2019		**TLM1**	
8.	One dimensional problems, FE Modeling	1	06-12-2019		**TLM1**	
9.	**TUTORIAL-1**	1	10-12-2019		**TLM3**	
10.	Finite element modeling coordinates and shape functions	1	11-12-2019		**TLM1**	
11.	Assembly of GSM & Load vector	1	12-12-2019		**TLM1**	
12.	Finite element equations and treatment of boundary conditions	1	13-12-2019		**TLM1**	
13.	Problems	1	17-12-2019		**TLM1**	
14.	**TUTORIAL-2**	1	18-12-2019		**TLM3**	
15.	Assignment/Quiz-1	1	19-12-2019		**TLM6**	
No. of classes required to complete UNIT-1:**15**				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-** Introduction, Beam elements	1	20-12-2019		**TLM1,2**	
2.	Types loading ,DOF, Treatment of Boundary conditions	1	24-12-2019		**TLM1**	
3.	Hermite shape functions	1	26-12-2019		**TLM1**	
4.	Element Stiffness matrix for two nodes, 2 DOF per node beam element	1	27-12-2019		**TLM1,2**	
5.	**TUTORIAL-3**	1	31-12-2019		**TLM3**	
6.	Problems	1	01-01-2020		**TLM4**	

7.	Two dimensional elements(CST), Boundary conditions	1	02-01-2020		**TLM1**	
8.	Jacobian, Shape functions, Area of triangles-boundary conditions	1	03-01-2020		**TLM1**	
9.	Problems	1	07-01-2020		**TLM4**	
10.	**TUTORIAL-4**	1	08-01-2020		**TLM3**	
11.	Assignment/Quiz-2	1	09-01-2020		**TLM6**	
No. of classes required to complete UNIT-II:**11**				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 subjected Axisymmetric loading	1	28-01-2020		**TLM1, TLM2**	
2.	Finite element modeling	1	29-01-2020		**TLM1**	
3.	Axisymmetric loading with triangular elements	1	30-01-2020		**TLM1**	
4.	Problems	1	31-01-2020		**TLM4**	
5.	2-D four nodded isoparametric elements, Jacobian, shape functions	1	04-02-2020		**TLM1**	
6.	Problems	1	05-02-2020		**TLM4**	
7.	**TUTORIAL-5**	1	06-02-2020		**TLM3**	
8.	Isoparametric formulation of 4 node quadrilateral element - problems	1	07-02-2020		**TLM1**	
9.	Numerical integration, Gauss Quadrature	1	11-02-2020		**TLM1**	
10.	Problems	1	12-02-2020		**TLM4**	
11.	**TUTORIAL-6**	1	13-02-2020		**TLM3**	
12.	Assignment/Quiz-3	1	14-02-2020		**TLM6**	
No. of classes required to complete UNIT-III:**12**				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	18-02-2020		**TLM1, TLM2**	
2.	Heat conduction in plane walls, Conductivity matrix, boundary conditions	1	19-02-2020		**TLM1**	
3.	Convection heat transfer in fins. Conductivity matrix boundary conditions	1	20-02-2020		**TLM1**	
4.	**TUTORIAL-7**	1	25-02-2020		**TLM3**	
5.	Problems	1	26-02-2020		**TLM1**	
6.	Problems	1	27-02-2020		**TLM1**	
7.	Two dimensional analysis of thin plate triangular elements	1	28-02-2020		**TLM4**	

8.	Conductivity matrix, boundary conditions	1	03-03-2020		**TLM4**	
9.	Convection matrix, Heat rate vector	1	04-03-2020		**TLM1**	
10.	Problems	1	05-03-2020		**TLM1**	
11.	Problems	1	06-03-2020		**TLM1,4**	
12.	**TUTORIAL-8**	1	11-03-2020		**TLM3**	
13.	Assignment/Quiz-4	1	12-03-2020		**TLM6**	
No. of classes required to complete UNIT-IV: **13**				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	13-03-2020		**TLM1,2**	
2.	Mass matrices, consistent Mass Matrices, Lumped Mass Matrices	1	17-03-2020		**TLM1**	
3.	Evaluation of Eigen values &Eigenvectors	1	18-03-2020		**TLM1**	
4.	**TUTORIAL-9**	1	19-03-2020		**TLM3**	
5.	Eigen values &Eigenvectors of stepped bars and beams	1	20-03-2020		**TLM4**	
6.	**problems**	1	24-03-2020		**TLM4**	
7.	**problems**	1	26-03-2020		**TLM3**	
8.	**TUTORIAL-10**	1	27-03-2020		**TLM6**	
9.	Assignment/Quiz-5		31-03-2020			
CRT CLASSES:1 WEEK						
No. of classes required to complete UNIT-V :**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	HOD Sign Weekly
1.	Modal Analysis of beamsusing FEA	1	10-01-2020		**TLM1,2**	
2.	Analysis of beams for Uniformly variable loads	1	01-04-2020		**TLM1,2**	
3.	Evaluation of Eigen values &Eigenvectors for various beams	1	03-04-2020		**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.
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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.

CH. Siva Sankara Babu	B.Sudheer Kumar	Dr.Y.Appala Naidu	Dr.S.Pichi Reddy
Course Instructor	**Course Coordinator**	**Module Coordinator**	**HOD**

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

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : **Dr.N.SUNIL NAIK**
Course Name & Code : Automobile Engineering & 17ME24
L-T-P Structure : 3-0-0 Credits : 3
Program/Sem/Sec : B.Tech., MECH., VI-Sem., Section- A A.Y: 2019-20
PRE-REQUISITES **:** Thermodynamics, IC Engines and Gas-turbines

COURSE EDUCATIONAL OBJECTIVES (CEOs):

The objective of this course is to make students learn about automobile layout, working of Transmission system, Steering system, Suspension system, Braking system, Fuel system, different Electrical and Electronic 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 and electronics 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	-	-	-	1	2	2	-	-	-	-	2	1	-	-
CO2	3	-	-	-	2	2	3	2	-	-	-	2	2	-	-
CO3	3	-	-	-	-	2	2	-	-	-	-	1	1	-	-
CO4	3	1	2	-	2	-	-	-	-	-	-	2	2	-	2
CO5	2	1	-	-	-	-	-	2	-	-	-	2	2	-	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:

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):

UNIT-I: INTRODUCTION AND ENGINE CONSTRUCTIONAL DETAILS

Sl. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
11.	Introduction to CO’s and PO’s	1	26-11-2019		TLM1	
12.	Introduction, Components of an Automobile	1	29-11-2019		TLM1	
13.	Rear wheel drive, front wheel drive and four-wheel drive	1	30-11-2019		TLM1/TLM2	
14.	Chassis, Frame-Types, Specifications of Automobiles, Types of Automobiles	1	03-12-2019		TLM1	
15.	Comparison of SI and CI Engines, Comparison of two stroke and four stroke engines	1	06-12-2019		TLM1	
16.	**Tutorial-I**	1	07-12-2019		TLM3	
17.	Cylinder block, Cylinder head, Crank case, Gaskets	1	10-12-2019		TLM1/TLM2	
18.	Manifolds, Oil-sump, Piston Construction, Piston clearance	1	13-12-2019		TLM1/TLM2	
19.	Expansion control in Pistons	1	14-12-2019		TLM1	
20.	Connecting Rod, Crank shaft, Cam-shaft, Flywheel	1	17-12-2019		TLM1/TLM2	
21.	Valve Construction, Straight poppet valve mechanism, Over head poppet valve mechanism	1	20-12-2019		TLM1/TLM2	
22.	**Tutorial-II and Quiz-I**	1	21-12-2019		TLM3	
No. of classes required to complete UNIT-I		**12**			No. of classes taken:	

UNIT-II: FUEL INJECTION SYSTEM IN SI AND CI ENGINES

Sl. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly

23.	Fuel feed system in petrol engines-Types	1	24-12-2019		TLM1	
24.	Air-fuel mixtures, Mixture requirements at different loads and speeds	1	27-12-2019		TLM1	
25.	Carburetion, Principle of carburetion, Simple Carburetor	1	28-12-2019		TLM1/TLM2	
26.	Difficulties encountered by simple Carburetor	1	31-12-2019		TLM1	
27.	Zenith and SU type Carburetor	1	03-01-2020		TLM1/TLM2	
28.	Fuel pumps (Mechanical and Electrical pumps)	1	03-01-2020		TLM1	
29.	**Tutorial-III**	1	07-01-2020		TLM3	
30.	Petrol Injection- Types of Petrol Injection	1	07-01-2020		TLM2	
31.	Methods of Diesel Injection system	1	10-01-2020		TLM1	
32.	Fuel Injector, Nozzle, Types of Nozzles and Spray formation	1	10-01-2020		TLM2	
33.	Air-cleaners in Petrol and Diesel engines and Fuel gauges	1	11-01-2020		TLM1	
34.	Fuel filters in Petrol and Diesel engines	1	11-01-2020		TLM1	
35.	**Tutorial-IV and Quiz-II**	1	14-01-2020		TLM3	
No. of classes required to complete UNIT-II		**13**		No. of classes taken:		

UNIT-III: IGNITION SYSTEM AND SENSORS

Sl. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
36.	Requirements of Ignition system, Battery Ignition system	1	28-01-2020		TLM1	
37.	Components of Battery Ignition system	1	31-01-2020		TLM2	
38.	Electronic Ignition system	1	31-01-2020		TLM2	
39.	Magneto Ignition system, Spark Plug Defects	1	01-02-2020		TLM1/TLM2	
40.	**Tutorial-V**	1	01-02-2020		TLM3	
41.	Sensors-Electromagnetic Sensors	1	04-02-2020		TLM2	
42.	Combustion knock Sensors & Variable	1	04-02-2020		TLM2	

	resistance Sensors					
43.	Temperature Sensors	1	07-02-2020		TLM2	
44.	Manifold absolute pressure Sensors & Exhaust gas oxygen Sensors	1	07-02-2020		TLM1/TLM2	
45.	Traction control and stability control	1	08-02-2020		TLM2	
46.	**Tutorial-VI and Quiz-III**	1	08-02-2020		TLM3	
No. of classes required to complete UNIT-III		**11**			No. of classes taken:	

UNIT-IV: Electrical System and Transmission system

Sl. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
47.	Starting system-Starter motor	1	11-02-2020		TLM1	
48.	Bendix drive mechanism,solenoid switch	1	14-02-2020		TLM2	
49.	Lighting system,Horn and wiper	1	14-02-2020		TLM1	
50.	Clutches-Requirements of clutches, principle of Clutch	1	15-02-2020		TLM1	
51.	cone clutch and Problems	1	15-02-2020		TLM1	
52.	Single plate clutch, Multi plate clutch	1	18-02-2020		TLM2	
53.	**Tutorial-VII**	1	18-02-2020		TLM3	
54.	Centrifugal clutches	1	21-02-2020		TLM2	
55.	Transmission-Functions of transmission and Various Resistances	1	21-02-2020		TLM1	
56.	Sliding mesh Gear box, Constant mesh gear box	1	22-02-2020		TLM2	
57.	Synchromesh gear box	1	22-02-2020		TLM2	
58.	Automatic transmission-Fluid-Flywheel, Torque convertor		25-02-2020		TLM2	
59.	Propeller shaft,Universal joint		28-02-2020		TLM1/TLM2	
60.	Hotchkiss drive, Differential		29-02-2020		TLM1/TLM2	
61.	**Tutorial-VIII and Quiz-IV**		29-02-2020		TLM3	
No. of classes required to complete UNIT-IV		**15**			No. of classes taken:	

UNIT-V: Steering, Suspension and Braking systems

Sl. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
62.	Front axle-Types, Steering geometry-I	1	03-03-2020		TLM1/TLM2	
63.	Steering geometry-II	1	06-03-2020		TLM1	

64.	Correct steering angle- Davis steering gear mechanism	1	06-03-2020		TLM1	
65.	Types of Steering gears	1	07-03-2020		TLM2	
66.	Power steering and **Tutorial-IX**	1	10-03-2020		TLM2/TLM3	
67.	Suspension system-Leaf springs,Coil springs	1	13-03-2020		TLM1	
68.	Torsion bar, Shock absorbers, Air-suspension system	1	14-03-2020		TLM1/TLM2	
69.	Independent Suspension systems	1	17-03-2020		TLM2	
70.	Braking system-Requirements,Drum and Disc brakes	1	20-03-2020		TLM1	
71.	Hydraulic braking system circuit, Air braking system		21-03-2020		TLM2	
72.	Anti-lock Braking system		24-03-2020		TLM2	
73.	**Tutorial-X and Quiz-V**		24-03-2019		TLM3	
No. of classes required to complete UNIT-V		**12**			No. of classes taken:	

Contents beyond the Syllabus

Sl. 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
74.	Contents beyond syllabus-Emissions	1	27-03-2020		TLM1	Revision of all units	T1/T2	
75.	Contents beyond syllabus-Emission regulations	1	27-03-2020		TLM2	CO1	R1/R4	

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.

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

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DEPARTMENT OFMECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : N SAMBASIVA RAO
Course Name & Code : 17MB82: LOGISTICS & SUPPLY MANAGEMENT
L-T-P Structure : 3-0-0 Credits : 3
Program/Sem/Sec : B.Tech., ME., VI-Sem., Sections- A A.Y : 2019-20

PRE-REQUISITE:Inventory Management, Production Management, Materials Management

COURSE EDUCATIONAL OBJECTIVES (CEOs):

- Apply and gain in-depth knowledge on the integrated purchasing, logistics, materials and supply chain management
- Identify the integration between the various elements in the supply chain process
- Learn how to establish benchmark of the organization by taking best practices of the world class organizations.
- Design transportation networks and use of deferent modes of transportation.
- Apply the latest IT tools and techniques to evaluate supply chain systems

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

CO 1	Examine the design and performance of supply networks and processes in different business contexts.
CO 2	Develop capabilities in logistics, coordination for supply chain integration, inventory management; risk pooling, procurement, product and process design, and international supply chain management.
CO 3	Configure logistics networks and assess their performance impacts on efficiency and service levels
CO 4	Design supply chain contracts for effective governance of supply chain

	relationships.
CO 5	Diagnose information integration problems across the supply chain and their consequent impacts in deploying physical and financial resources optimally.

