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 : C.Rajamallu
Course Name & Code : **BASIC CIVIL ENGINEERING&17CE80**
L-T-P Structure : 3-0-0 Credits : 3
Program/Sem/Sec : B.Tech., ME., VII-Sem., Sections- A-B-C- A.Y : 2022-23

PRE-REQUISITE:Nil

COURSE EDUCATIONAL OBJECTIVES (CEOs):.This course deals withthe importance of building planning, properties and applications of various building materials, soil classification and different types of foundations, important aspects of surveying, levelling operations and identify the terminology in roadway and railway networks, principles of water resources and environmental engineering

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

CO 1	Recognize the importance of building planning for construction
CO 2	Identify appropriate building materials for construction purposes
CO 3	Distinguish the different types of soils and foundations required for specific usage
CO 4	Evaluate the basics of surveying and levelling operations for field application and categorize the important elements of roadway and railway networks
CO 5	Discriminate the importance of quantity and quality aspects of water in the society and priorities for sanitation management.

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

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1				2		2	1				2		2	1	3
CO2				2		2	1				2		2	1	3
CO3		1	1	2		2	1				2		2	1	3
CO4		1	1	2		2	1				2		2	1	3
CO5		1	1	2	2	2	1				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 1. M.S Palanichamy "Basic Civil Engineering", Tata McGraw Hill Publishing 2000.

REFERENCE BOOKS:

R1 1. S SBhavikatti "Basic Civil Engineering", New age International Publications, 2010

R2 C P Kaushik& S SBhavikatti "Basic Civil Engineering ", New age International Publications 2010.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Building Planning

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.	Building Planning-Role of a Civil Engineer	1	11-07-2022		TLM2	
2.	Inter connection among specializations in Civil Engineering	1	13-07-2022		TLM2	
3.	Elements of a Building, Basic Requirements of a Building	1	14-07-2022		TLM2	
4.	Planning- Hot and dry climates	1	15-07-2022		TLM1	
5.	Hot and wet climates, Cold climatic conditions	1	18-07-2022		TLM1	
6.	Aspect and Prospect, Roominess- Grouping, Privacy, circulation	1	20-07-2022		TLM1	
7.	Sanitation and ventilation	1	21-07-2022		TLM2	
8.	Orientation, Economy, Role of Bye-laws	1	22-07-2022		TLM2	
No. of classes required to complete UNIT-I:				No. of classes taken:		

UNIT-II: Building Materials

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.	Building Materials - Classification	1	25-07-2022		TLM1	
2.	Rocks, Bricks Classification, Composition, Properties, Commercial forms, Uses	1	27-07-2022		TLM2	
3.	Timber, Ply wood Classification, Composition, Properties, Commercial forms	1	28-07-2022		TLM2	
4.	Glass, Bitumen Classification, Composition, Properties,	1	29-07-2022		TLM1	

	Commercial forms,					
5.	Aluminium, Cement Classification, Composition, Properties, Commercial forms,	1	01-08-2022		TLM1	
6.	Steel, Concrete Classification, Composition, Properties, Commercial forms, Uses	1	03-08-2022		TLM2	
7.	Mortar Classification, Composition, Properties, Commercial forms, Uses	1	04-08-2022		TLM2	
8.	Concept of eco-friendly materials, examples	1	05-08-2022		TLM1	
No. of classes required to complete UNIT-II:				No. of classes taken:		

UNIT-III:SOIL CLASSIFICATION AND FOUNDATION

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.	Types of soils, soil classification	1	8-08-2022		TLM1	
2.	Engineering properties	1	10-08-2022		TLM1	
3.	Bearing Capacity of soil, purpose and methods of improving bearing capacity	1	12-08-2022		TLM2	
4.	Foundations – Requirements	1	17-08-2022		TLM2	
5.	Loads, Types	1	22-08-2022		TLM1	
6.	for special structures-water tanks-	1	24-08-2022		TLM2	
7.	for special structures- silos, chimneys- transmission line towers- cooling towers, telecommunication towers	1	25-08-2022		TLM1	
No. of classes required to complete UNIT-III:07				No. of classes taken:		

UNIT-IV :SURVEYING, LEVELLING & HIGHWAY NETWORK

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.	Objective of surveying– Principles, applications and uses of - chain surveying	1	26-08-2022		TLM2	
2.	theodolite, levelling, contour maps, Planimeter, EDM concept	1	29-08-2022		TLM2	
3.	linear distance and area measurement	1	1-09-2022		TLM1	
4.	Total station- GIS-Concept and applications in civil engineering.	1	2-09-2022		TLM2	
5.	CRT Classes:5-9-2022 to 17-09-2022					
6.	MID-1 Examinations:19-09-2022 to 24-09-2022					
7.	Indian highways- Basic terminology- Classification of roads - PIEV theory - Traffic	1	26-09-2022		TLM1	

	signs - IRC Code provisions					
8.	Indian railways –Permanent way and components of railway track	1	28-09-2022		TLM2	
9.	Gauges – Rails -Sleepers – Ballast.	1	29-09-2022		TLM2	
No. of classes required to complete UNIT-IV:07				No. of classes taken:		

UNIT-V :WATER RESOURCES AND ENVIRONMENTAL ENGINEERING

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.	Objectives of water supply system-Sources of water supply-Hydrologic cycle	1	30-09-2022		TLM1	
2.	Rainfall measurement - Purpose of dams, reservoirs, intakes, infiltration galleries	1	10-10-2022		TLM1	
3.	Water demands –Water quality parameters and their impacts - Principles of water treatment	1	12-10-2022		TLM2	
4.	Objectives of water distribution systems	1	13-10-2022		TLM2	
5.	Wastewater characteristics and their impacts	1	14-10-2022		TLM1	
6.	Principles of sewage treatment	1	17-10-2022		TLM2	
7.	Disposal of sewage	1	19-10-2022		TLM2	
8.	Water quality standards for – drinking purpose,	1	20-10-2022		TLM2	
9.	irrigation, -making	1	21-10-2022		TLM1	
10.	curing of concrete	1	26-10-2022		TLM1	
11.	methods of water distribution systems	1	27-10-2022		TLM2	
12.	Sewage generation in a society	1	28-10-2022		TLM2	
13.	Revision of Unit-1	1	2-11-2022		TLM2	
14.	Revision of Unit-1	1	3-11-2022		TLM2	
15.	Revision of Unit-2	1	4-11-2022		TLM1	
16.	Revision of Unit-2	1	7-11-2022		TLM1	
17.	Revision of Unit-3	1	9-11-2022		TLM1	
18.	Revision of Unit-3	1	10-11-2022		TLM1	
19.	Revision of Unit-4	1	11-11-2022		TLM2	
20.	Revision of Unit-4	1	14-11-2022		TLM2	
21.	Revision of Unit-5	1	16-11-2022		TLM2	

22.	Revision of Unit-5	1	17-11-2022		TLM1	
No. of classes required to complete UNIT-V:12				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

ACADEMIC CALENDAR:

Description	**From**	**To**	**Weeks**
I Phase of Instructions-1	11-07-2022	03-09-2022	6W
CRT Classes	05-09-2022	17-09-2022	2W
I Mid Examinations	19-09-2022	24-09-2022	1W
II Phase of Instructions	26-09-2022	19-11-2022	7W
II Mid Examinations	21-11-2022	26-11-2022	1W
Preparation and Practicals	28-11-2022	03-12-2022	1W
Semester End Examinations	05-12-2022	17-12-2022	2W

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	Possesses necessary skill set to analyze and design various systems using analytical and software tools related to civil engineering
PSO 2	Possesses ability to plan, examine and analyse the various laboratory tests required for the professional demands
PSO 3	Possesses basic technical skills to pursue higher studies and professional practice in civil engineering domain

Course Instructor	Course Coordinator	Module Coordinator	HOD
(C.Rajamallu)	(C.Rajamallu)	(B.NarasimhaRao)	(S.Pichi Reddy)

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Mrs.T.Nagadurga
Course Name & Code : Utilization of Electrical Energy & 17EE81
L-T-P Structure : 4-0-0 Credits : 3
Program/Sem/Sec : B.Tech., ME., VII-Sem., Sections- A&B A.Y:2022-23

PRE-REQUISITES:-

COURSE EDUCATIONAL OBJECTIVES (CEOs): This course enables the student to familiarize with characteristics of various drives, comprehend the different issues related to heating, welding and illumination.

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

CO 1	Choose a drive for particular application
CO 2	Identify a heating /welding scheme for a given application
CO 3	Illustrate the different schemes of traction and its main components
CO 4	Develop a lighting scheme for a given practical case
CO5	Assess the economic aspects in utilization of electrical energy

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

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	-	2	-	-	-	-	-	-	1	-	-	-	
CO2	3	2	1	2	-	-	-	-	-	-	-	1	-	-	-	
CO3	3	1	3	-	3	-	-	-	-	-	-	2	-	-	-	
CO4	3	2	2	2	-	-	-	-	-	-	-	1	-	-	-	
CO5	2		1		-	-		-				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).

TEXT BOOKS:

T1 C.L.Wadhwa "Generation,Distribution and Utilization of Electrical energy, New Age International Publishers,3rd Edition,2015.

T2 N.V.Suryanarayana"Utilization of electric power including electric drives and electric traction,New age international publishers New Delhi,2nd edition 2014.

REFERENCE BOOKS:

R1 Art & Science of Utilization of electrical Energy, Partab, DhanpatRai& Co., 2004.