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

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

TEXT BOOKS:

T1	K.Sridhara butt, "*Logistics and Supply Chain management",* Himalaya Publishers, New Delhi, 2009

REFERENCE BOOKS:

R1	Sunil Chopra and Peter Meindl, " *Supply Chain Management: Strategy, Planning & Operations",* Pearson Education, New Delhi, 2004.
R2	Sunil Chopra and Peter Meindl, " *Supply Chain Management: Strategy, Planning & Operations",* Pearson Education, New Delhi, 2004.
R3	D.K.Agarwal, "*Logistics and Supply Chain management",* Mc millan Publishers.
R4	B.Rajasekhar, Acharyulu, "*Logistics and Supply Chain management",* Excel Books, New Delhi, 2009.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Introduction to Supply Chain Management& supply chain drivers & performance

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 Course and COs	1	25.11.2019		TLM1	
77.	Introduction to Unit-I	1	26.11.2019		TLM1	
78.	**Introduction to Supply Chain Management:**	1	27.11.2019		TLM2	
79.	Concept, Objectives	1	02.12.2019		TLM1	
80.	Scope and Functions of Supply Chain	1	03.12.2019		TLM1	
81.	Process view of a Supply Chain, Impact of Supply Chain Flows.	1	04.12.2019		TLM1	
82.	**Supply Chain Drivers**	1	09.12.2019		TLM2	
83.	Facilities, Inventory, Transportation	1	10.12.2019		TLM1	
84.	Information, Sourcing, Pricing	1	11.12.2019		TLM1	

85.	Obstacles to Achieve Strategic fit	1	16.12.2019		TLM1	
86.	Role of Aggregate Planning in Supply Chain	1	17.12.2019		TLM1	
87.	Methods and Managing Supply and Demand.	1	18.12.2019		TLM1	
88.	**Supply Chain Performance**	1	23.12.2019		TLM2	
89.	Competitive Advantage and Supply Chain Strategies	1	24.12.2019		TLM1	
90.	Achieving Strategic fit.	1	30.12.2019		TLM1	
No. of classes required to complete UNIT-I:				No. of classes taken:		

UNIT-II: Logistics Management&Supply Chain Customer Service

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.	Introduction to Unit-II	1	31.12.2019		TLM1	
12.	**Logistics Management:** Introduction	1	06.01.2020		TLM2	
13.	Difference between Logistics and Supply Chain	1	07.01.2020		TLM1	
14.	Inbound, Inter and Outbound Logistics; Integrated Logistics Management	1	08.01.2020		TLM1	
15.	3PL, 4PL, Intermodal and Reverse Logistics.	1	20.01.2020		TLM1	
16.	**Supply Chain Customer Service:** The Marketing and Logistics interface	1	21.01.2020		TLM2	
17.	Customer Service and Customer Retention	1	22.01.2020		TLM1	
18.	Service-Driven Logistics System	1	27.01.2020		TLM1	
19.	Setting customer Service Priorities and Service Standards.	1	28.01.2020		TLM1	
No. of classes required to complete UNIT-II:				No. of classes taken:		

UNIT-III: Supply Chain Relationship, Sourcing in Supply Chain, Pricing and Revenue in Supply Chain:

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.	Introduction to Unit-III	1	29.01.2020		TLM1	
12.	**Supply Chain Relationship:** Bench marking	1	03.02.2020		TLM2	
13.	Objectives, Bench marking Cycle, Process and types	1	04.02.2020		TLM1	
14.	Setting Bench marking Priorities.	1	05.02.2020		TLM1	
15.	**Sourcing in Supply Chain:** Role of Sourcing in Supply Chain Management,	1	10.02.2020		TLM2	
16.	Supplier Scoring and Assessment	1	11.02.2020		TLM1	
17.	Supplier Selection and Controlling	1	12.02.2020		TLM1	
18.	The Procurement process, Sourcing Planning and Analysis	1	17.02.2020		TLM1	
19.	Global Sourcing, The role of Revenue Management in Supply Chain.	1	18.02.2020		TLM1	
No. of classes required to complete UNIT-III:				No. of classes taken:		

UNIT-IV: Network design in Supply Chain,Coordination in Supply Chain

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.	Introduction to Unit-IV	1	19.02.2020		TLM1	
12.	The role of distribution in the Supply Chain	1	24.02.2020		TLM1	

	Management					
13.	factors influencing distribution network design	1	25.02.2020		TLM1	
14.	Transportation Fundamentals: The role of Transportation in Supply Chain	1	26.02.2020		TLM1	
15.	Factors influencing Transportation Decisions	1	02.03.2020		TLM1	
16.	Modes of transportation, Transportation documentation.	1	03.03.2020		TLM1	
17.	**Coordination in Supply Chain**	1	04.03.2020		TLM2	
18.	, Lack of Supply Chain Coordination and the Bullwhip effect	1	09.03.2020		TLM1	
19.	Obstacles to Coordination in Supply Chain	1	11.03.2020		TLM1	
20.	Managerial levers to achieve Coordination.	1	16.03.2020		TLM1	
No. of classes required to complete UNIT-IV:				No. of classes taken:		

UNIT-V: IT in Supply Chain, Global Logistics and Global Supply Chain

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.	Introduction to Unit-V		17.03.2020		TLM1	
12.	The role of IT in the Supply Chain		18.03.2020		TLM1	
13.	The Supply Chain IT framework; CRM, Internal SCM		23.03.2020		TLM1	
14.	SRM; The future of IT in Supply Chain		24.03.2020		TLM1	
15.	Supply Chain IT in Practice.		25.03.2020		TLM2	
16.	Logistics in Global Economy		30.03.2020		TLM1	
17.	Change in Global Logistics		31.03.2020		TLM1	
18.	Global Supply Chain business process		01.04.2020		TLM1	
19.	Global Strategy; Global Purchasing, Global SCM.		01.04.2020		TLM1	
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	**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.

Course Instructor	Course Coordinator	Module Coordinator	HOD
N Sambasiva Rao	Dr D Venkateswarlu	Dr D Venkateswarlu	Dr A Adisesha reddy

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L.B.Reddy Nagar, Mylavaram-521230, Krishna Dist, Andhra Pradesh, India
DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : 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., Sections- A A.Y : 2019-20

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
91.	Introduction to Course and COs	1	26-11-2019		TLM1	
92.	Introduction to Unit-I	1	28-11-2019		TLM1	
93.	Strategy of experimentation	2	29-11-2019 03-12-2019		TLM1	
94.	some typical applications of experimentaldesign,	1	05-12-2019		TLM1	
95.	Basic principles	1	06-12-2019		TLM1	
96.	Guidelines for designing experiments	1	10-12-2019		TLM1	
97.	a brief history of statistical design, using statistical design in experimentation	1	12-12-2019		TLM1	
No. of classes required to complete UNIT-I: 08				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
20.	Introduction	1	13-12-2019		TLM1	
21.	Basic statistical concepts	1	17-12-2019		TLM1	
22.	Sampling andSampling Distribution	1	19-12-2019		TLM1	
23.	Inferences about the Differences in means	1	20-12-2019		TLM2	
24.	randomized designs	1	24-12-2019		TLM2	
25.	paired comparison Designs	1	26-12-2019		TLM1	
26.	Inferences about theVariances of Normal Distributions	1	27-12-2019		TLM2	
27.	problems	1	31-12-2019			
No. of classes required to complete UNIT-II:8				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
20.	Basic principles of variance, analysis of variance	1	02-01-2020		TLM1	
21.	Analysis of fixed effects model	1	03-01-2020		TLM1	
22.	Decomposition of the total sum of squares	1	07-01-2020		TLM1	
23.	Statistical Analysis	1	09-01-2020		TLM2	
24.	Estimation of model parameters, unbalanced data	2	10-01-2020 28-01-2020		TLM2	
25.	Nonparametric methods in the Analysis of variance	2	30-01-2020 31-01-2020		TLM1	
No. of classes required to complete UNIT-III:8				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
21.	The Randomized Complete Block Design	2	04-02-2020 06-02-2020		TLM1	
22.	Statistical Analysis of the RCBD	1	07-02-2020		TLM1	
23.	Model adequacy checking	1	11-02-2020		TLM1	
24.	Latin square design	1	13-02-2020		TLM2	
25.	Graeco-Latin Square Design	2	14-02-2020 18-02-2020		TLM2	
26.	Balanced incomplete block design	2	20-02-2020 25-02-2020		TLM1	
No. of classes required to complete UNIT-IV:9				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
20.	Quality Improvement and Statistics	1	27-02-2020		TLM1	
21.	Statistical Quality Control	1	28-02-2020		TLM1	
22.	Statistical Process Control, Control Charts	1	03-03-2020		TLM1	
23.	$\bar{X}$ and R chart	2	05-03-2020 06-03-2020		TLM2	
24.	P chart, U chart	2	10-03-2020 12-03-2020		TLM2	
25.	Control chart performance	1	13-03-2020		TLM1	
26.	Implementing SPC	1	17-03-2020		TLM2	
No. of classes required to complete UNIT-V:9				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.

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

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DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : B.Chaitanya/ A Nageswara Rao
Course Name & Code : CAD/CAM LAB & 17ME70
L-T-P Structure : 0-0-2 Credits : 2
Program/Sem/Sec : B.Tech., MECH., VI-Sem., Sections- A A.Y : 2019-20

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	25.11.19		TLM4	
2	Knuckle joint - Part drawing	2	02.12.19		TLM4	

3	Knuckle joint - Assembly	2	09.12.19		TLM4	
4	Universal coupling - Part drawing	2	16.12.19		TLM4	
5	Universal coupling - Assembly	2	23.12.19		TLM4	
6	Piston-Connecting rod - Part drawing	2	30.12.19		TLM4	
7	Piston-Connecting rod - Assembly	2	06.01.20		TLM4	
8	Cantilever beam structural analysis	2	27.01.20		TLM4	
9	Truss structural analysis	2	03.02.20		TLM4	
10	Knuckle joint structural analysis	2	10.02.20		TLM4	
11	Spring-mass system modal analysis	2	17.02.20		TLM4	
12	Pin Fin heat transfer analysis	2	24.02.20		TLM4	
13	Linear and circular interpolation using XL mill	2	02.03.20		TLM4	
14	CNC programming for turning operation	2	09.03.20		TLM4	
15	Repetition	2	16.03.20		TLM4	
16	Repetition	2	23.03.20		TLM4	
17	Internal Exam	2	30.03.20		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	27.11.19		TLM4	
2	Knuckle joint - Part drawing	2	04.12.19		TLM4	
3	Knuckle joint - Assembly	2	11.12.19		TLM4	
4	Universal coupling - Part drawing	2	18.12.19		TLM4	
5	Universal coupling - Assembly	2	08.01.20		TLM4	
6	Piston-Connecting rod - Part drawing	2	29.01.20		TLM4	
7	Piston-Connecting rod - Assembly	2	05.02.20		TLM4	
8	Cantilever beam structural analysis	2	12.02.20		TLM4	
9	Truss structural analysis	2	19.02.20		TLM4	
10	Knuckle joint structural analysis	2	26.02.20		TLM4	

11	Spring-mass system modal analysis	2	04.03.20		TLM4	
12	Pin Fin heat transfer analysis	2	11.03.20		TLM4	
13	Linear and circular interpolation using XL mill	2	18.03.20		TLM4	
14	CNC programming for turning operation	2	25.03.20		TLM4	
15	Repetition	2	01.04.20		TLM4	
17	Internal Exam	2			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	A NAGESWARA RAO	J SUBBAREDDY	Dr S PICHI REDDY

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DEPARTMENT OF MECHANICAL ENGINEERING

HEAT TRANSFER LABORATORY COURSE HANDOUT

Part-A

PROGRAM : B.Tech, VI-Sem., ME, A/S
ACADEMIC YEAR : 2019-20
COURSE NAME & CODE : Heat Transfer Lab &17ME71
L-T-P STRUCTURE : 0-0-3
COURSE CREDITS : 2
LABORATORY INSTRUCTORS :Dr.P.Vijay Kumar/K.Lakshmi Prasad/S.Srinivasa Reddy Jr.
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).