R2 Utilization of Electric Energy, E. Openshaw Taylor and V. V. L. Rao, Universities Press, 2009.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: ELECTRIC HEATING AND WELDING:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
9.	Introduction, CEO's &CO's	1	11/7/22		TLM1/TLM2	
10.	Advantages &applications of Electric heating	1	13/7/22		TLM1/TLM2	
11.	Classification of electric heating	1	14/7/22		TLM1/TLM2	
12.	Classification of electric heating	1	15/7/22		TLM1/TLM2	
13.	Requirement of good heating material	1	18/7/22		TLM1/TLM2	
14.	Electric Arc Furnace	1	20/7/22		TLM1/TLM2	
15.	Induction heating	1	21/7/22		TLM1/TLM2	
16.	Dielectric heating	1	22/7/22		TLM1/TLM2	
17.	Electric welding	1	25/7/22		TLM1/TLM2	
18.	Resistance welding	1	27/7/22		TLM1/TLM2	
19.	Arc welding	1	28/7/22		TLM1/TLM2	
No. of classes required to complete UNIT-I:11				No. of classes taken:		

UNIT-II: ILLUMINATION ENGINEERING:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
9.	Introduction	1	29/7/22		TLM1/TLM2	
10.	Nature of light &Laws of illumination	1	1/8/22		TLM1/TLM2	
11.	Lighting schemes, sources of light	1	3/8/22		TLM1/TLM2	
12.	Fluorescent Lamps	1	4/8/22		TLM1/TLM2	
13.	Compact Fluorescent Lamps	1	5/8/22		TLM1/TLM2	
14.	LED Lamps discharge lamps	1	8/8/22		TLM1/TLM2	
15.	Sodium Vapour Lamp	1	10/8/22		TLM1/TLM2	
16.	mercury vapour lamps	1	11/8/22		TLM1/TLM2	
17.	Neon lamps	1	12/8/22		TLM1/TLM2	
18.	Comparison between tungsten &fluorescent tubes	1	17/8/22		TLM1/TLM2	

19.	Requirements of good lighting	1	18/8/22		TLM1/TLM2	
20.	Street lighting	1	19/8/22		TLM1/TLM2	
21.	Mid-I Exams	1	20/9/22			
22.	Mid-I Exams	1	21/9/22			
23.	Mid-I Exams	1	23/9/22			
24.	Mid-I Exams	1	24/9/22			
No. of classes required to complete UNIT-II: 12				No. of classes taken:		

UNIT-III: ELECTRIC DRIVES

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
8.	Introduction	1	22/8/22		TLM1/TLM2	
9.	Factors affecting selection of motor	1	24/8/22		TLM1/TLM2	
10.	Types of loads	1	25/8/22		TLM1/TLM2	
11.	Elements of electric drive	1	26/8/22		TLM1/TLM2	
12.	Steady state characteristics of drives	1	29/8/22		TLM1/TLM2	
13.	Transient characteristics of drives	1	31/8/22		TLM1/TLM2	
14.	Size of motor	1	1/9/22		TLM1/TLM2	
15.	Load equalization	1	2/9/22		TLM1/TLM2	
16.	Industrial applications	1	26/9/22		TLM1/TLM2	
No. of classes required to complete UNIT-III:10				No. of classes taken:		

UNIT-IV: ELECTRIC TRACTION

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
10.	Introduction	1	28/9/22		TLM1/TLM2	
11.	Requirement of an ideal traction system	1	3/10/22		TLM1/TLM2	
12.	Supply system for electric traction	1	7/10/22		TLM1/TLM2	
13.	Supply system for electric traction	1	13/10/22		TLM1/TLM2	
14.	Train movement	1	17/10/22		TLM1/TLM2	
15.	Mechanism of train movement	1	19/10/22		TLM1/TLM2	
16.	Traction motors	1	20/10/22		TLM1/TLM2	
17.	Modern trends in electric traction	1	21/10/22		TLM1/TLM2	
18.	Automation in electric traction	1	24/10/22		TLM1/TLM2	
19.	problems	1	26/10/22		TLM1/TLM2	
No. of classes required to complete UNIT-IV:10				No. of classes taken:		

UNIT-V: REFRIGERATION AND AIRCONDITIONING

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
23.	Introduction	1	27/10/22		TLM1/TLM2	
24.	Types of refrigeration	1	28/10/22		TLM1/TLM2	
25.	Compression refrigeration	1	1/11/22		TLM1/TLM2	
26.	Basic vapour compression cycle	1	3/11/22		TLM1/TLM2	
27.	Absorption refrigeration system	1	4/11/22		TLM1/TLM2	
28.	Operational features	1	7/11/22		TLM1/TLM2	
29.	household refrigerator	1	9/11/22		TLM1/TLM2	
30.	Air-conditioning	1	10/11/22		TLM1/TLM2	
31.	Types of air conditioning system	1	11/11/22		TLM1/TLM2	
32.	Room air conditioner	1	14/11/22		TLM1/TLM2	
33.	Summer & winter air conditioning systems	1	16/11/22		TLM1/TLM2	
34.	Cooling capacity of an air conditioner	1	17/11/22		TLM1/TLM2	
35.	Working of electrical system	1	18/11/22		TLM1/TLM2	
36.	Revision	1	18-11-2022		TLM1/TLM2	
37.	Mid-II Exams	1	22-11-2022			
38.	Mid-II Exams	1	23-11-2022			
39.	Mid-II Exams	1	25-11-2022			
40.	Mid-II Exams	1	26-11-2022			
No. of classes required to complete UNIT-V:				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
1.	Economicaspects inutilization ofelectrical energy	1	28-09-2022		TLM1/TLM2	

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/SwayamPrabha/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

ACADEMIC CALENDAR:

Description	From	To	Weeks
I Phase of Instructions-1	11-07-2022	03-09-2022	8W
CRT classes	05-09-2022	17-09-2022	2W
I Mid Examinations	19-09-2022	24-09-2022	1W
II Phase of Instructions	26-09-2022	19-11-2022	8W
II Mid Examinations	21-11-2022	26-11-2022	1W
Preparation and Practicals	28-11-2022	03-12-2022	1W
Semester End Examinations	5-12-2022	17-12-2022	2W

PART-D

PROGRAMME OUTCOMES (POs):

PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
PO 6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to

	the professional engineering practice
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.
PO 8	**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	Specify, design and analyze systems that efficiently generate, transmit and distribute electrical power
PSO 2	Design and analyze electrical machines, modern drive and lighting systems
PSO 3	Specify, design, implement and test analog and embedded signal processing electronic systems
PSO 4	Design controllers for electrical and electronic systems to improve their performance.

Course Instructor	Course Coordinator	Module Coordinator	HOD
T.Nagadurga	MrsT.Naga Durga		Dr. J.SivaVara Prasad

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

COURSE HANDOUT

PROGRAM : B.Tech., VII-Sem.,(A/S)ME

ACADEMIC YEAR : 2022-2023

COURSE NAME & CODE : Refrigeration and Air-Conditioning -17ME28

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

COURSE CREDITS : 3

COURSE INSTRUCTOR : **Dr. V. DHANA RAJU**

COURSE COORDINATOR : **Dr. V. DHANA RAJU**

PRE-REQUISITE: Thermodynamics

COURSE OBJECTIVE: In a broader way, this course provides the simple understanding of refrigeration and air conditioning fundamentals. First, it covers the different refrigeration cycles and its analysis. Then the concepts of psychrometry and psychrometry processes used for air conditioning are imparted. Finally, the concepts of comfort air conditioning, cooling load design and its estimation are addressed.

COURSE OUTCOMES (CO)

CO1: Describe the basic concepts of refrigeration and its applications.
CO2: Evaluate the performance parameters of refrigeration systems.
CO3:Identify the desirable refrigerants and its use in various refrigeration systems.
CO4: Analyze the psychrometric properties and processes used in Air Conditioning systems.
CO5: Design of Air Conditioning systems for thermal comfort conditions.

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

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

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

BOS APPROVED TEXT BOOKS:

T1 C. P. Arora. , Refrigeration and air conditioning - TMH, 2nd Edition, 2000.

T2 R. Dossat, Principles of Refrigeration - - Pearson 4th Edition 2001.

BOS APPROVED REFERENCE BOOKS:

R1 S. C. Arora, Domkundwar, A course in refrigeration and air conditioning-Dhanapat Rai& sons 5th Edition 1997.

R2 Wilbert F.Stoecker, Jerold W. J.Jones, MGH, 1986.

R3 Manohar Prasad, Refrigeration and Air conditioning, New Age international, 2003

COURSE DELIVERY PLAN (LESSON PLAN): Section-A

UNIT-I FUNDAMENTALS OF REFRIGERATION

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome Cos	Textbook followed	HOD Sign Weekly
20.	**Introduction:**Refrigeration, CEOs, Course Outcomes, POs and PSOs	1	11-07-22		**TLM2**	CO1	**T1**	
21.	Applications of refrigeration	1	12-07-22		**TLM2**	CO2	**T1**	
22.	Unit of refrigeration and COP	1	14-07-22		**TLM2**	CO1	**T1**	
23.	Heat Engine, Refrigerator and Heat pump	1	15-07-22		**TLM2**	CO1	**T1**	
24.	Types of Refrigeration systems	1	16-07-22		**TLM2, TLM 4**	CO2	**T1**	
25.	Problems on refrigeration basics	1	18-07-22		**TLM2, TLM 4**	CO2	**T1**	
26.	**Refrigerant:** Desirable characteristics of ideal refrigerant	1	19-07-22		**TLM2**	CO3	**T1**	
27.	Classification of refrigerants- Desirable Properties-Nomenclature, Refrigerant Designation	1	21-07-22		**TLM 1**	CO3	**T1**	
28.	Commonly used refrigerants, Alternate refrigerants, Green House effect& Global	1	22-07-22		**TLM 1**	CO3	**T1**	
29.	**Air refrigeration system**: working on Reversed Carnot cycle	1	23-07-22		**TLM 1**	CO2	**T1**	
30.	Air refrigeration system working on Bell Coleman cycle	1	25-07-22		**TLM 1**	CO2	**T1**	
31.	Air refrigeration Problems	1	26-07-22		**TLM 1**	CO2	**T1**	
32.	COP- Open and Dense air systems Problems	1	28-07-22		**TLM 1**	CO2	**T1**	
33.	Tutorial	1	29-07-22		**TLM 1**	CO2	**T1**	
No. of classes required to complete UNIT-I = 14			No. of classes taken:					

UNIT-II VAPOUR COMPRESSION REFRIGERATION SYSTEM&COMPONENTS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome Cos	Text Book followed	HOD Sign Weekly
15	**Introduction to VCR system:** Essential components of the VCR plant	1	30-07-22		**TLM 1**	CO1	**T1**	
16	, Simple vapour compression refrigeration cycle, COP	1	01-08-22		**TLM 1**	CO1	**T2**	
17	Representation of cycle on T-S and p-h Charts	1	02-08-22		**TLM 1**	CO1	**T2**	

18	VCR numerical problems	1	04-08-22		**TLM 1**	CO1	**T2**	
19	Tutorial	1	05-08-22		**TLM 1**	CO1	**T2**	
20	Effect of sub cooling and superheating,	1	06-08-22		**TLM 1**	CO1	**T2**	
21	Effect of condenser and evaporator pressure	1	08-08-22		**TLM 1**	CO1	**T2**	
22	Actual VCR and theoretical VCR, Tutorial	1	11-08-22		**TLM 1**	CO1	**T2**	
23	**VCR-System Components**: Compressors -Classification-Working Principles	1	12-08-22		**TLM 1**	CO1	**R1**	
24	Work expression for the reciprocating compressor	1	17-08-22		**TLM 1**	CO1	**R1**	
25	Rotary compressors, Problems	1	19-08-22		**TLM 1**	CO1	**R1**	
26	Condensers – Classification-working principle,	1	20-08-22		**TLM 1**	CO1	**R1**	
27	Evaporators-Classification-working principle	1	22-08-22		**TLM 1**	CO1	**R1**	
28	Expansion valve – Classification-working principle-	1	23-08-22		**TLM 1**	CO1	**R1**	
No. of classes required to complete UNIT-II = 14			No. of classes taken:					

UNIT-III VAPOUR ABSORPTION, STEAM JET &NON-CONVENTIONAL REFRIGERATION SYSTEM

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome Cos	Text Book followed	HOD Sign Weekly
29	Introduction to VAR system and its working principle,	1	25-08-22		**TLM 1**	CO1	**T2**	
30	Max. COP derivation for the VAR system and VAR problems	1	26-08-22		**TLM 1**	CO1	**T2**	
31	Description and working of NH_3-Water system, Refrigerant-Absorbent solution requirements	1	27-08-22		**TLM 1**	CO1	**T2**	
32	LiBr-Water(Two shell & Four shell) System,**Tutorial**	1	29-08-22		**TLM 1**	CO1	**T2**	
33	Principle of operation of Three fluid absorption systems, Salient features	1	30-08-22		**TLM 1**	CO1	**T2**	
34	**Steam Jet Refrigeration System:**Working Principle, Basic Analysis- Applications	1	01-09-22		**TLM 1**	CO1	**T2**	
35	. **Non-Conventional Refrigeration Systems:** Thermo electric refrigeration,	1	02-09-22		**TLM 1**	CO1	**T2**	
36	Vortex tube refrigeration, Adiabatic Demagnetization refrigeration	1	03-09-22		**TLM 1**	CO1	**T2**	
	CRT Classes	**10**	**05-09-2022 to 17-09-2022**					

	I Mid Examinations	5	19-09-2022 to 24-09-2022
No. of classes required to complete UNIT-III = 08			No. of classes taken:

UNIT-IV PSYCHROMETRY &HUMAN COMFORT

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome Cos	Text Book followed	HOD Sign Weekly
37	**Psychrometry**: Introduction,	1	26-09-22		**TLM 1**	CO4	**T1**	
38	Psychometric properties and relations	1	27-09-22		**TLM 1**	CO4	**T1**	
39	Psychometric problems	1	29-09-22		**TLM 1**	CO4	**T1**	
40	Psychometric problems		30-09-22		**TLM 1**	CO4	**T1**	
41	Psychometric chart and its analysis,	1	01-10-22		**TLM 1**	CO4	**T1**	
42	Psychometric processes and its analysis	1	06-10-22		**TLM 1**	CO4	**T1**	
43	**Tutorial**	1	07-10-22		**TLM 1**	CO4	**T1**	
44	Psychometric processes and its analysis	1	10-10-22		**TLM 1**	CO4	**T1**	
45	Sensible, Latent and Total heat,	1	11-10-22		**TLM 1**	CO4	**T1**	
46	Sensible Heat Factor and Bypass Factor,	1	13-10-22		**TLM 1**	CO4	**T1**	
47	Solving Problems	1	14-10-22		**TLM 1**	CO4	**T1**	
48	**Human Comfort:** Thermodynamics of human body	1	15-10-22		**TLM 1**	CO4	**T1**	
49	Factors affecting the human comfort and its analysis.	1	17-10-22		**TLM 1**	CO4	**T1**	
50	Effective temperature –	1	18-10-22		**TLM 1**	CO4	**T1**	
51	Comfort chart	1	20-10-22		**TLM 1**	CO4	**T1**	
52	**Tutorial**	1	21-10-22		**TLM 1**	CO4	**T1**	
No. of classes required to complete UNIT-IV = 16			No. of classes taken:					

UNIT-V AIR CONDITIONING SYSTEMS AND DESIGN

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
53	**Introduction**: Air Conditioning Systems,	1	22-10-22		**TLM 1**	CO5	**T1**	
54	Components of Air conditioning	1	25-10-22		**TLM 1**	CO5	**T1**	
55	Classification of air conditioning system	1	27-10-22		**TLM 1**	CO5	**T1**	
56	Central and Unitary systems, Winter and Year-round systems	1	28-10-22		**TLM 1**	CO5	**T1**	
57	Cooling load estimation and its procedure	1	29-10-22		**TLM 1**	CO5	**T1**	
58	Cooling load components	1	31-10-22		**TLM 1**	CO5	**R1**	
59	Infiltration load, Design of Air Condition Systems,	1	03-11-22		**TLM 1**	CO5	**R1**	
60	Bypass factor-circulated air	1	04-11-22		**TLM 1**	CO5	**T1**	

	with ADP, System with Ventilated and re-circulation,							
61	RSHF, GSHF and ESHF, Solving cooling load Problems	1	05-11-22		**TLM 1**	CO5	**R1**	
62	Solving cooling load Problems	1	07-11-22		**TLM 1**	CO5	**R1**	
63	Solving cooling load Problems	1	08-11-22		**TLM 1**	CO5	**R1**	
64	Solving cooling load Problems	1	10-11-22		**TLM 1**	CO5	**R1**	
65	Solving cooling load Problems	1	11-11-22		**TLM 1**	CO5	**R1**	
66	Solving cooling load Problems	1	14-11-22		**TLM 1**	CO5	**R1**	
67	**Tutorial**	1	15-11-22		**TLM 1**	CO5	**R1**	
No. of classes required to complete UNIT-V = 15			No. of classes taken:					

Contents beyond the Syllabus

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
68	Air craft Refrigeration System and Cryogenics	1	17-11-22		TLM2	CO1,CO4	R3	
69	Eco friendly refrigerants	1	18-11-22		TLM2	CO4	R3	
70	Advanced refrigeration methods	1	19-11-22		TLM2	CO5	R3	

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

ACADEMIC CALENDER:

Commencement of Class work		**11-07-2022**	
I Phase of Instructions	11-07-2022	03-09-2022	8 Weeks
CRT Classes	05-09-2022	17-09-2022	2 weeks
I Mid Examinations	19-09-2022	24-09-2022	1 Week
II Phase of Instructions	26-09-2022	19-11-2022	8 Weeks
II Mid Examinations	21-11-2022	26-11-2022	1 Week
Preparation and Practical's	28-11-2022	03-12-2022	1 Week
Semester End Examinations	05-12-2022	17-12-2022	2 Weeks

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
Dr.V.Dhana Raju	Dr.V.Dhana Raju	Dr. P.Vijay Kumar	Dr. S. Pichi Reddy

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DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART - A

PROGRAM	**: B.Tech. - VII-Sem.- MechanicalEngineering – ASection**
ACADEMIC YEAR	**:** 2022-23
COURSE NAME & CODE	**: ROBOTICS–17ME29**
L-T-P STRUCTURE	**:** 3-0-0
COURSE CREDITS	**:** 3
COURSE INSTRUCTOR	**: J. Subba Reddy, Associate Professor**
COURSE COORDINATOR	**: J.Subba Reddy, Associate Professor**
PER-REQUISITE	**:** Engineering Mechanics & Kinematics of Machines

COURSE EDUCATIONAL OBJECTIVES:

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

COURSE OUTCOMES:

After completion of the course student will be able to:

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

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

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

CO4: Model the dynamic behavior of robot.

CO5: Analyze the trajectory of robotic motion.