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DEPARTMENT OF MECHANICAL ENGINEERING

HEAT TRANSFER LABORATORY

LAB SCHEDULE

COURSE: B.Tech **BRANCH: MECHANICAL** **SECTION: A-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	25-11-19	2-12-19	9-12-19	16-12-19	23-12-19	30-12-19	6-1-2020	27-1-20	3-2-20	10-2-20	24-2-20	2-3-20	9-3-20
		Regd.No	CYCLE-I						CYCLE-2						
1	BATCH-I	17761A0301	DEMO	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	REPITION	INTERNAL LAB TEST
2		17761A0302	DEMO	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5		
3		17761A0303	DEMO	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5		
4		17761A0304	DEMO	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5		
5		17761A0306	DEMO	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5		
6		17761A0307	DEMO	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5		
7	BATCH-2	17761A0308	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		
8		17761A0309	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		
9		17761A0310	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		
10		17761A0311	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		
11		17761A0312	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		
12		17761A0313	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		
13	BATCH-3	17761A0314	DEMO	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2		
14		17761A0316	DEMO	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2		

15		17761A0317	DEMO	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2		
16		17761A0318	DEMO	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2		
17		17761A0319	DEMO	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2		
18		17761A0320	DEMO	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2		
19		17761A0322	DEMO	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5		
20		17761A0323	DEMO	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5		
21	BATCH-4	17761A0324	DEMO	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5		
22		17761A0325	DEMO	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5		
23		17761A0326	DEMO	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5		
24		17761A0327	DEMO	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5		
25		17761A0328	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		
26		17761A0329	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		
27		17761A0330	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		
28	BATCH-5	17761A0331	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	REPITION	INTERNAL LAB TEST
29		17761A0332	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		
30		17761A0333	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		
31		17761A0334	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		

LAB INCHARGE

LAKIREDDY BALIREDDY COLLEGE OF ENGINEERING (AUTONOMOUS)

MYLAVARAM

DEPARTMENT OF MECHANICAL ENGINEERING

HEAT TRANSFER LABORATORY

LAB SCHEDULE

COURSE: B.Tech **BRANCH: MECHANICAL** **SECTION: A-Sec (Monday)**

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	27-11-19	4-12-19	11-12-19	18-12-19	8-01-20	22-01-20	5-2-20	12-2-20	19-2-20	26-2-20	4-3-20	11-3-20	18-3-20
		Regd.No	CYCLE-I						CYCLE-2						
1		17761A0335	DEMO	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5		
2		17761A0336	DEMO	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5		
3		17761A0337	DEMO	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5		
4	BATCH-I	17761A0338	DEMO	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5		
5		17761A0339	DEMO	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5		
6		17761A0341	DEMO	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5		
7		17761A0342	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		
8		17761A0343	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		
9		17761A0345	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		
10	BATCH-2	17761A0346	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	REPITION	INTERNAL LAB TEST
11		17761A0347	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		

12		17761A0348	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		
13	BATCH-3	17761A0349	DEMO	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2		
14		17761A0350	DEMO	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2		
15		17761A0351	DEMO	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2		
16		17761A0352	DEMO	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2		
17		17761A0353	DEMO	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2		
18	BATCH-4	18765A0301	DEMO	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	REPITION	INTERNAL LAB TEST
19		18765A0302	DEMO	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5		
20		18765A0303	DEMO	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5		
21		18765A0305	DEMO	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5		
22		18765A0306	DEMO	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5		
23		18765A0307	DEMO	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5		
24		18765A0308	DEMO	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5		
25	BATCH-5	18765A0309	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		
26		18765A0310	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		
27		18765A0311	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		
28		18765A0312	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		
29		18765A0313	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		
30		18765A0314	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		
31		18765A0315	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		

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	CY	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

LAB SCHEDULE

SECTION: A BATCH-1 (WEDNESDAY)				
BATCH-I	**BATCH-2**	**BATCH-3**	**BATCH-4**	**BATCH-5**
17761A0301	17761A0308	17761A0314	17761A0322	17761A0328
17761A0302	17761A0309	17761A0316	17761A0323	17761A0329
17761A0303	17761A0310	17761A0317	17761A0324	17761A0330
17761A0304	17761A0311	17761A0318	17761A0325	17761A0331
17761A0306	17761A0312	17761A0319	17761A0326	17761A0332
17761A0307	17761A0313	17761A0320	17761A0327	17761A0333
				17761A0334

SECTION: A BATCH-2 (MONDAY)				
BATCH-I	**BATCH-2**	**BATCH-3**	**BATCH-4**	**BATCH-5**
17761A0335	17761A0342	17761A0349	18765A0302	18765A0309
17761A0336	17761A0343	17761A0350	18765A0303	18765A0310
17761A0337	17761A0345	17761A0351	18765A0305	18765A0311
17761A0338	17761A0346	17761A0352	18765A0306	18765A0312
17761A0339	17761A0347	17761A0353	18765A0307	18765A0313
17761A0341	17761A0348	18765A0301	18765A0308	18765A0314
				18765A0315

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

DAY	1	2	3		4	5	6

TIME	9.00 to 10.00	10.00 to 11.00	11.00 to 12.00	12.00 to 01.10	01.10 to 2.10	2.10 To 3.10	3.10 to 4.10
MON		VI SEM- MECH-C/SBATCH- 2		LUNCH		VI SEM- MECH-A/S BATCH- 2	
TUE		VI SEM- MECH-B/S BATCH-2					
WED		VI SEM- MECH-A/S BATCH-1					
THU						VI SEM- MECH-B/S BATCH- 1	
FRI						VI SEM- MECH-C/S BATCH- 1	
SAT							

BATCH	A-SEC	B-SEC	C-SEC
Batch-1	17761A0301-17761A0334	17761A0355-17761A0391	17761A03B2-17761A03E7
Batch-2	17761A0335-18765A0315	17761A0392-18765A0330	17761A03E8-18765A0344

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**

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DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : K. Samaikya & T. Radha Rani
Course Name & Code : Employability Enhancement Skills-II
Program/Sem/Sec : B.Tech.,Mechanical Engineering -A, VI-Sem.,
A.Y: 2019-20

Prerequisite Subject: 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, students are able to

CO 1	To identify, analyze and apply quantitative techniques related to 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 and POs and PSOs):

Course Code	COs	Programme Outcomes												PSOs	
		1	2	3	4	5	6	7	8	9	10	11	12	1	2
		3	3				3	3	3				3		
		3	3				3	3					3		
		3		3				2					2		
		3					2	3	2				3		
		3	3	3	3		3	3	3				3		

1 = Slightly (low) **2 = Moderate (medium)** **3-Substantially(High)**

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

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

TEXTBOOK:

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

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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):

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
98.	Introduction	1	25.11.2019		TLM1/TLM2	
99.	Introduction –Alligation or Mixture	1	30.11.2019		TLM1/TLM2	
100.	Tenses	1	2.12.2019		TLM1/TLM2	
101.	Problems on Alligation or Mixture	1	7.12.2019		TLM1/TLM2	
102.	Tenses Worksheet	1	9.12.2019		TLM1/TLM2	
103.	Simple Interest	1	14.12.2019		TLM1/TLM2	
104.	Conditional Clauses	1	16.12.2019		TLM1/TLM2	
105.	Compound Interest	1	21.12.2019		TLM1/TLM2	
106.	Conditional Clauses worksheet	1	23.12.2019		TLM1/TLM2	
No. of classes required to complete UNIT-I:				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
28.	Time and Work	1	28.12.2019		TLM1/TLM2	
29.	Sentence Completion	1	30.12.2019		TLM1/TLM2	
30.	Pipes and Cistern	1	04.01.2020		TLM1/TLM2	
31.	Sentence Completion worksheet	1	06.01.2020		TLM1/TLM2	
32.	Permutations and Combinations	1	11.01.2020		TLM1/TLM2	
33.	Problems on Permutations and Combinations	1	18.01.2020		TLM1/TLM2	
No. of classes required to complete UNIT-II:				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
26.	Error spotting	1	27.01.2020		TLM1/TLM2	
27.	Time and Distance	1	01.02.2020		TLM1/TLM2	
28.	Error spotting worksheet	1	03.02.2020		TLM1/TLM2	
29.	Problems on Trains	1	08.02.2020		TLM1/TLM2	
30.	Boats and Streams	1	15.02.2020		TLM1/TLM2	
31.	Races and Games of Skill	1	22.02.2020		TLM1/TLM2	
No. of classes required to complete UNIT-III:				No. of classes taken:		

UNIT-IV :

S.No.	Topics to be covered	No. of	Tentative	Actual	Teaching	HOD

		Classes Required	Date of Completion	Date of Completion	Learning Methods	Sign Weekly
27.	Jumbled sentences	1	10.02.2020		TLM1/TLM2	
28.	Jumbled sentences worksheet	1	17.02.2020		TLM1/TLM2	
29.	Cloze tests	1	24.02.2020		TLM1/TLM2	
30.	Area, Volumes and Surface Area	1	29.02.2020		TLM1/TLM2	
31.	Cloze tests	1	02.03.2020		TLM1/TLM2	
32.	Progressions	1	07.03.2020		TLM1/TLM2	
33.	Cloze tests	1	09.03.2020		TLM1/TLM2	
No. of classes required to complete UNIT-IV:				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
27.	Clocks	1	14.03.2020		TLM1/TLM2	
28.	Advanced Reading Comprehension passages	1	16.03.2020		TLM1/TLM2	
29.	Calendars	1	21.03.2020		TLM1/TLM2	
30.	Advanced Reading Comprehension passages	1	23.03.2020		TLM1/TLM2	
31.	Cubes and Dice	1	28.03.2020		TLM1/TLM2	
32.	Advanced Reading Comprehension passages	1	30.03.2020		TLM1/TLM2	
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**
Cumulative Internal Examination (CIE) :	100
Total Marks = CIE	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.
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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

Course Instructor	Course Coordinator	Module Coordinator	HOD
K.Samaikhya	T.Radha Rani		Dr.Achuta Ramaiah

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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., Sections- B A.Y : 2019-20

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.Necati Ozisik, 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	26.11.2019		TLM1	
2.	Introduction of five Units importance	1	27.11.2019		TLM1	
3.	Introduction to heat transfer and its applications, Basic modes and its physical mechanisms in heat transfer.	1	29.11.2019		TLM1, TLM2 TLM5	
4.	Steady, unsteady and periodic heat transfer and thermal conductivity significance of in heat conduction.	1	30.11.2019		TLM1, TLM4	
5.	General heat conduction equation in Cartesian coordinate system and its simplifications.	1	03.12.2019		TLM1	
6.	Fourier's law of heat conduction;	1	04.12.2019		TLM1,	

	Numerical Problems.				TLM2
7.	General heat conduction equation in cylindrical coordinate system and its simplifications.	1	06.12.2019		TLM1
8.	**Tutorial-1**	1	07.12.2019		TLM3
9.	General heat equation conduction in spherical coordinate system and its simplifications.	1	10.12.2019		TLM1, TLM2
10.	Heat conduction through plane wall and cylinder with constant thermal conductivity– Numerical Problems.	1	11.12.2019		TLM1, TLM2
11.	Electrical analogy, thermal resistance and overall heat transfer coefficient.	1	13.12.2019		TLM1, TLM2 TLM5
12.	Numerical Problems on thermal resistance and overall heat transfer coefficient	1	14.12.2019		TLM1, TLM2
13.	Heat transfer through composite slab	1	17.12.2019		TLM1,

	and cylinder, Numerical Problems.				TLM2	
14.	Critical radius of insulation for cylinder and Applications.	1	18.12.2019		TLM1, TLM4	
15.	Numerical Problems on critical radius of insulation, **Assignment -1** **Questions.**	1	20.12.2019		TLM1 TLM6	
16.	**Tutorial-2**	1	21.12.2019		TLM3	
No. of classes required to complete UNIT-I: 16				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	24.12.2019		TLM1	
2.	Heat flow through the cylinder with variable thermal conductivity, Numerical Problems.	1	27.12.2019		TLM1	
3.	Derivation on Uniform Internal heat generation in and cylinders	1	28.12.2019		TLM1, TLM2	

	slabs					
4.	Numerical Problems on Uniform Internal heat generation in slabs.	1	31.12.2019		TLM1	

5.	Numerical Problems on Uniform Internal heat generation in cylinders.	1	30.12.2019		TLM1, TLM2	
6.	**Tutorial-3**	1	31.12.2019		TLM3	
7.	Extended surfaces and their applications; Thermal analysis of long Fins	1	03.01.2020		TLM1, TLM4	
8.	Thermal analysis of short fins with insulated tip, Numerical Problems	1	04.01.2020		TLM1, TLM2	
9.	Fin efficiency and effectiveness, Numerical Problems	1	07.01.2020		TLM1, TLM2	
10.	Systems with negligible internal Resistance (Lumped Heat Analysis), Significance of Biot and Fourier Numbers	1	08.01.2020		TLM1	
11.	Plane wall with finite surface and Internal Resistance Heisler using Charts, **Assignment-2 Questions,**		10.01.2020		TLM1, TLM6	
12.	**Tutorial-**		11.01.2020		TLM3	

	4					
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	28.01.2020		TLM1, TLM2	
2.	Dimensional analysis and Buckingham Pi theorem applied to Forced Convection.	1	29.01.2020		TLM1, TLM2	
3.	Significance of Non Dimensional Numbers.	1	31.01.2020		TLM1, TLM2	
4.	The concept of boundary layer; Velocity and Thermal Boundary Layers, Numerical Problems.	1	1.02.2020		TLM1, TLM2 TLM5	
5.	**Tutorial -5**	1	04.02.202		TLM3	

			0			
6.	Forced convection analysis in external flows (Flow over a Flat Plate): Laminar and turbulent flows.	1	05.02.2020		TLM1, TLM2	
7.	Forced convection analysis in internal flows (Flow through circular pipe): Laminar and turbulent flows.	1	07.02.2020		TLM1, TLM2	
8.	Numerical Problems on Forced Convection.	1	08.02.2020		TLM1, TLM2	
9.	**Tutorial -6**	1	11.02.2020		TLM3	
10.	Reynolds Colburn Analogy.	1	12.02.2020		TLM1	
11.	Natural convection: Development of Hydrodynamic and thermal boundary layer along vertical plate.	1	14.02.2020		TLM1, TLM2 TLM4	
12.	Natural convection: empirical correlations for vertical and	1	15.02.202		TLM1, TLM2	

	horizontal plate and numerical problems		0			
13.	Natural convection: correlations for vertical and horizontal cylinders, and numerical problems **Assignment-3 Questions**	1	18.02.2020		TLM1, TLM6	
14.	**Tutorial -7**	14	19.02.2020		TLM3	
No. of classes required to complete UNIT-III:14				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 heat transfer and boiling applications.	1	21.02.2020		TLM1, TLM2	
2.	Pool Boiling, Different regimes of boiling; Critical heat flux.	1	22.02.2020		TLM1, TLM2 TLM5	
3.	Numerical problems on nucleate boiling and critical heat flux conditions.	1	25.02.2020		TLM1, TLM2	
4.	Condensation: Film wise and Drop wise condensation	1	26.02.2020		TLM1, TLM2	
5.	Laminar film condensation on wise Vertical plate, Numerical Problems	1	28.02.2020		TLM1, TLM2	
6.	**Tutorial-8**	1	29.02.2020		TLM3	

7.	Introduction and applications of Thermal Radiation	1	03.03.2020		TLM1, TLM2	
8.	Emissive Power, Absorption, Reflection and Transmission and Definitions related to Radiation	1	04.03.2020		TLM1, TLM2 TLM4	
9.	Concept of black and non-black bodies; Laws of black body radiation	1	06.03.2020		TLM1, TLM2 TLM5	
10.	Emissivity, Kirchhoff's law and Shape Factors	1	07.03.2020		TLM1, TLM2	
11.	Radiation heat exchange between two black isothermal nonblack surfaces, infinite parallel plates;	1	10.03.2020		TLM1, TLM2	
12.	Derivation on Radiation shields,	1	11.03.2020		TLM1	
13.	Numerical problems on Radiation shields, Assignment-4 Questions	1	13.03.2020		TLM1, TLM6	

14.	**Tutorial-9**	1	14.03.2020		TLM3	
No. of classes required to complete UNIT-IV:14				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	17.03.2020		TLM1, TLM2 TLM6	
2.	Overall heat transfer coefficient- Fouling factor	1	18.03.2020		TLM1, TLM2	
3.	LMTD method of Heat exchanger analysis- Parallel flow, Numerical Problems	1	20.03.2020		TLM1, TLM2 TLM4	
4.	LMTD method of Heat exchanger analysis- Counter flow, Numerical Problems	1	21.03.2020		TLM1, TLM2	

5.	Correction factor for LMTD for use with Multi pass and Cross flow Heat Exchangers	1	24.03.2020		TLM1, TLM2	
6.	**Tutorial - 10**	1	25.03.2020		TLM3	
7.	Effectiveness - NTU method of Heat	1	27.03.2020		TLM1,	

	Exchanger analysis –Parallel flow				TLM2	
8.	Effectiveness - NTU method of Heat Exchanger analysis –Counter flow	1	28.03.2020		TLM1, TLM2 TLM4	
9.	Numerical Problems on Effectiveness- NTU analysis	1	31.03.2020		TLM1, TLM2	
10.	**Tutorial -11**	1	31.04.2020		TLM3	
11.	Content beyond the syllabus – Design of helical coil heat exchangers	1	03.04.2020		TLM1, TLM2 TLM5	
12.	Innovations on radiation shields	1	04.04.2020		TLM1, TLM5	
No. of classes required to complete UNIT-V: 10				No. of classes taken:		

Teaching Learning Methods			
TLM 1	Chalk and Talk	**TLM 4**	Demonstration (Lab/Field Visit)
TLM 2	PPT	**TLM 5**	ICT (NPTEL/Swayam Prabha/MOOCS)
TLM 3	Tutorial	**TLM 6**	Group Discussion/Project

PART-C

[redacted]

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	**Communication:** Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.
PSO 2	**VLSI and Embedded Systems:** Design and Analyze Analog and Digital Electronic Circuits or systems and Implement real time applications in the field of VLSI and Embedded Systems using relevant tools
PSO 3	**Signal Processing:** Apply the Signal processing techniques to synthesize and realize the issues related to real time applications.

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

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LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
DEPARTMENT OF MECHANICAL ENGINEERING
(Autonomous & Affiliated to JNTUK, Kakinada & Approved by AICTE, New Delhi, NAAC Accredited with 'A' grade, Accredited by NBA, 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 METHOD – 17ME23

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

Program /Sem/Sec : B.Tech. MECH., VI-Sem., Section -B A.Y: 2019-20

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
107.	Introduction to Finite Element Method	1	25-11-19		**TLM1, TLM2**	
108.	Equilibrium equations in elasticity, Stresses in typical element	1	26-11-19		**TLM1,**	
109.	Stresses and equilibrium	1	29-11-19		**TLM1**	
110.						
111.	Strain displacement relations, Stress strain relations	1	30-11-19		**TLM1**	
112.	Plane stress and plane strain problems	1	2-12-19		**TLM1**	
113.	Potential energy and equilibrium method	1	3-12-19		**TLM1**	
114.	FE Formulation from governing differential equations	1	6-12-19		**TLM1**	
115.	Weighted residual methods	1	7-12-19		**TLM1**	
116.	One dimensional problems, FE Modeling	1	9-12-19		**TLM1**	
117.	**TUTORIAL-1**	1	10-12-19		**TLM1**	
118.	Shape functions & coordinates of shape functions		13-12-19		**TLM1**	
119.	Assembly of GSM & Load vector	1	14-12-19		**TLM1**	
120.	Finite element equations and treatment of boundary conditions	1	16-12-19		**TLM1**	
121.	Problems	1	17-12-19		**TLM1**	
122.	**TUTORIAL-2**	1	20-12-19		**TLM3**	
123.	Assignment/Quiz-1	1	21-12-19		**TLM6**	
No. of classes required to complete:17			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

124.	Analysis of Beams: Beam elements	1	23-12-19		**TLM1**	
125.	Types loading ,DOF, Boundary conditions	1	24-12-19		**TLM1**	
126.	Hermite shape functions	1	27-12-19		**TLM1**	
127.	Stiffness matrix for two node DOF per node	1	28-12-19		**TLM1**	
128.	**TUTORIAL-3**	1	30-12-19		**TLM3**	
129.	Problems	1	31-12-19		**TLM4**	
130.	Two dimensional elements (CST), Boundary conditions	1	3-1-20		**TLM1**	
131.	Jacobian, Shape functions, Area of triangles	1	4-1-20		**TLM1**	
132.	Problems	1	6-1-20		**TLM4**	
133.	Problems	1	7-1-20		**TLM4**	
134.	**TUTORIAL-4**	1	10-1-20		**TLM4**	
135.	Assignment/Quiz-2	1	11-1-20		**TLM6**	
No. of classes required to complete:12			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
136.	Axisymmetric solids , Axisymmetric loading	1	27-1-20		**TLM1, TLM2**	
137.	Finite element modeling	1	28-1-20		**TLM1**	
138.	Axisymmetric loading with triangular elements	1	31-1-20		**TLM1**	
139.	Problems	1	1-2-20		**TLM4**	
140.	2-D four nodded isoparametric elements, Jacobian, shape functions,	1	3-2-20		**TLM1**	
141.	Problems	1	4-2-20		**TLM4**	
142.	**TUTORIAL-5**	1	7-2-20		**TLM3**	
143.	Isoparametric formulation of 4- node quadrilateral element	1	8-2-20		**TLM1**	
144.	Numerical integration, Gauss Quadrature	1	10-2-20		**TLM1**	
145.	Problems	1	11-2-20		**TLM4**	
146.	**TUTORIAL-6**	1	14-2-20		**TLM3**	
147.	Assignment/Quiz-3	1	15-2-20		**TLM6**	
No. of classes required to complete:12			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
148.	One dimensional		17-2-20		**TLM1, TLM2**	

	analysis of HT problems					
149.	Conductivity matrix, boundary conditions		18-2-20		**TLM1**	
150.	1-D analysis of a fin, Conductivity matrix boundary conditions, Problems	1	21-2-20		**TLM1**	
151.	**TUTORIAL-7**	1	22-2-20		**TLM3**	
152.	Problems	1	24-2-20		**TLM1**	
153.	Problems	1	25-2-20		**TLM1**	
154.	Two dimensional analysis of thin plate	1	28-2-20		**TLM4**	
155.	Conductivity matrix, boundary conditions	1	29-2-20		**TLM4**	
156.	Convection matrix, Heat rate vector	1	2-3-20		**TLM1**	
157.	Problems	1	3-3-20		**TLM1**	
158.	Problems	1	6-3-20		**TLM1**	
159.	**TUTORIAL-8**	1	7-3-20		**TLM3**	
160.	Assignment/Quiz-4	1	9-3-20		**TLM6**	
No. of classes required to complete: 13				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
161.	Dynamic analysis introduction, Formulation	1	13-3-20		**TLM1**	
162.	Mass matrices, consistent Mass Matrices, Lumped Mass Matrices	1	14-3-20		**TLM1**	
163.	Evaluation of Eigen values &Eigenvectors	1	16-3-20		**TLM1**	
164.	**TUTORIAL-9**	1	17-3-20		**TLM3**	
165.	Problems	1	20-3-20		**TLM4**	
166.	**problems**	1	21-3-20		**TLM4**	
167.	**TUTORIAL-10**	1	23-3-20		**TLM3**	
168.	Assignment/Quiz-5	1	24-3-20		**TLM6**	
CRT CLASSES:1 WEEK						
No. of classes required to complete:08				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
169.	Analysis of beams for Uniformly variable	1	24-3-20		**TLM1**	

	loads					
170.	Evaluation of Eigen values &Eigenvectors for beams	1	24-3-20		**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**	**Dr.Y.Appala Naidu**	**Dr.S.Pichi Reddy**
Course Instructor	**Course Coordinator**	**Module Coordinator**	**HOD**

COURSE HANDOUT

PART-A

Name of Course Instructor: B.SUDHEER KUMAR

COURSE NAME & CODE : FINITE ELEMENT METHOD – 17ME23

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

Program /Sem/Sec : B.Tech. MECH., VI-Sem., Section -C A.Y: 19-20

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	Tentative Date of	Actual Date of	Teaching Learning	HOD Sign

		Required	Completion	Completion	Methods	Weekly
16.	Introduction to Finite Element Method	1	26-11-19		**TLM1, TLM2**	
17.	Equilibrium equations in elasticity, Stresses in typical element	1	27-11-19		**TLM1,**	
18.	Strain displacement relations, Stress strain relations	1	29-11-19		**TLM1**	
19.	Plane stress and plane strain problems	1	3-12-19		**TLM1**	
20.	Potential energy and equilibrium method	1	4-12-19		**TLM1**	
21.	FE Formulation from governing differential equations	1	5-12-19		**TLM1**	
22.	Weighted residual methods	1	6-12-19		**TLM1**	
23.	One dimensional problems, FE Modeling	1	10-12-19		**TLM1**	
24.	**TUTORIAL-1**	1	11-12-19		**TLM1**	
25.	Shape functions & coordinates of shape functions		12-12-19		**TLM1**	
26.	Assembly of GSM & Load vector	1	13-12-19		**TLM1**	
27.	Finite element equations and treatment of boundary conditions	1	17-12-19		**TLM1**	
28.	Problems	1	18-12-19		**TLM1**	
29.	**TUTORIAL-2**	1	19-12-19		**TLM3**	
30.	Assignment/Quiz-1	1	20-12-19		**TLM6**	
No. of classes required to complete:17			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
31.	Analysis of Beams: Beam elements	1	24-12-19		**TLM1**	
32.	Types loading ,DOF, Boundary conditions	1	26-12-19		**TLM1**	
33.	Hermite shape functions	1	27-12-19		**TLM1**	
34.	Stiffness matrix for two node DOF per node	1	31-12-19		**TLM1**	
35.	**TUTORIAL-3**	1	2-1-20		**TLM3**	
36.	Problems	1	3-1-20		**TLM4**	
37.	Two dimensional elements (CST), Boundary conditions	1	7-1-20		**TLM1**	
38.	Jacobian, Shape functions, Area of triangles	1	8-1-20		**TLM1**	

39.	Problems	1	9-1-20		**TLM4**	
40.	**TUTORIAL-4**	1	10-1-20		**TLM4**	
41.	Assignment/Quiz-2	1	10-1-20		**TLM6**	
No. of classes required to complete:12			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
42.	Axisymmetric solids , Axisymmetric loading	1	28-1-20		**TLM1, TLM2**	
43.	Finite element modeling	1	29-1-20		**TLM1**	
44.	Axisymmetric loading with triangular elements	1	30-1-20		**TLM1**	
45.	Problems	1	31-1-20		**TLM4**	
46.	2-D four nodded isoparametric elements, Jacobian, shape functions,	1	4-2-20		**TLM1**	
47.	Problems	1	5-2-20		**TLM4**	
48.	**TUTORIAL-5**	1	6-2-20		**TLM3**	
49.	Isoparametric formulation of 4- node quadrilateral element	1	7-2-20		**TLM1**	
50.	Numerical integration, Gauss Quadrature	1	11-2-20		**TLM1**	
51.	Problems	1	12-2-20		**TLM4**	
52.	**TUTORIAL-6**	1	13-2-20		**TLM3**	
53.	Assignment/Quiz-3	1	14-2-20		**TLM6**	
No. of classes required to complete:12			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
54.	One dimensional analysis of HT problems		18-2-20		**TLM1, TLM2**	
55.	Conductivity matrix, boundary conditions		19-2-20		**TLM1**	
56.	1-D analysis of a fin, Conductivity matrix boundary conditions.	1	20-2-20		**TLM1**	
57.	**TUTORIAL-7**	1	21-2-20		**TLM3**	
58.	Problems	1	25-2-20		**TLM1**	
59.	Problems	1	26-2-20		**TLM1**	
60.	Two dimensional analysis of thin plate	1	27-2-20		**TLM4**	
61.	Conductivity matrix, boundary conditions	1	28-2-20		**TLM4**	
62.	Convection matrix,	1	3-3-20		**TLM1**	

	Heat rate vector					
63.	Problems	1	4-3-20		**TLM1**	
64.	Problems	1	5-3-20		**TLM1**	
65.	**TUTORIAL-8**	1	6-3-20		**TLM3**	
66.	Assignment/Quiz-4	1	10-3-20		**TLM6**	
No. of classes required to complete: 13				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
67.	Dynamic analysis introduction, Formulation	1	12-3-20		**TLM1**	
68.	Mass matrices, consistent Mass Matrices, Lumped Mass Matrices	1	13-3-20		**TLM1**	
69.	Evaluation of Eigen values &Eigenvectors	1	17-3-20		**TLM1**	
70.	**TUTORIAL-9**	1	18-3-20		**TLM3**	
71.	Problems	1	19-3-20		**TLM4**	
72.	**problems**	1	20-3-20		**TLM4**	
73.	**TUTORIAL-10**	1	24-3-20		**TLM3**	
74.	Assignment/Quiz-5	1	25-3-20		**TLM6**	
CRT CLASSES:1 WEEK						
No. of classes required to complete:08				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
75.	Analysis of beams for Uniformly variable loads	1	25-3-20		**TLM1**	
76.	Evaluation of Eigen values &Eigenvectors for beams	1	25-3-20		**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**	**Dr.Y.Appala Naidu**	**Dr.S.Pichi Reddy**
Course Instructor	**Course Coordinator**	**Module Coordinator**	**HOD**