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

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

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

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

BOS APPROVED TEXT BOOKS:

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

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

BOS APPROVED REFERENCE BOOKS:

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

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

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

COURSE DELIVERY PLAN (LESSON PLAN): ROBOTICS (17ME29)

PART - B

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

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
34.	**Introduction to Robotics**	1	11-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
35.	CEOs, Course Outcomes, POs and PSOs	1	13-07-2022		**TLM2**	-	-	
36.	Basic concepts – Robot anatomy	1	14-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
37.	Components of robots, **Tutorial**	1	15-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
38.	Robot motions	1	15-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
39.	Number of D.O.F – Work volume	1	18-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
40.	Robot applications in Material transfer and machine loading / unloading applications	1	20-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
41.	Robot applications in Processing operations – Assembly and inspection – Future applications	1	21-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
42.	**Robot End Effectors –**Introduction, **Tutorial**	1	22-07-2022		**TLM3**	CO1	T1, T2, R1, R2	
43.	Types of end effectors – Mechanical grippers	1	22-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
44.	Vacuum cups, magnetic grippers, adhesive gripers and others	1	25-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
45.	Robot / End effectors interface	1	27-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
46.	Considerations in gripper selection and design	1	28-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
47.	Case Studies, Numericals, **Tutorial**	1	29-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
48.	Numericals	1	29-07-2022		**TLM3**	CO1	T1, T2, R1, R2	
No. of classes required to complete UNIT-I:		**15**			**No. of classes taken:**			

UNIT-II:ROBOT ACTUATORS AND SENSORS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
49.	Introduction to Actuators	1	01-08-2022		**TLM2**	CO2	T1,R1	
50.	Characteristics of Actuating System	1	03-08-2022		**TLM2**	CO2	T1,R1	
51.	Pneumatic Actuators	1	04-08-2022		**TLM2**	CO2	T1,R1	
52.	Hydraulic Actuators, **Tutorial**	1	05-08-2022		**TLM2**	CO2	T1,R1	
53.	Electric Motors	1	05-08-2022		**TLM2**	CO2	T1,R1	
54.	Introduction to Sensors	1	08-08-2022		**TLM3**	CO2	T1,R1	
55.	Sensor characteristics	1	10-08-2022		**TLM1**	CO2	T1,R1	
56.	Position sensors: Potentiometers, LVDT	1	11-08-2022		**TLM1**	CO2	T1,R1	
57.	Resolvers, Encoders, **Tutorial**	1	12-08-2022		**TLM1**	CO2	T1,R1	
58.	Magnetostrictive Displacement Transducers (MDT)	1	12-08-2022		**TLM1**	CO2	T1,R1	
59.	Velocity Sensors: Encoders	1	17-08-2022		**TLM1**	CO2	T1,R1	
60.	Tachometers	1	18-08-2022		**TLM1**	CO2	T1,R1	
61.	Industrial Applications, **Tutorial**	1	19-08-2022		**TLM2**	CO2	T1,R1	
62.	Case Studies	1	19-08-2022		**TLM2**	CO2	T1,R1	
No. of classes required to complete UNIT-II		**14**		**No. of classes taken:**				

UNIT-III:MANIPULATOR KINEMATICS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
63.	Introduction to Manipulator Kinematics	1	22-08-2022		**TLM2**	CO3	T1,R1	
64.	Coordinate Frames	1	24-08-2022		**TLM2**	CO3	T1,R1	
65.	Description of Objects in space	1	25-08-2022		**TLM2**	CO3	T1,R1	
66.	Transformation of vectors, **Tutorial**	1	26-08-2022		**TLM2**	CO3	T1,R1	
67.	Numericals	1	26-08-2022		**TLM1**	CO3	T1,R1	
68.	Inverting a Homogeneous Transform	1	29-08-2022		**TLM3**	CO3	T1,R1	
69.	Numericals	1	31-08-2022		**TLM2**	CO3	T1,R1	
70.	Fundamental Rotation Matrices	1	01-09-2022		**TLM2**	CO3	T1,R1	
71.	Numericals, **Tutorial**	1	02-09-2022		**TLM2**	CO3	T1,R1	
72.	D-H representation	1	02-09-2022		**TLM2**	CO3	T1,R1	
73.	**CRT Classes**	**10**	**05-09-2022 to 17-09-2022**					
74.	**I Mid Examinations**	**5**	**19-09-2022 to 24-09-2022**					
75.	Problems on Forward Kinematics	1	26-09-2022		**TLM2**	CO3	T1,R1	
76.	Numericals	1	28-09-2022		**TLM2**	CO3	T1,R1	
77.	Numericals	1	29-09-2022		**TLM2**	CO3	T1,R1	
78.	Numericals, **Tutorial**	1	30-09-2022		**TLM2**	CO3	T1,R1	
79.	Numericals	1	30-09-2022		**TLM2**	CO3	T1,R1	
No. of classes required to complete UNIT-III		**15**			**No. of classes taken:**			

UNIT-IV:ROBOT DYNAMICS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
80.	Introduction to Dynamics of Robots	1	03-10-2022		**TLM2**	CO4	T1,R1	
81.	Differential transformations	1	05-10-2022		**TLM2**	CO4	T1,R1	
82.	Numericals	1	06-10-2022		**TLM2**	CO4	T1,R1	
83.	Numericals, **Tutorial**	1	07-10-2022		**TLM2**	CO4	T1,R1	
84.	Numericals	1	07-10-2022		**TLM2**	CO4	T1,R1	
85.	Numericals	1	10-10-2022		**TLM2**	CO4	T1,R1	
86.	Jacobian Matrix	1	12-10-2022		**TLM2**	CO4	T1,R1	
87.	Numericals	1	13-10-2022		**TLM1**	CO4	T1,R1	
88.	Numericals, **Tutorial**	1	14-10-2022		**TLM2**	CO4	T1,R1	
89.	Numericals	1	14-10-2022		**TLM1**	CO4	T1,R1	
90.	Lagrange Euler formulation	1	17-10-2022		**TLM2**	CO4	T1,R1	
91.	Numericals	1	19-10-2022		**TLM2**	CO4	T1,R1	
92.	Numericals	1	20-10-2022		**TLM1**	CO4	T1,R1	
93.	Numericals, **Tutorial**	1	21-10-2022		**TLM2**	CO4	T1,R1	
94.	Numericals	1	21-10-2022		**TLM1**	CO4	T1,R1	
No. of classes required to complete UNIT-IV		**15**			**No. of classes taken:**			

UNIT-V:TRAJECTORY PLANNING

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
95.	Introduction to Trajectory Planning	1	24-10-2022		**TLM2**	CO5	T1,R1	
96.	Considerations on Trajectory Planning	1	26-10-2022		**TLM2**	CO5	T1,R1	
97.	Joint Interpolated Trajectory	1	27-10-2022		**TLM2**	CO5	T1,R1	
98.	Numericals	1	28-10-2022		**TLM2**	CO5	T1,R1	
99.	Numericals, **Tutorial**	1	28-10-2022		**TLM3**	CO5	T1,R1	
100.	Numericals	1	31-10-2022		**TLM2**	CO5	T1,R1	
101.	Numericals	1	02-11-2022		**TLM2**	CO5	T1,R1	
102.	Numericals	1	03-11-2022		**TLM2**	CO5	T1,R1	
103.	Cartesian Path Trajectory	1	04-11-2022		**TLM2**	CO5	T1,R1	
104.	Numericals, **Tutorial**	1	04-11-2022		**TLM2**	CO5	T1,R1	
105.	Numericals	1	07-11-2022		**TLM2**	CO5	T1,R1	
106.	Numericals	1	09-11-2022		**TLM2**	CO5	T1,R1	
107.	Numericals	1	10-11-2022		**TLM2**	CO5	T1,R1	
108.	Numericals, **Tutorial**	1	11-11-2022		**TLM2**	CO5	T1,R1	
109.	Numericals	1	11-11-2022		**TLM2**	CO5	T1,R1	
110.	**Robot Programming**	1	14-11-2022		**TLM2**	CO5	T1,R1	
111.	**Robot Programming**	1	16-11-2022		**TLM2**	CO5	T1,R1	
112.	**Robot Programming**	1	17-11-2022		**TLM2**	CO5	T1,R1	
113.	**Robot Programming, Tutorial**	1	18-11-2022		**TLM2**	CO5	T1,R1	
114.	**Robot Programming**	1	18-11-2022		**TLM2**	CO5	T1,R1	
No. of classes required to complete UNIT-V		**15 + 05 (Beyond Syllabus)**			**No. of classes taken:**			
II Mid Examinations – 21-11-2022 to 26-11-2022								

TEACHING LEARNING METHODS:

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

ACADEMIC CALENDER:

Commencement of Class work		**11-07-2022**	
I Phase of Instructions	11-07-2022	03-09-2022	8 Weeks
CRT Classes	05-09-2022	17-09-2022	2 Weeks
I Mid Examinations	19-09-2022	24-09-2022	1 Week
II Phase of Instructions	26-09-2022	19-11-2022	8 Weeks
II Mid Examinations	21-11-2022	26-11-2022	1 Week
Preparation and Practicals	28-11-2022	03-12-2022	1 Week
Semester End Examinations	05-12-2022	17-12-2022	2 Weeks

PART – C

EVALUATION PROCESS:

Evaluation Task	**COs**	**Marks**
Assignment/Quiz – 1	1	A1=05
Assignment/Quiz – 2	2	A2=05
I-Mid Examination	1,2	B1=20
I-Online Mid Examination	1,2	C1=10
Assignment/Quiz – 3	3	A3=05
Assignment/Quiz – 4	4	A4=05
Assignment/Quiz – 5	5	A5=05
II-Mid Examination	3,4,5	B2=20
II-Online Mid Examination	3,4,5	C2=10
Evaluation of Assignment/Quiz Marks: A=(A1+A2+A3+A4+A5)/5	1,2,3,4,5	**A=05**
Evaluation of Mid Marks: B=75% of Max(B1,B2)+25% of Min(B1,B2)	1,2,3,4,5	**B=20**
Evaluation of Online Mid Marks: C=75% of Max(C1,C2)+25% of Min(	1,2,3,4,5	**C=10**
Attendance: D (≥95% =**5M**; 90%≤A<95%=**4M;** 85%≤A<90%=**3M;** 80%≤A<85%=**2M;** 75%≤A<80%=**1M; <75%=0M)**	-	**D=05**
Cumulative Internal Examination: A+B+C+D	**1,2,3,4,5**	**A+B+C+D=40**
Semester End Examinations: E	**1,2,3,4,5**	**E=60**
Total Marks: A+B+C+D+E	**1,2,3,4,5**	**100**

PART – D

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

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

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

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

PROGRAMME OUTCOMES (POs):

Engineering Graduates will be able to:

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

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

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

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

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

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

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

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

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

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

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART - A

PROGRAM	**: B.Tech. - VII-Sem.- Mechanical Engineering – A Section**
ACADEMIC YEAR	**:** 2022-23
COURSE NAME & CODE	**: PRODUCTION PLANNING AND CONTROL –17ME33**
L-T-P STRUCTURE	**:** 4-0-0
COURSE CREDITS	**:** 3
COURSE INSTRUCTOR	**: Dr.K.Dilip Kumar, Professor**
COURSE COORDINATOR	**: J.Subba Reddy, Associate Professor**
PER-REQUISITE	**: Industrial Management & Operational Research**

COURSE EDUCATIONAL OBJECTIVES:

The objectives of the course are to understand the basic concepts of production planning and control, familiarize with different forecasting techniques, familiarize the concepts of inventory management, understand the concepts of routing and scheduling and acquire basic knowledge in aggregate planning, expediting and follow up.