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

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : **Dr.N.SUNIL NAIK**
Course Name & Code : Automobile Engineering & 17ME24
L-T-P Structure : 3-0-0 Credits : 3
Program/Sem/Sec : B.Tech., MECH., VI-Sem., Section- B A.Y : 2019-20
PRE-REQUISITES : Thermodynamics, IC Engines and Gas-turbines

COURSE EDUCATIONAL OBJECTIVES (CEOs):

The objective of this course is to make students learn about automobile layout, working of Transmission system, Steering system, Suspension system, Braking system, Fuel system, different Electrical and Electronic 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 and electronics 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	-	-	-	1	2	2	-	-	-	-	2	1	-	-
CO2	3	-	-	-	2	2	3	2	-	-	-	2	2	-	-
CO3	3	-	-	-	-	2	2	-	-	-	-	1	1	-	-
CO4	3	1	2	-	2	-	-	-	-	-	-	2	2	-	2
CO5	2	1	-	-	-	-	-	2	-	-	-	2	2	-	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:

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):

UNIT-I: INTRODUCTION AND ENGINE CONSTRUCTIONAL DETAILS

Sl. 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 CO's and PO's	1	26-11-2019		TLM1	
2.	Introduction, Components of an Automobile	1	27-11-2019		TLM1	
3.	Rear wheel drive, front wheel drive and four-wheel drive	1	29-11-2019		TLM1/TLM2	
4.	Chassis, Frame-Types, Specifications of Automobiles, Types of Automobiles	1	03-12-2019		TLM1	
5.	Comparison of SI and CI Engines, Comparison of two stroke and four stroke engines	1	04-12-2019		TLM1	
6.	**Tutorial-I**	1	06-12-2019		TLM3	
7.	Cylinder block, Cylinder head, Crank case, Gaskets	1	10-12-2019		TLM1/TLM2	
8.	Manifolds, Oil-sump, Piston Construction, Piston clearance	1	11-12-2019		TLM1/TLM2	
9.	Expansion control in Pistons	1	13-12-2019		TLM1	
10.	Connecting Rod, Crank shaft, Cam-shaft, Flywheel	1	17-12-2019		TLM1/TLM2	
11.	Valve Construction, Straight poppet valve mechanism, Over head poppet valve mechanism	1	18-12-2019		TLM1/TLM2	
12.	**Tutorial-II and Quiz-I**	1	20-12-2019		TLM3	
No. of classes required to complete UNIT-I		**12**			No. of classes taken:	

UNIT-II: FUEL INJECTION SYSTEM IN SI AND CI ENGINES

Sl. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
13.	Fuel feed system in petrol engines-Types	1	24-12-2019		TLM1	
14.	Air-fuel mixtures, Mixture requirements at different loads and speeds	1	27-12-2019		TLM1	
15.	Carburetion, Principle	1	27-12-2019		TLM1/TLM2	

	of carburetion, Simple Carburetor					
16.	Difficulties encountered by simple Carburetor	1	31-12-2019		TLM1	
17.	Zenith and SU type Carburetor	1	03-01-2020		TLM1/TLM2	
18.	Fuel pumps (Mechanical and Electrical pumps)	1	03-01-2020		TLM1	
19.	**Tutorial-III**	1	07-01-2020		TLM3	
20.	Petrol Injection- Types of Petrol Injection	1	07-01-2020		TLM2	
21.	Methods of Diesel Injection system	1	08-01-2020		TLM1	
22.	Fuel Injector, Nozzle, Types of Nozzles and Spray formation	1	08-01-2020		TLM2	
23.	Air-cleaners in Petrol and Diesel engines and Fuel gauges	1	10-01-2020		TLM1	
24.	Fuel filters in Petrol and Diesel engines	1	10-01-2020		TLM1	
25.	**Tutorial-IV and Quiz-II**	1	14-01-2020		TLM3	
No. of classes required to complete UNIT-II		**13**		No. of classes taken:		

UNIT-III: IGNITION SYSTEM AND SENSORS

Sl. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
26.	Requirements of Ignition system, Battery Ignition system	1	28-01-2020		TLM1	
27.	Components of Battery Ignition system	1	29-01-2020		TLM2	
28.	Electronic Ignition system	1	31-01-2020		TLM2	
29.	Magneto Ignition system, Spark Plug Defects	1	31-01-2020		TLM1/TLM2	
30.	**Tutorial-V**	1	04-02-2020		TLM3	
31.	Sensors- Electromagnetic Sensors	1	05-02-2020		TLM2	
32.	Combustion knock Sensors & Variable resistance Sensors	1	05-02-2020		TLM2	
33.	Temperature Sensors	1	07-02-2020		TLM2	
34.	Manifold absolute pressure Sensors & Exhaust gas oxygen Sensors	1	07-02-2020		TLM1/TLM2	
35.	Traction control and stability control	1	11-02-2020		TLM2	
36.	**Tutorial-VI and Quiz-III**	1	11-02-2020		TLM3	

No. of classes required to complete UNIT-III	**11**	No. of classes taken:

UNIT-IV: Electrical System and Transmission system

Sl. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
37.	Starting system-Starter motor	1	12-02-2020		TLM1	
38.	Bendix drive mechanism, solenoid switch	1	12-02-2020		TLM2	
39.	Lighting system, Horn and wiper	1	14-02-2020		TLM1	
40.	Clutches-Requirements of clutches, principle of Clutch	1	14-02-2020		TLM1	
41.	cone clutch and Problems	1	18-02-2020		TLM1	
42.	Single plate clutch, Multi plate clutch	1	19-02-2020		TLM2	
43.	**Tutorial-VII**	1	19-02-2020		TLM3	
44.	Centrifugal clutches	1	21-02-2020		TLM2	
45.	Transmission-Functions of transmission and Various Resistances	1	21-02-2020		TLM1	
46.	Sliding mesh Gear box, Constant mesh gear box	1	25-02-2020		TLM2	
47.	Synchromesh gear box	1	25-02-2020		TLM2	
48.	Automatic transmission-Fluid-Flywheel, Torque convertor	1	26-02-2020		TLM2	
49.	Propeller shaft, Universal joint	1	26-02-2020		TLM1/TLM2	
50.	Hotchkiss drive, Differential	1	28-02-2020		TLM1/TLM2	
51.	**Tutorial-VIII and Quiz-IV**	1	28-02-2020		TLM3	
No. of classes required to complete UNIT-IV		**15**			No. of classes taken:	

UNIT-V: Steering, Suspension and Braking systems

Sl. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
52.	Front axle-Types, Steering geometry-I	1	03-03-2020		TLM1/TLM2	
53.	Steering geometry-II	1	04-03-2020		TLM1	
54.	Correct steering angle- Davis steering gear mechanism	1	04-03-2020		TLM1	
55.	Types of Steering gears	1	06-03-2020		TLM2	
56.	Power steering and **Tutorial-IX**	1	10-03-2020		TLM2/TLM3	
57.	Suspension system-Leaf springs, Coil springs	1	11-03-2020		TLM1	
58.	Torsion bar, Shock absorbers, Air-suspension system	1	13-03-2020		TLM1/TLM2	
59.	Independent Suspension systems	1	17-03-2020		TLM2	
60.	Braking system-Requirements, Drum and Disc brakes	1	18-03-2020		TLM1	

61.	Hydraulic braking system circuit, Air braking system	1	20-03-2020		TLM2	
62.	Anti-lock Braking system	1	24-03-2020		TLM2	
63.	**Tutorial-X and Quiz-V**	1	25-03-2019		TLM3	
No. of classes required to complete UNIT-V		**12**			No. of classes taken:	

Contents beyond the Syllabus

Sl. 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
64.	Contents beyond syllabus-Emissions	1	27-03-2020		TLM1	Revision of all units	T1/T2	
65.	Contents beyond syllabus-Emission regulations	1	27-03-2020		TLM2	CO1	R1/R4	

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	**Communication:** Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.
PSO 2	**VLSI and Embedded Systems:** Design and Analyze Analog and Digital Electronic Circuits or systems and Implement real time applications in the field of VLSI and Embedded Systems using relevant tools
PSO 3	**Signal Processing:** Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

Course Instructor	Course Coordinator	Module Coordinator	HOD
(Name)	(Name)	(Name)	(Name)

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DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Mr. S.Srinivasa reddy
Course Name & Code : 17ME13, MECHANICAL ENGINEERING DESIG-II
L-T-P Structure : 2-2-0 Credits : 3
Program/Sem/Sec : B.Tech., ME.,VI-Sem., Sections- A&B A.Y: 2019-20

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

URSE DELIVERY PLAN (LESSON PLAN):

T-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	25-11-2019		TLM1	
2	Introduction to Unit-1, **Bearings** –Introduction, theory of lubrication, Types, materials	1	27-11-2019		TLM1 TLM2	
3	**Journal Bearings** – Types, Important dimensionless parameters,	1	28-11-2019		TLM1 TLM2	
4	Design procedure of journal bearing	1	30-11-2019		TLM1	
5	Journal bearings - problems	1	02-12-2019		TLM4	
6	Heat generated and heat dissipated in the bearing design – problems	1	04-12-2019		TLM4	
7	**Tutorial-1**	1	05-12-2019			
8	**Rolling contact bearings-**types, bearing life, Materials and designation	1	07-12-2019		TLM3	
9	Static load and dynamic load capacity, equivalent bearing load	1	09-12-2019		TLM1 TLM2	
10	Selection of ball bearing - problems	1	11-12-2019		TLM1	
11	Selection of roller bearing - problems	1	12-12-2019		TLM4	
12	**Tutorial-2**	1	14-12-2019		TLM4	
13	Cubic mean load derivation, Reliability of bearings - problems	1	16-12-2019		TLM3	
14	Problem on roller bearings	1	18-12-2019		TLM4	
15	**Assignment -1/ Quiz-1**	1	19-12-2019		TLM6	
No. of classes required to complete UNIT-I: 15			No. of classes taken:			

T-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	21-12-2019		TLM1 TLM2	
2	Cylinder design - problems	1	23-12-2019		TLM4	
3	Problems on cylinder design	1	26-12-2019			
4	**PISTON** : Piston design, -design	1	2812-2019		TLM1 TLM2	
5	Problems on piston design	1	30-12-2019		TLM3	
6	Problems on Piston	1	01-01-2020			
7	**Tutorial-3**	1	02-01-2020			
8	**CONNECTING ROD**: Thrust in C.R, buckling load	1	04-01-2020		TLM1 TLM2	

9	Stresses due to whipping action on connecting rod ends- problems	1	06-01-2020		TLM4	
10	**CRANK SHAFT:** Design of crank and crank shaft	1	08-01-2020		TLM1 TLM2	
11	Strength of overhung shaft, center crank shaft -problem	1	09-01-2020		TLM4	
12	**Tutorial-4**	1	10-01-2020		TLM3	
13	**Assignment-2/Quiz-2**	1	11-01-2020		TLM6	
No. of classes required to complete UNIT-II: 13			No. of classes taken:			

T-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	27-01-2020		TLM1 TLM2	
2	Design of pulleys(mild steel & cast iron)	1	29-01-2020		TLM1	
3	V-belts –designation, design and selection	1	30-01-2020		TLM1 TLM2	
4	Design of V- grooved pulley	1	01-02-2020		TLM1	
5	Design of V belts - problems	1	03-02-2020		TLM4	
6	Problems on design of belts	1	05-02-2020			
7	**Tutorial-5**	1	06-02-2020		TLM3	
8	**WIRE ROPES: I**ntroduction**,** designation classification	1	10-02-2020		TLM1 TLM2	
9	Selection of wire ropes, Stresses in hoisting ropes	1	12-02-2020		TLM1	
10	Design of wire ropes-problems	1	13-02-2020		TLM4	
11	**Tutorial-6**	1	15-02-2020		TLM3	
12	**Assignment-4/Quiz-4**	1	17-02-2020		TLM6	
No. of classes required to complete UNIT-III: 11			No. of classes taken:			

T-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	19-02-2020		TLM1 TLM2	
2	Stresses, deflection and stiffness in springs and their derivations	1	20-02-2020		TLM1 TLM2	
3	Design of springs-problems	1	22-02-2020		TLM4	
4	Springs for fatigue loading	1	24-02-2020		TLM1	
5	**Tutorial-7**	1	26-02-2020		TLM3	
6	Spring failures, design of helical springs	1	27-02-2020		TLM1	
7	Natural frequency of helical spring	1	29-02-2020		TLM1	
8	Energy storage capacity in springs	1	02-03-2020		TLM1	
9	Tension and torsion springs	1	04-03-2020		TLM1	
10	Co-axial springs design- Problems	1	05-03-2020		TLM4	

11	Design of leaf springs- Problems	1	07-03-2020		TLM4	
12	**Tutorial-8**	1	09-03-2020		TLM3	
13	**Assignment-4/Quiz-4**	1	11-03-2020		TLM6	
No. of classes required to complete UNIT-V: 13			No. of classes taken:			