COURSE OUTCOMES:

After completion of the course student will be able to:

CO1: Exhibit the ability in developing production planning for operating economy, effectivenessand cost control.

CO2: Apply the forecasting techniques in estimating the number of products.

CO3: Use the inventory management techniques to determine the optimum quantity of material.

CO4: To develop the route sheet required for a production process/activities.

CO5: To decide the dispatch procedure required for a production processes and other activities.

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

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

BOS APPROVED TEXT BOOKS:

T1 R.Pannerselavn, Production and Operations Management, 2nd Edition, PHI,2007.

T2 P.Rama Murthy, Production and Operations Management, New Age Internationa, 2ndEdition, 2005

BOS APPROVED REFERENCE BOOKS:

R1 S.N.Chary, Production and Operations Management, TMcH, 4th Edition 2010.

R2 SamuelEilon, Elements of Production Planning and Control, Universal Publishing Corporation, 2004

R3 Seetharama L.N, Production Planning and Inventory Control, PHI, 2nd Edition1995

COURSE DELIVERY PLAN (LESSON PLAN): PPC [Program Elective – IV]

PART - B

UNIT-I:INTRODUCTION TO PRODUCTION PLANNING AND CONTROL (PPC)

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
115.	CEOs, Course Outcomes, POs and PSOs	1	11-7-2022		**TLM2**	CO1	R1, R2	
116.	**UNIT-I** Introduction to PPC	1	12-7-2022		**TLM2**	CO1	R1, R2	
117.	Definition-Objectives of PPC	1	15-7-2022		**TLM2**	CO1	R1, R2	
118.	Functions of production planning and control	1	16-7-2022		**TLM2**	CO1	R1, R2	
119.	Elements of production control	1	18-7-2022		**TLM2**	CO1	R1, R2	
120.	Types of production	1	19-7-2022		**TLM2**	CO1	R1, R2	
121.	Process chart	1	22-7-2022		**TLM2**	CO1	R1, R2	
122.	**Tutorial-I**	1	23-7-2022		**TLM3**	CO1	R1, R2	
123.	Product life cycle	1	25-7-2022		**TLM2**	CO1	R1, R2	
124.	Design of product	1	26-7-2022		**TLM2**	CO1	R1, R2	
125.	Product Analysis	1	29-7-2022		**TLM2**	CO1	R1, R2	
126.	Org. Chart for PPC	1	30-7-2022		**TLM2**	CO1	R1, R2	
127.	Case Studies	1	1-8-2022		**TLM2**	CO1	R1, R2	
128.	**Tutorial-II**	1	2-8-2022		**TLM3**	CO1	R1, R2	
No. of classes required to complete UNIT-I:		**14**			**No. of classes taken:**			

UNIT-II: FORECASTING

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
129.	**UNIT-II** Introduction to Forecasting	1	5-8-2022		**TLM2**	CO2	T1,R1	
130.	Importance of forecasting – sales forecasting	1	6-8-2022		**TLM2**	CO2	T1,R1	
131.	Types of forecasting	1	8-8-2022		**TLM2**	CO2	T1,R1	
132.	Qualitative methods	1	12-8-2022		**TLM2**	CO2	T1,R1	
133.	Quantities methods – Introduction	1	16-8-2022		**TLM2**	CO2	T1,R1	
134.	**Tutorial-III**	1	20-8-2022		**TLM3**	CO2	T1,R1	
135.	Moving Avg. method	1	22-8-2022		**TLM1**	CO2	T1,R1	
136.	weighted MAM	1	23-8-2022		**TLM1**	CO2	T1,R1	
137.	Exponential smoothing method	1	26-8-2022		**TLM1**	CO2	T1,R1	
138.	Errors in Forecasting	1	27-8-2022		**TLM1**	CO2	T1,R1	
139.	MAD, MAE, MAPE etc	1	29-8-2022		**TLM1**	CO2	T1,R1	
140.	Correlation and Regression Analysis	1	30-8-2022		**TLM1**	CO2	T1,R1	
141.	Delphi Method -Problems	1	2-9-2022		**TLM2**	CO2	T1,R1	
142.	Numericals, Industrial Applications, Tutorial-IV	1	3-9-2022		**TLM3**	CO2	T1,R1	
No. of classes required to complete UNIT-II		**14**		**No. of classes taken:**				

UNIT-III:INVENTORY MANAGEMENT

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
143.	**UNIT-III** Inventory of management – introduction	1	5-9-2022		**TLM2**	CO3	T1,R1	
144.	Types of Inventories	1	6-9-2022		**TLM2**	CO3	T1,R1	
145.	Functions of inventory management	1	9-9-2022		**TLM2**	CO3	T1,R1	
146.	Cost Associated with Inventories	1	12-9-2022		**TLM2**	CO3	T1,R1	
147.	EOQ model – Problem	1	13-9-2022		**TLM1**	CO3	T1,R1	
148.	Selective Control of Inventories	1	16-9-2022		**TLM3**	CO3	T1,R1	
149.	ABC analysis, VED analysis	1	17-9-2022		**TLM2**	CO3	T1,R1	
150.	HMI Analysis etc.	1	19-9-2022		**TLM2**	CO3	T1,R1	
151.	Inventory control systems	1	20-9-2022		**TLM2**	CO3	T1,R1	
152.	P-Systems	1	23-9-2022		**TLM2**	CO3	T1,R1	
153.	Q-Systems	1	24-9-2022		**TLM2**	CO3	T1,R1	
154.	Numericals	1	26-9-2022		**TLM2**	CO3	T1,R1	
155.	**Tutorial-V**	1	27-9-2022		**TLM1**	CO3	T1,R1	
156.	Introduction to MRP	1	30-9-2022		**TLM2**	CO3	T1,R1	
157.	objective of MRP	1	1-10-2022		**TLM2**	CO3	T1,R1	
158.	Inputs of MRP	1	10-10-2022		**TLM2**	CO3	T1,R1	
159.	Bill of Materials	1	11-10-2022		**TLM2**	CO3	T1,R1	
160.	Introduction to JIT inventory	1	14-10-2022		**TLM2**	CO3	T1,R1	
161.	Element of JIT	1	15-10-2022		**TLM2**	CO3	T1,R1	
162.	Japanese concepts, Kanban system	1	17-10-2022		**TLM2**	CO3	T1,R1	
163.	**Tutorial-VI**	1	18-10-2022		**TLM3**	CO3	T1,R1	
No. of classes required to complete UNIT-III		**21**			**No. of classes taken:**			

UNIT-IV:ROUTING

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
164.	**Unit-IV-** Routing, Routing procedure	1	21-10-2022		**TLM2**	CO4	T1,R1	
165.	Route sheets ,Maintanance Sheets	1	22-10-2022		**TLM2**	CO4	T1,R1	
166.	Factors affecting routing procedure	1	25-10-2022		**TLM2**	CO4	T1,R1	
167.	Definition of Scheduling	1	28-10-2022		**TLM2**	CO4	T1,R1	
168.	Forward and Backward Scheduling	1	29-10-2022		**TLM2**	CO4	T1,R1	
169.	Johnsons Rules	1	31-10-2022		**TLM1**	CO4	T1,R1	
170.	**Tutorial-VII**	1	1-11-2022		**TLM3**	CO4	T1,R1	
171.	Difference between loading & scheduling	1	2-11-2022		**TLM2**	CO4	T1,R1	
172.	Scheduling Policies	1	4-11-2022		**TLM2**	CO4	T1,R1	
173.	Techniques- Gant Chart, Gant Chart Symbols	1	5-11-2022		**TLM2**	CO4	T1,R1	
174.	Scheduling Methods	1	7-11-2022		**TLM2**	CO4	T1,R1	
175.	**Tutorial-VIII**	1	11-11-2022		**TLM3**	CO4	T1,R1	
No. of classes required to complete UNIT-IV		**12**			**No. of classes taken:**			

UNIT-V:AGGREGATE PLANNING

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
176.	Aggregate Planning Stage of Aggregate Planning	1	12-11-2022		**TLM2**	CO5	T1,R1	
177.	Chase Planning Expanding & Controlling Accepts	1	12-11-2022		**TLM2**	CO5	T1,R1	
178.	**Tutorial-IX**	1	13-11-2022		**TLM2**	CO5	T1,R1	
179.	Introduction to Dispatching, Activities of Dispatcher, Dispatching Procedure	1	14-11-2022		**TLM2**	CO5	T1,R1	
180.	Follow up definition, Types of Follow up, Reasons for existence of functions	1	14-11-2022		**TLM3**	CO5	T1,R1	
181.	Computer Applications in PPC	1	15-11-2022		**TLM2**	CO5	T1,R1	
182.	ERP Systems, ERP Modules, Basics of MRP-II	1	16-11-2022		**TLM2**	CO5	T1,R1	
183.	**Numericals, Tutorial-X**	1	19-11-2022		**TLM2**	CO5	T1,R1	
No. of classes required to complete UNIT-V		**08**			**No. of classes taken:**			

TEACHING LEARNING METHODS:

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

ACADEMIC CALENDER:

Commencement of Class work		10-12-2018	
I Phase of Instructions	11-07-2022	03-09-2022	8 Weeks
I Mid Examinations	19-09-2022	24-09-2022	1 Week
II Phase of Instructions	26-09-2022	19-11-2022	8 Weeks
II Mid Examinations	21-11-2022	26-11-2022	1 Week
Preparation and Practicals	28-11-2022	03-12-2022	1 Week
Semester End Examinations	05-12-2022	17-12-2022	1 Week

PART - C

EVALUATION PROCESS:

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

PART – D

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

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

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

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

PROGRAMME OUTCOMES (POs):

Engineering Graduates will be able to:

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

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

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

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

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

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

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

Faculty Name	**Dr.K.Dilip Kumar**	**Dr.K.Dilip Kumar**	**J.Subba Reddy**	**Dr. S. Pichi Reddy**
Designation	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**HOD**
Signature				

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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 : KAMALA PRIYA B
Course Name & Code : POWER PLANT ENGINEERING
L-T-P Structure : 4-0-0 Credits : 3
Program/Sem/Sec : B.Tech., MECH., VII-Sem., Sections- A,B&C A.Y : 2022-23

PRE-REQUISITE: Thermodynamics, Thermal Engineering.

COURSE EDUCATIONAL OBJECTIVES (CEOs): To study the various power plant potentials and its working principles.

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

CO 1	Understand the basics of various energy sources and various circuits in steam power plant(Understanding level).
CO 2	Comprehend Diesel and Gas Turbine power generating plants (Remembering level).
CO 3	Analyze salient features of Hydroelectric and Nuclear power plants and interpret the data (Analysis level).
CO 4	Differentiates direct and indirect energy conversion systems (Understanding level).
CO5	Evaluate economics of power generation and pollution issues related to power plants (Apply level).

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

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	-	-	-	-	-	-	-	1	1	-	-
CO2	3	1	2	2	-	1	2	-	-	-	-	1	2	-	2
CO3	2	3	-	3	-	1	2	-	-	-	-	1	2	-	2
CO4	2	3	1	2	-	-	1	-	-	-	-	1	2	-	1
CO5	3	2	2	3	-	-	3	-	-	-	-	1	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 Arora &Domkundwar, A course in Power Plant Engineering- Dhanpat Rai & Company 5th Revised Reprint Edition, 2004.
T2 P.K.Nag, Power Plant Engineering,3rd Edition ,2008 TMH, New Delhi,

REFERENCE BOOKS:

R1 R.K.Rajput, A Text book of Power Plant Engineering, Laxmi Publications ,2nd Edition 2001
R2 M.M.ElWakil, Power plant technology, 3rd Edition 2010 TMH.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I:STEAM POWER PLANT

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
184.	Course Outcomes	1	11-07-2022		TLM1	
185.	Introduction to Subject	1	13-07-2022		TLM1	
186.	Energy sources, Resources and Development of Power in India.	1	14-07-2022		TLM1	
187.	Steam power plant:Plant Layout, Working of Different circuits, factors to be considered for the selection of the plant	1	15-07-2022		TLM2	
188.	Types of Coal-Fuel handling systems-	1	18-07-2022		TLM1	
189.	Coal handling, choice of coal handling equipment, Coal Storage	2	20-07-2022		TLM1, TLM2	
190.	Ash handling systems	2	21-07-2022		TLM2	
191.	Overfeed and underfeed stokers	1	22-07-2022		TLM1, TLM2	
192.	Traveling grate stokers, Spreader stokers, Retort stokers	1	25-07-2022		TLM1, TLM2	
193.	Pulverized fuel burning system and, its components	2	27-07-2022		TLM2	
194.	Draught system, Cyclone furnace	1	28-07-2022		TLM1	
195.	Design and construction, Dust collectors,	1	29-07-2022		TLM1	
196.	Dust collectors, Electrostatic precipitator	1	01-08-2022		TLM2	
197.	Cooling towers and heat rejection	2	03-08-2022		TLM1, TLM2	
198.	TUTORIAL-1	1	04-08-2022		TLM3	
No. of classes required to complete UNIT-I: 15				No. of classes taken:		

UNIT-II:DIESEL POWER PLANT AND GAS TURBINE PLANT

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
25.	Plant layout with auxiliaries-Fuel storage	1	05-08-2022		TLM2	
26.	Fuel supply system-Air supply system-Exhaust system	1	08-08-2022		TLM2	
27.	Water cooling system-Lubrication system	1	10-08-2022		TLM2	
28.	Starting system-Supercharging	1	11-08-2022		TLM1	

29.	Advantages and Disadvantages of Diesel plants over Thermal plants	1	12-08-2022		TLM1	
30.	TUTORIAL-2	1	17-08-2022		TLM3	
31.	Introduction-Classification-Layout with auxiliaries	1	18-08-2022		TLM2	
32.	Principles of working of Closed and Open cycle gas turbines	1	22-08-2022		TLM1	
33.	Combined cycle power plants and comparison	1	24-08-2022		TLM1, TLM2	
34.	TUTORIAL-3	1	24-08-2022		TLM3	
No. of classes required to complete UNIT-II: 10				No. of classes taken:		

UNIT-III:HYDRO ELECTRIC POWER PLANT AND NUCLEAR POWER PLANT

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.	Hydrology-Hydrological cycle	1	25-08-2022		TLM1	
18.	Rainfall- Run off Hydrograph	1	26-08-2022		TLM1	
19.	Flow duration curve- Mass curve	1	29-08-2022		TLM2	
20.	Site selection of hydro plant-Typical layout	1	01-09-2022		TLM1	
21.	Different types of hydro plants	2	02-09-2022		TLM2	
22.	TUTORIAL-4	1	26-09-2022		TLM3	
23.	Nuclear Fission and Fusion - Nuclear Fuels-	1	28-09-2022		TLM1	
24.	Breeding- Components of Reactor	1	29-09-2022		TLM1	
25.	Types of Nuclear Reactors-Pressurized water reactor(PWR)-	1	30-09-2022		TLM1	
26.	Boiling water reactor (BWR)	1	10-10-2022		TLM1	
27.	CANDU reactor-Gas cooled reactor	1	12-10-2022		TLM1	
28.	Liquid metal cooled reactor-Fast Breeder Reactor	1	13-10-2022		TLM1	
29.	Nuclear waste and its Disposal	1	14-10-2022		TLM1	
30.	TUTORIAL-5	1	17-10-2022		TLM3	
No. of classes required to complete UNIT-III: 14				No. of classes taken:		

UNIT-IV :POWER FROM NON-CONVENTIONAL SOURCES AND DIRECT ENERGY CONVERSION SYSTEMS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
20.	Solar power plants-Utilization of Solar collectors.	1	19-10-2022		TLM1	
21.	Different types of solar collectors.	2	20-10-2022		TLM1, TLM2	

22.	Principle of working of Wind energy-Types	1	21-10-2022		TLM1	
23.	Tidal Energy	1	26-10-2022		TLM2	
24.	TUTORIAL-6	1	27-10-2022		TLM3	
25.	Solar cell- Fuel cell	1	28-10-2022		TLM1	
26.	Thermo Electric and Thermo ionic conversion system	1	31-10-2022		TLM1	
27.	MHD power generation	2	02-11-2022		TLM2	
28.	TUTORIAL-7	1	03-11-2022		TLM3	
No. of classes required to complete UNIT-IV:09				No. of classes taken:		

UNIT-V :POWER PLANT ECONOMICS AND POLLUTION & 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
41.	Fixed cost-Operating cost.-Fluctuating loads	1	04-11-2022		TLM1	
42.	General arrangement of Power Distribution-Load curves	1	07-11-2022		TLM1	
43.	Load duration curve and its problems	2	09-11-2022		TLM1	
44.	Various load factors in power plants	1	10-11-2022		TLM1	
45.	TUTORIAL-8	1	11-11-2022		TLM3	
46.	Particulate and gaseous pollutants	1	14-11-2022		TLM1	
47.	Air and Water pollution by Thermal plants	1	16-11-2022		TLM1	
48.	Acid rains -Methods to control pollution	1	17-11-2022		TLM1	
49.	Numerical Problems on economics of power generation	3	18-11-2022		TLM1	
50.	TUTORIAL-9	1	18-11-2022		TLM3	
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

ACADEMIC CALENDAR:

Description	From	To	Weeks
Commencement of Class Work: 11-07-2022			
I Phase of Instructions	11.07.2022	17.09.2022	7W
I Mid Examinations	19.09.2022	24.09.2022	1W
II Phase of Instructions	25.09.2022	19.11.2022	9W
II Mid Examinations	21.11.2022	26.11.2022	1W
Preparation and Practicals	28.11.2022	03.12.2022	1W
Semester End Examinations	05.12.2022	17.12.2022	2W

PART-C

EVALUATION PROCESS (R17 Regulations):

Evaluation Task	COs	Marks
Assignment/Quiz – 1	1	A1=05
Assignment/Quiz – 2	2	A2=05
I-Mid Examination	1,2	B1=20
I-Online Mid Examination	1,2	C1=10
Assignment/Quiz – 3	3	A3=05
Assignment/Quiz – 4	4	A4=05
Assignment/Quiz – 5	5	A5=05
II-Mid Examination	3,4,5	B2=20
II-Online Mid Examination	3,4,5	C2=10
Evaluation of Assignment/Quiz Marks: A=(A1+A2+A3+A4+A5)/5	1,2,3,4,5	**A=05**
Evaluation of Mid Marks: B=75% of Max(B1,B2)+25% of Min(B1,B2)	1,2,3,4,5	**B=20**
Evaluation of Online Mid Marks: C=75% of Max(C1,C2)+25% of Min(C1,C	1,2,3,4,5	**C=10**
Attendance: D (≥95% =**5M**; 90%≤A<95%=**4M;** 85%≤A<90%=**3M;** 80%≤A<85%=**2M;** 75%≤A<80%=**1M; <75%=0M)**	-	**D=05**
Cumulative Internal Examination: A+B+C+D	**1,2,3,4,5**	**A+B+C+D=40**
Semester End Examinations: E	**1,2,3,4,5**	**E=60**
Total Marks: A+B+C+D+E	**1,2,3,4,5**	**100**

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
Kamala Priya B	Kamala Priya B	Dr. P.Vijay Kumar	Dr. S. Pichi Reddy

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DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART - A

PROGRAM	**: B.Tech. - VII-Sem.- MechanicalEngineering – A Section**
ACADEMIC YEAR	**:** 2022-23
COURSE NAME & CODE	**: Total Quality management& 17ME36**
L-T-P STRUCTURE	**:** 3-0-0
COURSE CREDITS	**:** 3
COURSE INSTRUCTOR	**: Seelam Srinivasa Reddy, Assoc., Professor**
COURSE COORDINATOR	**: Seelam Srinivasa Reddy, Associate Professor**
PER-REQUISITE	**:IndustrialManagement**

COURSE EDUCATIONAL OBJECTIVES: The main objective of this course is to familiarize the concepts of quality management techniques in industries

COURSE OUTCOMES:

After completion of the course student will be able to:

CO1: Comprehend the principles and strategies of quality control

CO2: Apply the principles of total quality management in an industry.