T-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	12-03-2020		TLM1 TLM2	
2	Design Analysis of gears, Estimation of centre distance, module & face width	1	16-03-2020		TLM1 TLM2	
3	Design procedure of spur gears, Check for dynamic and wear considerations	1	18-03-2020		TLM1 TLM2	
4	Design of spur gears - problems.	1	19-03-2020		TLM4	
5	Design procedure of helical gears.	1	21-03-2020		TLM1	
6	**Tutorial-9**	1	23-03-2020		TLM3	
7	**GEAR BOX**: Functions, Progress ratio	1	26-03-2020		TLM1	
8	Speed diagram, Kinematic arrangement	1	28-03-2020		TLM1	
9	Gear box design procedure -problems		30-03-2020		TLM4	
10	Problems	1	01-04-2020		TLM4	
11	**Tutorial-10**	1	02-04-2020		TLM3	
12	**Assignment-5/Quiz-5**	1	04-04-2020		TLM6	
No. of classes required to complete UNIT-V: 13			No. of classes taken:			

tents 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	09-02-2020		TLM1 TLM2		
2	Design of epicycle gear train	1	31-03-2020		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	Dr.Y.Appala Naidu	Dr.Y.Appala Naidu	Dr.S.Pichi Reddy

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DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : B. Chaitanya/ A Nageswara Rao
Course Name & Code : CAD/CAM LAB & 17ME70
L-T-P Structure : 0-0-2 Credits : 2
Program/Sem/Sec : B.Tech., MECH., VI-Sem., Sections- B A.Y : 2019-20

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	26.11.19		TLM4	
2	Knuckle joint - Part drawing	2	03.12.19		TLM4	
3	Knuckle joint - Assembly	2	10.12.19		TLM4	
4	Universal coupling - Part drawing	2	17.12.19		TLM4	
5	Universal coupling - Assembly	2	24.12.19		TLM4	
6	Piston-Connecting rod - Part drawing	2	31.12.19		TLM4	
7	Piston-Connecting rod - Assembly	2	07.01.20		TLM4	
8	Cantilever beam structural analysis	2	28.01.20		TLM4	
9	Truss structural analysis	2	04.02.20		TLM4	
10	Knuckle joint structural analysis	2	11.02.20		TLM4	
11	Spring-mass system modal analysis	2	18.02.20		TLM4	
12	Pin Fin heat transfer analysis	2	25.02.20		TLM4	
13	Linear and circular interpolation using XL mill	2	03.03.20		TLM4	
14	CNC programming for turning operation	2	10.03.20		TLM4	
15	Repetition	2	17.03.20		TLM4	
16	Repetition	2	24.03.20		TLM4	
17	Internal Exam	2	31.03.20		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	28.11.19		**TLM4**	
2	Knuckle joint - Part drawing	2	05.12.19		TLM4	
3	Knuckle joint - Assembly	2	11.12.19		TLM4	
4	Universal coupling - Part drawing	2	19.12.19		TLM4	
5	Universal coupling - Assembly	2	26.12.19		TLM4	
6	Piston-Connecting rod - Part drawing	2	02.01.20		TLM4	
7	Piston-Connecting rod - Assembly	2	09.01.20		TLM4	
8	Cantilever beam structural analysis	2	30.01.20		TLM4	
9	Truss structural analysis	2	06.02.20		TLM4	
10	Knuckle joint structural analysis	2	13.02.20		TLM4	
11	Spring-mass system modal analysis	2	20.02.20		TLM4	
12	Pin Fin heat transfer analysis	2	27.02.20		TLM4	
13	Linear and circular interpolation using XL mill	2	05.03.20		TLM4	
14	CNC programming for turning operation	2	12.03.20		TLM4	
15	Repetition	2	19.03.20		TLM4	
17	Internal Exam	2	26.03.20		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	A NAGESWARA RAO	J SUBBAREDDY	Dr S PICHI REDDY

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DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Dr.P.Ravindra Kumar
Course Name & Code : HEAT TRANSFER & 17ME20
L-T-P Structure : 3-1-0 Credits : 3
Program/Sem/Sec : B.Tech., Mech Engg., VI-Sem., Section- C A.Y : 2019-20

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.Necati Ozisik, 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	25.11.2019		TLM1	
2.	Introduction of five Units importance	1	26.11.2019		TLM1	
3.	Introduction to heat transfer and its applications, Basic modes and its physical mechanisms in heat transfer.	1	27.11.2019		TLM1, TLM2 TLM5	
4.	Steady, unsteady and periodic heat transfer and significance of thermal conductivity in heat conduction.	1	30.11.2019		TLM1, TLM4	
5.	General heat conduction equation in Cartesian coordinate system and its simplifications.	1	02.12.2019		TLM1	
6.	Fourier's law of heat conduction; Numerical Problems.	1	03.12.2019		TLM1, TLM2	
7.	General heat conduction equation in cylindrical coordinate system and its simplifications.	1	04.12.2019		TLM1	
8.	**Tutorial-1**	1	07.12.2019		TLM3	
9.	General heat conduction equation in spherical coordinate system and its simplifications.	1	09.12.2019		TLM1, TLM2	
10.	Heat conduction through plane wall and cylinder with constant thermal conductivity– Numerical Problems.	1	10.12.2019		TLM1, TLM2	
11.	Electrical analogy, thermal resistance and overall heat transfer coefficient.	1	11.12.2019		TLM1, TLM2 TLM5	
12.	Numerical Problems on thermal resistance and overall heat transfer coefficient	1	14.12.2019		TLM1, TLM2	
13.	Heat transfer through composite slab and cylinder, Numerical Problems.	1	16.12.2019		TLM1, TLM2	
14.	Critical radius of insulation for cylinder and Applications.	1	17.12.2019		TLM1, TLM4	
15.	Numerical Problems on critical radius of insulation, **Assignment-1 Questions.**	1	18.12.2019		TLM1 TLM6	
16.	**Tutorial-2**	1	21.12.2019		TLM3	
No. of classes required to complete UNIT-I: 16				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	23.12.2019		TLM1	
2.	Heat flow through the cylinder with variable thermal conductivity, Numerical Problems.	1	24.12.2019		TLM1	

3.	Derivation on Uniform Internal heat generation in slabs and cylinders	1	28.12.2019		TLM1, TLM2	
4.	Numerical Problems on Uniform Internal heat generation in slabs.	1	30.12.2019		TLM1	

5.	Numerical Problems on Uniform Internal heat generation in cylinders.	1	31.12.2019		TLM1, TLM2	
6.	**Tutorial-3**	1	04.01.2020		TLM3	
7.	Extended surfaces and their applications; Thermal analysis of long Fins	1	06.01.2020		TLM1, TLM4	
8.	Thermal analysis of short fins with insulated tip, Fin efficiency and effectiveness	1	07.01.2020		TLM1, TLM2	
9.	Systems with negligible internal Resistance (Lumped Heat Analysis), Significance of Biot and Fourier Numbers	1	08.01.2020		TLM1, TLM2	
10.	Plane wall with finite surface and Internal Resistance using Heisler Charts, **Assignment-2 Questions, Tutorial-4**	1	11.01.2020		TLM3 TLM6	
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	27.01.2020		TLM1, TLM2	
2.	Dimensional analysis and Buckingham Pi theorem applied to Forced Convection.	1	28.01.2020		TLM1, TLM2	
3.	Significance of Non Dimensional Numbers.	1	29.01.2020		TLM1, TLM2	
4.	The concept of boundary layer; Velocity and Thermal Boundary Layers, Numerical Problems.	1	01.02.2020		TLM1, TLM2 TLM5	
5.	**Tutorial-5**	1	03.02.2020		TLM3	
6.	Forced convection analysis in external flows (Flow over a Flat Plate): Laminar and turbulent flows.	1	04.02.2020		TLM1, TLM2	
7.	Forced convection analysis in internal flows (Flow through circular pipe): Laminar and turbulent flows.	1	05.02.2020		TLM1, TLM2	
8.	Numerical Problems on Forced Convection.	1	08.02.2020		TLM1, TLM2	
9.	**Tutorial-6**	1	10.02.2020		TLM3	
10.	Reynolds Colburn Analogy.	1	11.02.2020		TLM1	
11.	Natural convection: Development of Hydrodynamic and thermal boundary layer along vertical plate.	1	12.02.2020		TLM1, TLM2 TLM4	
12.	Natural convection: empirical correlations for vertical and horizontal plate and numerical problems	1	15.02.2020		TLM1, TLM2	
13.	Natural convection: empirical correlations for vertical and horizontal cylinders, and numerical problems **Assignment-3 Questions**	1	17.02.2020		TLM1, TLM6	
14.	**Tutorial-7**	14	18.02.2020		TLM3	
No. of classes required to complete UNIT-III:14				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	19.02.2020		TLM1, TLM2	
2.	Pool Boiling, Different regimes of boiling; Critical heat flux.	1	22.02.2020		TLM1, TLM2 TLM5	
3.	Numerical problems on nucleate boiling and critical heat flux conditions.	1	24.02.2020		TLM1, TLM2	
4.	Condensation: Film wise and Drop wise condensation	1	25.02.2020		TLM1, TLM2	
5.	Laminar film wise condensation on Vertical plate, Numerical Problems	1	26.02.2020		TLM1, TLM2	
6.	**Tutorial-8**	1	29.02.2020		TLM3	
7.	Introduction and applications of Thermal Radiation	1	02.03.2020		TLM1, TLM2	
8.	Emissive Power, Absorption, Reflection and Transmission and Definitions related to Radiation	1	03.03.2020		TLM1, TLM2 TLM4	
9.	Concept of black and non-black bodies; Laws of black body radiation	1	04.03.2020		TLM1, TLM2 TLM5	
10.	Emissivity, Kirchhoff's law and Shape Factors	1	07.03.2020		TLM1, TLM2	
11.	Radiation heat exchange between two black isothermal surfaces, nonblack infinite parallel plates;	1	09.03.2020		TLM1, TLM2	
12.	Derivation on Radiation shields,	1	10.03.2020		TLM1	
13.	Numerical problems on Radiation shields, Assignment-4 Questions	1	11.03.2020		TLM1, TLM6	
14.	**Tutorial-9**	1	14.03.2020		TLM3	
No. of classes required to complete UNIT-IV:14				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	16.03.2020		TLM1, TLM2 TLM6	
2.	Overall heat transfer coefficient- Fouling factor	1	17.03.2020		TLM1, TLM2	
3.	LMTD method of Heat exchanger analysis- Parallel flow, Numerical Problems	1	18.03.2020		TLM1, TLM2 TLM4	
4.	LMTD method of Heat exchanger analysis- Counter flow, Numerical Problems	1	21.03.2020		TLM1, TLM2	
5.	Correction factor for LMTD for use with Multi pass and Cross flow Heat Exchangers	1	23.03.2020		TLM1, TLM2	
6.	**Tutorial -10**	1	24.03.2020		TLM3	
7.	Effectiveness - NTU method of Heat Exchanger analysis –Parallel flow	1	25.03.2020		TLM1, TLM2	
8.	Effectiveness - NTU method of Heat	1	28.03.2020		TLM1,	

	Exchanger analysis –Counter flow				TLM2 TLM4	
9.	Numerical Problems on Effectiveness-NTU analysis	1	30.03.2020		TLM1, TLM2	
10.	**Tutorial -11**	1	31.03.2020		TLM3	
11.	Content beyond the syllabus – Design of helical coil heat exchangers	1	01.04.2020		TLM1, TLM2 TLM5	
12.	Innovations on radiation shields	1	04.04.2020		TLM1, TLM5	
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 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.P.Ravindra Kumar)	(Dr.P.Ravindra Kumar)	(Dr.P.Vijay Kumar)	(Dr.S.Pichi Reddy)

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DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Dr. Y. Appala Naidu

Course Name & Code : 17ME13, MECHANICAL ENGINEERING DESIGN-II

Structure : 2-2-0 Credits : 3

Program/Sem/Sec : B.Tech., ME.,VI-Sem., Section- C A.Y : 2019-20

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	25-11-2019		TLM1	
2	Introduction to Unit-1, **Bearings** –Introduction, theory of lubrication, Types, materials	1	27-11-2019		TLM1 TLM2	
3	**Journal Bearings** – Types, Important dimensionless parameters,	1	28-11-2019		TLM1 TLM2	
4	Design procedure of journal bearing	1	30-11-2019		TLM1	
5	Journal bearings - problems	1	02-12-2019		TLM4	
6	Heat generated and heat dissipated in the bearing design – problems	1	04-12-2019		TLM4	
7	**Tutorial-1**	1	05-12-2019			
8	**Rolling contact bearings**-types, bearing life, Materials and designation	1	07-12-2019		TLM3	
9	Static load and dynamic load capacity, equivalent bearing load	1	09-12-2019		TLM1 TLM2	
10	Selection of ball bearing - problems	1	11-12-2019		TLM1	
11	Selection of roller bearing - problems	1	12-12-2019		TLM4	
12	**Tutorial-2**	1	14-12-2019		TLM4	
13	Cubic mean load derivation, Reliability of bearings - problems	1	16-12-2019		TLM3	
14	Problem on roller bearings	1	18-12-2019		TLM4	
15	**Assignment -1/ Quiz-1**	1	19-12-2019		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	21-12-2019		TLM1 TLM2	
2	Cylinder design - problems	1	23-12-2019		TLM4	
3	Problems on cylinder design	1	26-12-2019			

4	**PISTON** : Piston design, -design	1	2812-2019		TLM1 TLM2	
5	Problems on piston design	1	30-12-2019		TLM3	
6	Problems on Piston	1	01-01-2020			
7	**Tutorial-3**	1	02-01-2020			
8	**CONNECTING ROD**: Thrust in C.R, buckling load	1	04-01-2020		TLM1 TLM2	

9	Stresses due to whipping action on connecting rod ends- problems	1	06-01-2020		TLM4	
10	**CRANK SHAFT:** Design of crank and crank shaft	1	08-01-2020		TLM1 TLM2	
11	Strength of overhung shaft, center crank shaft -problem	1	09-01-2020		TLM4	
12	**Tutorial-4**	1	10-01-2020		TLM3	
13	**Assignment-2/Quiz-2**	1	11-01-2020		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	27-01-2020		TLM1 TLM2	
2	Design of pulleys(mild steel & cast iron)	1	29-01-2020		TLM1	
3	V-belts –designation, design and selection	1	30-01-2020		TLM1 TLM2	
4	Design of V- grooved pulley	1	01-02-2020		TLM1	
5	Design of V belts - problems	1	03-02-2020		TLM4	
6	Problems on design of belts	1	05-02-2020			
7	**Tutorial-5**	1	06-02-2020		TLM3	
8	**WIRE ROPES: I**ntroduction**,** designation classification	1	10-02-2020		TLM1 TLM2	
9	Selection of wire ropes, Stresses in hoisting ropes	1	12-02-2020		TLM1	
10	Design of wire ropes-problems	1	13-02-2020		TLM4	
11	**Tutorial-6**	1	15-02-2020		TLM3	
12	**Assignment-4/Quiz-4**	1	17-02-2020		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	19-02-2020		TLM1 TLM2	
2	Stresses, deflection and stiffness in springs and their derivations	1	20-02-2020		TLM1 TLM2	
3	Design of springs-problems	1	22-02-2020		TLM4	

4	Springs for fatigue loading	1	24-02-2020		TLM1	
5	**Tutorial-7**	1	26-02-2020		TLM3	
6	Spring failures, design of helical springs	1	27-02-2020		TLM1	
7	Natural frequency of helical spring	1	29-02-2020		TLM1	
8	Energy storage capacity in springs	1	02-03-2020		TLM1	
9	Tension and torsion springs	1	04-03-2020		TLM1	
10	Co-axial springs design- Problems	1	05-03-2020		TLM4	

11	Design of leaf springs- Problems	1	07-03-2020		TLM4	
12	**Tutorial-8**	1	09-03-2020		TLM3	
13	**Assignment-4/Quiz-4**	1	11-03-2020		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	12-03-2020		TLM1 TLM2	
2	Design Analysis of gears, Estimation of centre distance, module & face width	1	16-03-2020		TLM1 TLM2	
3	Design procedure of spur gears, Check for dynamic and wear considerations	1	18-03-2020		TLM1 TLM2	
4	Design of spur gears - problems.	1	19-03-2020		TLM4	
5	Design procedure of helical gears.	1	21-03-2020		TLM1	
6	**Tutorial-9**	1	23-03-2020		TLM3	
7	**GEAR BOX**: Functions, Progress ratio	1	26-03-2020		TLM1	
8	Speed diagram, Kinematic arrangement	1	28-03-2020		TLM1	
9	Gear box design procedure -problems		30-03-2020		TLM4	
10	Problems	1	01-04-2020		TLM4	
11	**Tutorial-10**	1	02-04-2020		TLM3	
12	**Assignment-5/Quiz-5**	1	04-04-2020		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	09-02-2020		TLM1 TLM2		
2	Design of epicycle gear train	1	31-03-2020		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
Dr.Y.Appala Naidu	Dr.Y.Appala Naidu	Dr.Y.Appala Naidu	Dr.S.Pichi Reddy

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DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : S.Indrasena Reddy
Course Name & Code : CAD/CAM & 17ME22
L-T-P Structure : 3-0-0 Credits : 3
Program/Sem/Sec : B.Tech., Mech., VI-Sem., Section- C A.Y : 2019-20

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

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

REFERENCE BOOKS:

R1 P.N Rao,CAD/CAM Principle and applications, Tata McGraw Hill Education Private Ltd,New Delhi,8th edition 2013.

R2 P.Radhakrishnan,S.Subramanyam&V.Raju,CAD/CAM/CIM,New Age International Publishers,3rd edition 2010.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: FUNDAMENTALS OF CAD:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
17.	Introduction to CAD	1	25-11-19		TLM1	
18.	The design process, application of computers for design	1	27-11-19		TLM2	
19.	Product cycle, Benefits of CAD	1	29-11-19		TLM1	
20.	Functions of a Graphics package	1	02-12-19		TLM1	
21.	Raster scan graphics	1	04-12-19		TLM2	
22.	Transformations	1	06-12-19		TLM1	
23.	scaling, reflection	1	09-12-19		TLM1	
24.	Transformations: rotation	1	11-12-19		TLM1	
25.	Homogeneous, Concatenated transformations	1	13-12-19		TLM2	
No. of classes required to complete UNIT-I: 09				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.	Introduction to Representation of curves	1	16-12-19		TLM1	
12.	wireframe models, wireframe entities, analytical curves	1	18-12-19		TLM1	
13.	Representation of Bezier and B-Spline curves	1	20-12-19		TLM2	
14.	Curve fitting	1	23-12-19		TLM1	
15.	Representation of analytical surfaces	1	27-12-19		TLM1	
16.	Bezier and B-Spline surfaces	1	30-12-19		TLM2	
17.	Representation of solid entities	1	03-01-20		TLM1	
18.	Boundary representation	1	06-01-20		TLM1	
19.	CSG representation	1	08-01-20		TLM2	
20.	Sweep representation.	1	10-01-20		TLM1	
No. of classes required to complete UNIT-II:10				No. of classes taken:		

UNIT-III: COMPUTER NUMERICAL 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
15.	CNC, NC modes – NC elements	1	27-01-20		TLM1	
16.	NC Coordinate systems,	1	29-01-20		TLM1	

	Structure of CNC Machine Tools					
17.	Spindle design ,drives	1	31-01-20		TLM1	
18.	Feed drives – actuation - systems.	1	03-02-20		TLM2	
19.	NC Coding	1	05-02-20		TLM4	
20.	Part programming Fundamentals	1	07-02-20		TLM1	
21.	Manual part programming	1	10-02-20		TLM1	
22.	computer aided part programming	1	12-02-20		TLM2	
23.	APT Language.	1	14-02-20		TLM1	
No. of classes required to complete UNIT-III:09				No. of classes taken:		

UNIT-IV : GROUP TECHNOLOGY

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
15.	Introduction to GT, Parts classifications and coding	1	17-02-20		TLM1	
16.	OPITZ system	1	19-02-20		TLM2	
17.	MICLASS system	1	21-02-20		TLM1	
18.	CODE System	1	24-02-20		TLM1	
19.	GT Machine cells	1	26-02-20		TLM2	
20.	CAPP	1	28-02-20		TLM1	
21.	Retrieval and generative type	1	02-03-20		TLM1	
22.	Introduction to FMS	1	04-03-20		TLM1	
23.	FMS components	1	06-03-20		TLM2	
No. of classes required to complete UNIT-IV:09				No. of classes taken:		

UNIT-V : COMPUTER AIDED 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
13.	Introduction to CAQC	1	09-03-20		TLM1	
14.	Contact Inspection methods	1	11-03-20		TLM2	
15.	Non contact inspection methods	1	13-03-20		TLM2	
16.	optical, non optical – Computer Aided Testing	1	16-03-20		TLM2	
17.	Integration of CAQC with CAD/CAM	1	18-03-20		TLM1	
18.	Introduction to CIM Systems	1	20-03-20		TLM1	
19.	Integration-CIM	1	23-03-20		TLM1	
20.	Benefits of CIM.	1	25-03-20		TLM1	
21.	Lean manufacturing	1	27-03-20		TLM1	
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 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.Indrasena Reddy)	(A.Nageswara Rao)	(J.Subba Reddy)	(Dr.S.Pichi Reddy)

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DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor: B.SUDHEER KUMAR

COURSE NAME & CODE : FINITE ELEMENT METHOD – 17ME23

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

Program /Sem/Sec : B.Tech. MECH., VI-Sem., Section -C A.Y: 19-20

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	26-11-19		**TLM1, TLM2**	
2.	Equilibrium equations in elasticity, Stresses in typical element	1	27-11-19		**TLM1,**	
3.	Strain displacement relations, Stress strain relations	1	29-11-19		**TLM1**	
4.	Plane stress and plane strain problems	1	3-12-19		**TLM1**	
5.	Potential energy and equilibrium method	1	4-12-19		**TLM1**	
6.	FE Formulation from governing differential equations	1	5-12-19		**TLM1**	
7.	Weighted residual methods	1	6-12-19		**TLM1**	
8.	One dimensional problems, FE Modeling	1	10-12-19		**TLM1**	
9.	**TUTORIAL-1**	1	11-12-19		**TLM1**	
10.	Shape functions & coordinates of shape functions		12-12-19		**TLM1**	
11.	Assembly of GSM & Load vector	1	13-12-19		**TLM1**	
12.	Finite element equations and treatment of boundary conditions	1	17-12-19		**TLM1**	
13.	Problems	1	18-12-19		**TLM1**	
14.	**TUTORIAL-2**	1	19-12-19		**TLM3**	
15.	Assignment/Quiz-1	1	20-12-19		**TLM6**	
No. of classes required to complete:17			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

16.	Analysis of Beams: Beam elements	1	24-12-19		**TLM1**	
17.	Types loading ,DOF, Boundary conditions	1	26-12-19		**TLM1**	

18.	Hermite shape functions	1	27-12-19		**TLM1**	
19.	Stiffness matrix for two node DOF per node	1	31-12-19		**TLM1**	
20.	**TUTORIAL-3**	1	2-1-20		**TLM3**	
21.	Problems	1	3-1-20		**TLM4**	
22.	Two dimensional elements (CST), Boundary conditions	1	7-1-20		**TLM1**	
23.	Jacobian, Shape functions, Area of triangles	1	8-1-20		**TLM1**	
24.	Problems	1	9-1-20		**TLM4**	
25.	**TUTORIAL-4**	1	10-1-20		**TLM4**	
26.	Assignment/Quiz-2	1	10-1-20		**TLM6**	
No. of classes required to complete:12			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
27.	Axisymmetric solids , Axisymmetric loading	1	28-1-20		**TLM1, TLM2**	
28.	Finite element modeling	1	29-1-20		**TLM1**	
29.	Axisymmetric loading with triangular elements	1	30-1-20		**TLM1**	
30.	Problems	1	31-1-20		**TLM4**	
31.	2-D four nodded isoparametric elements, Jacobian, shape functions,	1	4-2-20		**TLM1**	
32.	Problems	1	5-2-20		**TLM4**	
33.	**TUTORIAL-5**	1	6-2-20		**TLM3**	
34.	Isoparametric formulation of 4- node quadrilateral element	1	7-2-20		**TLM1**	
35.	Numerical integration, Gauss Quadrature	1	11-2-20		**TLM1**	
36.	Problems	1	12-2-20		**TLM4**	
37.	**TUTORIAL-6**	1	13-2-20		**TLM3**	
38.	Assignment/Quiz-3	1	14-2-20		**TLM6**	
No. of classes required to complete:12			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
39.	One dimensional analysis of HT problems		18-2-20		**TLM1, TLM2**	

40.	Conductivity matrix, boundary conditions		19-2-20		**TLM1**	

41.	1-D analysis of a fin, Conductivity matrix boundary conditions.	1	20-2-20		**TLM1**	
42.	**TUTORIAL-7**	1	21-2-20		**TLM3**	
43.	Problems	1	25-2-20		**TLM1**	
44.	Problems	1	26-2-20		**TLM1**	
45.	Two dimensional analysis of thin plate	1	27-2-20		**TLM4**	
46.	Conductivity matrix, boundary conditions	1	28-2-20		**TLM4**	
47.	Convection matrix, Heat rate vector	1	3-3-20		**TLM1**	
48.	Problems	1	4-3-20		**TLM1**	
49.	Problems	1	5-3-20		**TLM1**	
50.	**TUTORIAL-8**	1	6-3-20		**TLM3**	
51.	Assignment/Quiz-4	1	10-3-20		**TLM6**	
No. of classes required to complete: 13				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
52.	Dynamic analysis introduction, Formulation	1	12-3-20		**TLM1**	
53.	Mass matrices, consistent Mass Matrices, Lumped Mass Matrices	1	13-3-20		**TLM1**	
54.	Evaluation of Eigen values &Eigenvectors	1	17-3-20		**TLM1**	
55.	**TUTORIAL-9**	1	18-3-20		**TLM3**	
56.	Problems	1	19-3-20		**TLM4**	
57.	**problems**	1	20-3-20		**TLM4**	
58.	**TUTORIAL-10**	1	24-3-20		**TLM3**	
59.	Assignment/Quiz-5	1	25-3-20		**TLM6**	
CRT CLASSES:1 WEEK						
No. of classes required to complete:08				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
60.	Analysis of beams for Uniformly variable loads	1	25-3-20		**TLM1**	
61.	Evaluation of Eigen values &Eigenvectors for beams	1	25-3-20		**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**	**Dr.Y.Appala Naidu**	**Dr.S.Pichi Reddy**
Course Instructor	**Course Coordinator**	**Module Coordinator**	**HOD**

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DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : K. Lakshmi Prasad &
Course Name & Code : Automobile Engineering & 17ME 24
L-T-P Structure : 3-0-0 Credits : 3
Program/Sem/Sec : B.Tech., ME., VI-Sem., Sections- C A.Y : 2019-20

PRE-REQUISITE: 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, students are able to

CO 1	Acquire the basic knowledge of anatomy of an Automobile and its components.
CO 2	Comprehend the fuel supply system in petrol and Diesel Engines.
CO 3	Realize the functions of various electrical systems used in automobiles.
CO 4	Distinguish various transmission systems used in automobiles.
CO 5	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).

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.

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):

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	HOD Sign Weekly
26.	Introduction to CO's and PO's	1	26.11.19			
27.	Introduction, Components of an Automobile	1	27.11.19			
28.	Rear wheel drive, front wheel drive and four wheel drive	1	29.11.19			
29.	Chassis, Frame-Types, Specifications of Automobiles, Types of Automobiles	1	03.12.19			
30.	**ENGINE:** Basic terminology and working of engines	1	04.12.19			
31.	Engine construction Details- Cylinder Block and Crankcase- Cylinder Head- Oil Pan- Manifolds- Gaskets- Cylinder Liners- Piston- Connecting Rod- Engine Valves,	1	06.12.19			
32.	Firing Order, Turbo charging.	1	10.12.19			
33.	**AUTOMOBILE POLLUTION:** Emissions from Automobiles	1	11.12.19			
34.	Nitrogen oxides, Soot, Carbon monoxide, Hydrocarbons, Particulates, Emission Regulations	1	17.12.19			
No. of classes required to complete UNIT-I: 9				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	HOD Sign Weekly
21.	**ENGINE SERVICING:** Engine Removal, Cylinder Head, Gaskets	1	18.12.19			
22.	Valves, Piston-connecting Rod Assembly.	1	20.12.19			
23.	Fuel feed system in petrol engines- Types	1	24.12.19			
24.	Carburetion, Principle of carburetion, Simple Carburetor	1	27.12.19			
25.	Defects encountered by simple Carburetor	1	31.12.19			
26.	Zenith and SU type Carburetor	1	03.01.20			
27.	Petrol Injection- Types	1	07.01.20			
28.	Types of Injection systems in Diesel Engines,	1	08.01.20			
29.	Fuel Injection pumps – Jerk type Pump, Governor- Types	1	10.01.20			
No. of classes required to complete UNIT-II: 9				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	HOD Sign Weekly

24.	**IGNITION SYSTEM:** Types of Ignition systems	1	28.01.20			
25.	Battery Ignition system- Components of Battery Ignition system, Ignition timing,	1	29.01.20			

	Spark plug,					
26.	Magneto Ignition system,	1	31.01.20			
27.	Electronic Ignition system- Capacitive discharge Ignition system.	1	04.02.20			
28.	**CHARGING SYSTEM & STARTING SYTEMS:** Batteries- Types	1	05.02.20			
29.	Charging system- Introduction- Principle of Generator and constructional details	1	07.02.20			
30.	Generator output control	1	11.02.20			
31.	Starting Motor, Starting drives	1	12.02.20			
32.	Bendix rives, Solenoid switch.	1	14.02.20			
No. of classes required to complete UNIT-III: 9				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	HOD Sign Weekly
24.	**TRANSMISSION SYSTEM:** Clutches- Introduction, Types, Single plate clutch	1	18.02.20			
25.	-Multi plate Clutch, Centrifugal clutch, Fluid Fly wheel	1	19.02.20			
26.	Necessity of Transmission, Types of Transmission	1	21.02.20			
27.	Sliding Mesh Gear Box- Constant Mesh gear box	1	25.02.20			
28.	Torque convertor, Propeller shaft, Final drive, Differential, Rear axle drives.	1	26.02.20			
29.	**WHEELS AND TYRES:** Types of Wheels, Wheel dimensions	1	28.02.20			
30.	Tyre- Types of Tyres, Carcass types	1	03.03.20			
31.	Tyre Materials, Tyre designations.	1	04.03.20			
32.	**FRONT AXLE AND STEERING:** Front Axle, Types of stub axle,	1	06.03.20			
No. of classes required to complete UNIT-IV: 9				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	HOD Sign Weekly
22.	Wheel alignment, Steering geometry- Camber- Kingpin inclination-	1	11.03.20			
23.	Combined angle and scrub radius- Castor- Toe in and Toe out,	1	13.03.20			
24.	Understeer and Oversteer, Power steering, Steering Linkages, Steering gears.	1	17.03.20			
25.	**SUSPENSION SYSTEM:** Introduction, Types of Suspension springs,	1	18.03.20			
26.	Leaf springs, Coil springs, Torsion bars, Shock Absorbers	1	20.03.20			
27.	Independent suspension- Types, Air-suspension	1	24.03.20			
28.	**BRAKING SYSTEM:** Braking Requirements, Types of Brakes	1	27.03.20			

29.	Drum brakes and Disc Brakes, Hydraulic Brakes, Air brakes, Anti-lock braking systems.	1	31.03.20			
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 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	**Communication:** Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.
PSO 2	**VLSI and Embedded Systems:** Design and Analyze Analog and Digital Electronic Circuits or systems and Implement real time applications in the field of VLSI and Embedded Systems using relevant tools
PSO 3	**Signal Processing:** Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

Course Instructor	Course Coordinator	Module Coordinator	HOD
K. Lakshmi Prasad	Dr. N.Sunil Naik	Dr. P.Vijay Kumar	Dr. S. Pichi Reddy

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DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : 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., Sections- C A.Y : 2019-20

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
35.	Introduction to Course and COs	1	26-11-2019		TLM1	
36.	Introduction to Unit-I	1	27-11-2019		TLM1	
37.	Strategy of experimentation	2	30-11-2019 03-12-2019		TLM1	
38.	some typical applications of experimental design,	1	04-12-2019		TLM1	
39.	Basic principles	1	07-12-2019		TLM1	
40.	Guidelines for designing experiments	1	10-12-2019		TLM1	
41.	a brief history of statistical design, using statistical design in experimentation	1	11-12-2019		TLM1	
No. of classes required to complete UNIT-I: 08				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
30.	Introduction	1	14-12-2019		TLM1	
31.	Basic statistical concepts	1	17-12-2019		TLM1	
32.	Sampling and Sampling Distribution	1	18-12-2019		TLM1	
33.	Inferences about the Differences in means	1	21-12-2019		TLM2	
34.	randomized designs	1	24-12-2019		TLM2	
35.	paired comparison Designs	1	28-12-2019		TLM1	
36.	Inferences about the Variances of Normal Distributions	1	31-12-2019		TLM2	
37.	problems	1	04-01-2020			
No. of classes required to complete UNIT-II:8				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
33.	Basic principles of variance, analysis of variance	1	07-01-2020		TLM1	
34.	Analysis of fixed effects model	1	08-01-2020		TLM1	
35.	Decomposition of the total sum of squares	1	11-01-2020		TLM1	

36.	Statistical Analysis	1	28-01-2020		TLM2	
37.	Estimation of model parameters, unbalanced data	2	29-01-2020 04-02-2020		TLM2	
38.	Nonparametric methods in the Analysis of variance	2	05-02-2020 08-02-2020		TLM1	
No. of classes required to complete UNIT-III:8				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
33.	The Randomized Complete Block Design	2	11-02-2020 12-02-2020		TLM1	
34.	Statistical Analysis of the RCBD	1	15-02-2020		TLM1	
35.	Model adequacy checking	1	18-02-2020		TLM1	
36.	Latin square design	1	19-02-2020		TLM2	
37.	Graeco-Latin Square Design	2	22-02-2020 25-02-2020		TLM2	
38.	Balanced incomplete block design	2	26-02-2020 29-02-2020		TLM1	
No. of classes required to complete UNIT-IV:9				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
30.	Quality Improvement and Statistics	1	03-03-2020		TLM1	
31.	Statistical Quality Control	1	04-03-2020		TLM1	
32.	Statistical Process Control, Control Charts	1	07-03-2020		TLM1	
33.	X and R chart	2	10-03-2020 11-03-2020		TLM2	
34.	P chart, U chart	2	14-03-2020 17-03-2020		TLM2	
35.	Control chart performance	1	18-03-2020		TLM1	
36.	Implementing SPC	1	21-03-2020		TLM2	
No. of classes required to complete UNIT-V:9				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	**Communication:** Design and develop modern communication technologies for building the inter disciplinary skills to meet current and future needs of industry.
PSO 2	**VLSI and Embedded Systems:** Design and Analyze Analog and Digital Electronic Circuits or systems and Implement real time applications in the field of VLSI and Embedded Systems using relevant tools
PSO 3	**Signal Processing:** Apply the Signal processing techniques to synthesize and realize the issues related to real time applications

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

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DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Kamala Priya B/ A Dhanunjay Kumar
Course Name & Code : CAD/CAM LAB & 17ME70
L-T-P Structure : 0-0-2 Credits : 2
Program/Sem/Sec : B.Tech., MECH., VI-Sem., Section- C A.Y : 2019-20

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	25.11.19		TLM4	
2	Knuckle joint - Part drawing	2	02.12.19		TLM4	
3	Knuckle joint - Assembly	2	09.12.19		TLM4	
4	Universal coupling - Part drawing	2	16.12.19		TLM4	
5	Universal coupling - Assembly	2	23.12.19		TLM4	
6	Piston-Connecting rod - Part drawing	2	30.12.19		TLM4	
7	Piston-Connecting rod - Assembly	2	06.01.20		TLM4	
8	Cantilever beam structural analysis	2	27.01.20		TLM4	
9	Truss structural analysis	2	03.02.20		TLM4	
10	Knuckle joint structural analysis	2	10.02.20		TLM4	
11	Spring-mass system modal analysis	2	17.02.20		TLM4	
12	Pin Fin heat transfer analysis	2	24.02.20		TLM4	
13	Linear and circular interpolation using XL mill	2	02.03.20		TLM4	
14	CNC programming for turning operation	2	09.03.20		TLM4	
15	Repetition	2	16.03.20		TLM4	
16	Repetition	2	23.03.20		TLM4	
17	Internal Exam	2	30.03.20		TLM4	
No. of classes required to complete : 17				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	29.11.19		TLM4	
2	Knuckle joint - Part drawing	2	06.12.19		TLM4	
3	Knuckle joint - Assembly	2	13.12.19		TLM4	
4	Universal coupling - Part drawing	2	20.12.19		TLM4	
5	Universal coupling - Assembly	2	27.12.20		TLM4	
6	Piston-Connecting rod - Part drawing	2	03.01.20		TLM4	
7	Piston-Connecting rod - Assembly	2	10.01.20		TLM4	
8	Cantilever beam structural analysis	2	31.01.20		TLM4	
9	Truss structural analysis	2	07.02.20		TLM4	
10	Knuckle joint structural analysis	2	14.02.20		TLM4	
11	Spring-mass system modal analysis	2	21.02.20		TLM4	
12	Pin Fin heat transfer analysis	2	28.02.20		TLM4	
13	Linear and circular interpolation using XL mill	2	06.03.20		TLM4	
14	CNC programming for turning operation	2	13.03.20		TLM4	
15	Repetition	2	20.03.20		TLM4	
17	Internal Exam	2	27.03.20		TLM4	
No. of classes required to complete: 17				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**
KAMALA PRIYA B	A NAGESWARA RAO	J SUBBAREDDY	Dr S PICHI REDDY

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DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

Part-A

PROGRAM : B.Tech, VI-Sem., ME, C/S

ACADEMIC YEAR : 2019-20

COURSE NAME & CODE : Heat Transfer Lab &17ME71

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

COURSE CREDITS 2

LABORATORY INSTRUCTORS : Dr. P.Ravindra Kumar/B.Udaya Lakshmi

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 Publisher

Part-B

COURSE: B.Tech BRANCH: MECHANICAL 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	25.11.19	02.12.19	09.12.19	16.12.19	23.12.19	30.12.19	28.01.20	04.02.20	11.02.20	18.02.20	25.02.20	02.03.20	09.03.20
		Regd. No	CYCLE-I						CYCLE-2						
1	BATCH-I	17761A03B2	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		17761A03B3	DEMO	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5		
3		17761A03B4	DEMO	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5		
4		17761A03B5	DEMO	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5		

5		17761A03B6	DEMO	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5		
6		17761A03B7	DEMO	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5		
7	BATCH-2	17761A03B8	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		
8		17761A03B9	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		
9		17761A03C0	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		
10		17761A03C1	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		
11		17761A03C2	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		
12		17761A03C4	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		
13	BATCH-3	17761A03C5	DEMO	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2		
14		17761A03C6	DEMO	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2		
15		17761A03C8	DEMO	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2		
16		17761A03D0	DEMO	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2		
17		17761A03D1	DEMO	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2		
18		17761A03D2	DEMO	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2		
19	BATCH-4	17761A03D3	DEMO	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3		
20		17761A03D4	DEMO	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3		
21		17761A03D5	DEMO	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3		
22		17761A03D6	DEMO	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3		
23		17761A03D7	DEMO	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3		
24		17761A03D9	DEMO	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3		
25		17761A03E0	DEMO	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3		
26	BATCH-5	17761A03E1	DEMO	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4		
27		17761A03E2	DEMO	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4		
28		17761A03E3	DEMO	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4		
29		17761A03E4	DEMO	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4		
30		17761A03E5	DEMO	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4		
31		17761A03E6	DEMO	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4		
32		17761A03E7	DEMO	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4		

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	29.11.19	06.12.19	13.12.19	20.12.19	27.12.19	03.01.20	10.01.20	31.01.20	07.02.20	14.02.20	21.02.20	28.02.20	06.03.20
		Regd.No	CYCLE-I						CYCLE-2						
1	BATCH-I	17761A03E8	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		17761A03E9	DEMO	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5		
3		17761A03F1	DEMO	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5		
4		17761A03F2	DEMO	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5		
5		17761A03F3	DEMO	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5		
6		17761A03F4	DEMO	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5		
8	BATCH-2	17761A03F5	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		
9		17761A03F6	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		
10		17761A03F7	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		
11		17761A03F8	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		
12		17761A03F9	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		
13		17761A03G0	DEMO	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1		
15	BATCH-3	17761A03G1	DEMO	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2		
16		17761A03G2	DEMO	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2		
17		17761A03G3	DEMO	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2		
18		17761A03G4	DEMO	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2		
19		17761A03G5	DEMO	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2		
20		17761A03G6	DEMO	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2		
21	BATCH-4	18765A0331	DEMO	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	REPITION	INTERNAL LAB TEST
22		18765A0332	DEMO	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3		
23		18765A0333	DEMO	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3		
24		18765A0334	DEMO	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3		
25		18765A0335	DEMO	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3		
26		18765A0336	DEMO	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3		
27	BATCH-5	18765A0337	DEMO	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4		
28		18765A0338	DEMO	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4		
29		18765A0340	DEMO	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4		
30		18765A0341	DEMO	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4		
31		18765A0342	DEMO	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4		
32		18765A0343	DEMO	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4		
33		18765A0344	DEMO	HT-5	HT-1	HT-2	HT-3	HT-4	HT-5	HT-1	HT-2	HT-3	HT-4		

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**