CO3: Analyze statistical quality control tools towards improving the quality.

CO4: Adopt the principles of Taguchi techniques for industrial needs.

CO5: Implement ISO quality standards in an organization.

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

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

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

BOS-APPROVEDTEXTBOOKS:

T : Dale H. Besterfiled., Total Quality Management, Pearson Education, 3rd Edition 2010

BOS APPROVED REFERENCE BOOKS:

R1. James R. Evans & William M. Lidsay, The Management and Control of Quality, South-Western (Thomson Learning), 2002.

R2. Feigenbaum.A.V, Total Quality Management, MCGraw-Hill, 2005.

R3. Narayana V. and Sreenivasan, N.S, Quality Management- Concepts and Tasks, New Age International, 2006.

R4. Zeiri, Total Quality Management for Engineers, Wood Head Publishers, 2009.

COURSE DELIVERY PLAN (LESSON PLAN): ROBOTICS (17ME29)

PART - B

UNIT-I:INTRODUCTION TO TQM

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Textbook followed	HOD Sign Weekly
199.	**Introduction to TQM**	1	11-07-2022		TLM1	CO'1	T&R1	
200.	CEOs, Course Outcomes, POs and PSOs	1	13-07-2022		TLM1	CO'1	T&R1	
201.	INTRODUCTION: Evolution of total quality management	1	14-07-2022		TLM1	CO'1	T&R1	
202.	Definition of Quality	1	15-07-2022		TLM1	CO'1	T&R1	
203.	Quality costs,	1	18-07-2022		TLM2	CO'1	T&R1	
204.	Quality Council	1	20-07-2022		TLM2	CO'1	T&R1	
205.	Strategic Planning	1	21-07-2022		TLM2	CO'1	T&R1	
206.	Deming Philosophy	1	22-07-2022		TLM2	CO'1	T&R1	
207.	Barriers to TQM Implementation	1	25-07-2022		TLM2	CO'1	T&R1	
208.	Barriers to TQM Implementation	1	27-07-2022		TLM2	CO'1	T&R1	
209.	Revision	1	28-07-2022		TLM2	CO'1	T&R1	
210.	Quiz-1	1	29-07-2022		TLM6	CO'1	T&R1	
No. of classes required to complete UNIT-I:		**12**			**No. of classes taken:**			

UNIT-II:TQM PRINCIPLES

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Textbook followed	HOD Sign Weekly

211.	TQM Principles: Customer satisfaction.	1	01-08-2022		TLM1	CO2	T&R1	
212.	Types of Customers, customer supply chain	1	03-08-2022		TLM1	CO2	T&R1	
213.	Customer perception of quality, customer feedback.	1	04-08-2022		TLM2	CO2	T&R1	
214.	customer retention, Service quality.	1	05-08-2022		TLM2	CO2	T&R1	
215.	Employee Involvement, Motivation.	1	08-08-2022		TLM2	CO2	T&R1	
216.	Maslow 's hierarchy of needs, Herzberg theory,	1	10-08-2022		TLM2	CO2	T&R1	
217.	Empowerment and Teamwork, Performance appraisal, Benefits,	1	12-08-2022		TLM2	CO2	T&R1	
218.	Continuous process improvement- Juran Trilogy.	1	17-08-2022		TLM2	CO2	T&R1	
219.	PDSA cycle,	1	18-08-2022		TLM2	CO2	T&R1	
220.	5S, Kaizen, Supplier	1	22-08-2022		TLM2	CO2	T&R1	
221.	Partnership- Partnering, sourcing,	1	24-08-2022		TLM2	CO2	T&R1	
222.	supplier selection,	1	25-08-2022		TLM2	CO2	T&R1	
223.	Performance Measures-Basic Concepts,	1	26-08-2022		TLM2	CO2	T&R1	
224.	Strategy, Performance Measure	1	29-08-2022		TLM2	CO2	T&R1	
225.	Revision	1	01-09-2022		TLM2	CO2	T&R1	
226.	Quiz	1	02-09-2022		TLM6	CO2	T&R1	
No. of classes required to complete UNIT-II		**16**		**No. of classes taken:**				

UNIT-III:STATISTICAL PROCESS CONTROL

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
227.	STATISTICAL PROCESS CONTROL: The seven tools of quality,	1	26-09-2022		TLM1	CO3	T&R1	
228.	Statistical Fundamentals,	1	28-09-2022		TLM2	CO3	T&R1	
229.	Population and Sample,	1	29-09-2022		TLM2	CO3	T&R1	
230.	Normal curve,	1	30-09-2022		TLM2	CO3	T&R1	
231.	Control charts for variables and attributes,	1	06-10-2022		TLM2	CO3	T&R1	
232.	Process capability,	1	07-10-2022		TLM2	CO3	T&R1	
233.	Concepts of six sigma,	1	10-10-2022		TLM2	CO3	T&R1	
234.	New seven Management tools.	1	12-10-2022		TLM2	CO3	T&R1	
235.	Problems	1	13-10-2022		TLM3	CO3	T&R1	
236.	Revision & Quiz	1	14-10-2022		TLM2&6	CO3	T&R1	
No. of classes required to complete UNIT-III		**10**			**No. of classes taken:**			

UNIT-IV:TQM TOOLS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
237.	TQM TOOLS: Benchmarking,	1	17-10-2022		TLM1	CO4	T&R1	
238.	Benchmarking Process,	1	19-10-2022		TLM2	CO4	T&R1	
239.	Quality Function Deployment (QFD),	1	20-10-2022		TLM2	CO4	T&R1	
240.	House of Quality, QFD Process	1	21-10-2022		TLM2	CO4	T&R1	
241.	Taguchi Quality Loss Function,	1	24-10-2022		TLM2	CO4	T&R1	
242.	Total Productive Maintenance Concept,	1	26-10-2022		TLM2	CO4	T&R1	
243.	improvement needs,.	1	27-10-2022		TLM2	CO4	T&R1	
244.	FMEA- Stages of FMEA	1	28-10-2022		TLM2	CO4	T&R1	
245.	Revision	1	31-10-2022		TLM2	CO4	T&R1	
246.	Quiz	1	02-11-2022		TLM6	CO4	T&R1	
No. of classes required to complete UNIT-IV		**10**			**No. of classes taken:**			

UNIT-V:QUALITY SYSTEMS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
247.	QUALITY SYSTEMS: Need for ISO 9000 and other Quality systems,	1	03-11-2022		TLM1	CO5	T&R1	
248.								
249.	ISO 9000:2000 Quality System,	1	04-11-2022		TLM2	CO5	T&R1	
250.	Implementation of Quality system,	1	07-11-2022		TLM2	CO5	T&R1	
251.	Documentation,	1	09-11-2022		TLM2	CO5	T&R1	
252.	Quality Auditing,	1	10-11-2022		TLM2	CO5	T&R1	
253.	TS 16949, ISO 14000- concepts.	1	11-11-2022		TLM2	CO5	T&R1	
254.	Revision & Quiz	1	14-11-2022		TLM2	CO5	T&R1	
255.		1	16-11-2022		TLM2&6	CO5	T&R1	
256.		1	17-11-2022					
257.		1	18-11-2022					
No. of classes required to complete UNIT-V		**07 + 03 (Beyond Syllabus)**						
II Mid Examinations – 21-11-2022 to 26-11-2022								

TEACHING LEARNING METHODS:

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

ACADEMIC CALENDER:

Commencement of Class work		**11-07-2022**	
I Phase of Instructions	11-07-2022	03-09-2022	8 Weeks
CRT Classes	05-09-2022	17-09-2022	2 Weeks
I Mid Examinations	19-09-2022	24-09-2022	1 Week
II Phase of Instructions	26-09-2022	19-11-2022	8 Weeks
II Mid Examinations	21-11-2022	26-11-2022	1 Week
Preparation and Practicals	28-11-2022	03-12-2022	1 Week
Semester End Examinations	05-12-2022	17-12-2022	2 Weeks

PART – C

EVALUATION PROCESS:

Evaluation Task	**COs**	**Marks**
Assignment/Quiz – 1	1	A1=05
Assignment/Quiz – 2	2	A2=05
I-Mid Examination	1,2	B1=20
I-Online Mid Examination	1,2	C1=10
Assignment/Quiz – 3	3	A3=05
Assignment/Quiz – 4	4	A4=05
Assignment/Quiz – 5	5	A5=05
II-Mid Examination	3,4,5	B2=20
II-Online Mid Examination	3,4,5	C2=10
Evaluation of Assignment/Quiz Marks: A=(A1+A2+A3+A4+A5)/5	1,2,3,4,5	**A=05**
Evaluation of Mid Marks: B=75% of Max(B1,B2)+25% of Min(B1,B2)	1,2,3,4,5	**B=20**
Evaluation of Online Mid Marks: C=75% of Max(C1,C2)+25% of Min(C1,C	1,2,3,4,5	**C=10**
Attendance: D (≥95% =**5M**; 90%≤A<95%=**4M;** 85%≤A<90%=**3M;** 80%≤A<85%=**2M;** 75%≤A<80%=**1M; <75%=0M)**	-	**D=05**
Cumulative Internal Examination: A+B+C+D	**1,2,3,4,5**	**A+B+C+D=40**
Semester End Examinations: E	**1,2,3,4,5**	**E=60**
Total Marks: A+B+C+D+E	**1,2,3,4,5**	**100**

PART – D

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

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

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

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

PROGRAMME OUTCOMES (POs):

Engineering Graduates will be able to:

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

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

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

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

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

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

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

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

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

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

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

Laboratory Code	**: 17ME72(R 17 Reg)**	**Lab: Robotics and Simulation Lab**	
A.Y.	**: 2022-2023**	**Class: B. Tech – VII Semester (Section – A)**	
Lab/Practicals	**: 3 hrs/ Week**	**Continuous Internal Assessment**	**: 40**
Credits	**: 01**	**Semester End Examination**	**: 60**
Name of the Faculty	**: J. Subba Reddy (Associate Professor) / K. Karthik (Assistant Professor)**		

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

PRE-REQUISITES:Robotics, CAD/CAM

COURSE EDUCATIONAL OBJECTIVES:

The main objective of this course is to demonstrate and analysis of various types of robots.

COURSE OUTCOMES:

After completion of the course student will be able to:

CO1. Develop Robot Programmes to use to control commands

CO2. Experiment the robot operations like palletizing, gluing, spray painting, polishing, loading and unloading.

CO3. Simulate forward and inverse kinematic movements of a robot using MATLAB.

CO4. Perform the demo operations on SCARA and PUMA using Robo analysers.

Mapping of COs with POs and PSOs:

LABORATORY COURSE ARTICULATION MATRIX (Correlation between COs and POs and PSOs):

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) & PSOs – Robotics and SimulationLab (17ME72)															
		POs											PSOs		
		1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	PSO 3
COs	CO1	2	1			3							2		3	
	CO2	1	2	2		3							2		3	
	CO3	3	3		2	3							3			3
	CO4	1	1			3							2			3
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)															

Lab instructor (s) **Head of the Department**

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DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code	**: 17ME72(R 17 Reg)**	**Lab: Robotics and Simulation Lab**	
A.Y.	**: 2022-2023**	**Class: B. Tech – VII Semester (Section – A)**	
Lab/Practicals	**: 3 hrs/ Week**	**Continuous Internal Assessment**	**: 40**
Credits	**: 01**	**Semester End Examination**	**: 60**
Name of the Faculty	**: J. Subba Reddy (Associate Professor) / K. Karthik (Assistant Professor)**		

PROGRAM OUTCOMES (POs):

Engineering Graduates will be able to:

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

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

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

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

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

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

7.Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

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9.Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10.Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

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12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

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

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

Lab instructor (s) **Head of the Department**

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DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code	**: 17ME72(R 17 Reg)**	**Lab: Robotics and Simulation Lab**	
A.Y.	**: 2022-2023**	**Class: B. Tech – VII Semester (Section – A)**	
Lab/Practicals	**: 3 hrs/ Week**	**Continuous Internal Assessment**	**: 40**
Credits	**: 01**	**Semester End Examination**	**: 60**
Name of the Faculty	**: J. Subba Reddy (Associate Professor) / K. Karthik (Assistant Professor)**		

LIST OF EXPERIMENTS

At least 10 Experiments from 12 overall should be conducted

LIST OF EXPERIMENTS:

1. Program for commands like joint command, circle command
2. Program for commands SPLINE command (continues path)
3. Program for PTP command
4. Palletizing
5. Loading / Unloading
6. Gluing
7. Spray painting
8. Polishing
9. Simulateof Robot with 2 Dof, 3 Dof, 4 Dof using ROBOANALYZER
10. SimulateSCARA,PUMA using ROBOANALYZER
11. Simulate forward and inverse kinematics RR Manipulator using MATLAB
12. Simulate forward and inverse kinematics RP Manipulator using MATLAB

SOFTWARE PACKAGES

ARISTO ROBOT, ROBOANALYZER, MATLAB, C Prog

REFERENCE: Robotics and Simulation Lab Manual

Lab instructor (s) **Head of the Department**

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DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code	**: 17ME72(R 17 Reg)**	**Lab: Robotics and Simulation Lab**	
A.Y.	**: 2022-2023**	**Class: B. Tech – VII Semester (Section – A)**	
Lab/Practicals	**: 3 hrs/ Week**	**Continuous Internal Assessment**	**: 40**
Credits	**: 01**	**Semester End Examination**	**: 60**
Name of the Faculty	**: J. Subba Reddy (Associate Professor) / K. Karthik (Assistant Professor)**		

Notification of Cycles (Section –A)

At least TEN experiments may be conducted.

Cycle - I

1. Program for commands like joint command, circle command
2. Program for commands SPLINE command (continues path)
3. Program for PTP command
4. Palletizing
5. Loading / Unloading
6. Gluing

Cycle – II

7. Spray painting
8. Polishing
9. Simulation of Robot with 2 Dof, 3 Dof, 4 Dof using ROBOANALYZER
10. Simulation of SCARA,PUMA using ROBOANALYZER
11. Simulate forward and inverse kinematics RR Manipulator using MATLAB
12. Simulate forward and inverse kinematics RP Manipulator using MATLAB

SOFTWARE PACKAGES

ARISTO ROBOT, ROBOANALYZER, MATLAB

Lab instructor (s) **Head of the Department**

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DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code : 17ME72(R 17 Reg) **Lab: Robotics and Simulation Lab**

A.Y. : 2022-2023 **Class: B. Tech – VII Semester (Section – A)**

Lab/Practicals : 3 hrs/ Week **Continuous Internal Assessment** : 40

Credits : 01 **Semester End Examination** : 60

Name of the Faculty : J. Subba Reddy (Associate Professor) / K. Karthik (Assistant Professor)

Lab Occupancy Time Table (B.Tech Mech Engg- VIISem:Section – A / S)

↓Day/Date →	9.00 – 9.50	9.50-10.40	10.50-11.40	11.40-12.30-	12.30-1.30	1.30-2.20	2.20-3.10	3.10-4.00
Monday					LUNCH BREAK			
Tuesday	R&S –VII-A lab BATCH-B1							
Wednesday								
Thursday								
Friday								
saturday		R&S –VII-A lab BATCH- B2						

Faculty – In Charges:

S.No	Class	Section	Lab Assistant	Faculty – In Charge
1	B.Tech – VII Semester	A / S	Mr. P. Guna Sundar Reddy	Mr. JonnalaSubba Reddy Mr. K. Kathik

Lab instructor (s) **Head of the Department**

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DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code : 17ME72(R 17 Reg) **Lab: Robotics and Simulation Lab**
A.Y. : 2022-2023 **Class: B. Tech – VII Semester (Section – A)**
Lab/Practicals : 3 hrs/ Week **Continuous Internal Assessment** : 40
Credits : 01 **Semester End Examination** : 60
Name of the Faculty : J. Subba Reddy (Associate Professor) / K. Karthik (Assistant Professor)

Batches (Section – A)

S.No	Batches	Regd.Nos	Total No. of Students
1	B. Tech –VII Sem - A/S	18761A0301,3G1,19761A0301- 315, 316 – 332, 333 – 347, 20765A0301 – 315	58
2	Batch A1	18761A0301,3G1,19761A0301– 315, 316– 332	29
3	Batch A2	19761A0333–347, 20765A0301-315	29

Sub Batch of A11:
18761A0301,19761A0301– 315 (14)

S. No	Batch	Registered Nos	Total
1	A111	18761A0301,3G1-19761A0301	03
2	A112	197671A0302-305	03
3	A113	197671A0307-309	03
4	A114	197671A0310-311	02
5	A115	197671A0313-314	02
6	A116	197671A0315	01
Total (A11)			14

Sub Batch of A12:
19761A0316 – 332 (15)

S. No	Batch	Registered Nos	Total
1	A121	197671A0316-318	03
2	A122	197671A0319-322	03
3	A123	197671A0323-324	02
4	A124	197671A0326-328	03
5	A125	197671A0329-330	02
6	A126	197671A0331-332	02
Total (A12)			15

Sub Batches of A21:
19761A0333–347 (14)

S. No	Batch	Registered Nos	Total
1	A211	19761A0333-335	03
2	A212	19761A0336-338	03
3	A213	19761A0339-341	03
4	A214	19761A0342-343	02
5	A215	19761A0344-345	02
6	A216	19761A0347	01
Total (A21)			14

Sub Batches of A22:
20765A0301–307, 308-315 (15)

S. No	Batch	Registered Nos	Total
1	A221	20765A0301-303	03
2	A222	20765A0304-306	03
3	A223	20765A0307-309	03
4	A224	20765A0310-311	02
5	A225	20765A0312-313	02
6	A226	20765A0314-315	02
Total (A22)			15

Lab instructor (s) **Head of the Department**

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DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code : 17ME72(R 17 Reg) **Lab: Robotics and Simulation Lab**
A.Y. : 2022-2023 **Class: B. Tech – VII Semester (Section – A)**
Lab/Practicals : 3 hrs/ Week **Continuous Internal Assessment : 40**
Credits : 01 **Semester End Examination : 60**
Name of the Faculty : J. Subba Reddy (Associate Professor) / K. Karthik (Assistant Professor)

Schedule of Experiments (Section – A: A1 Batch)

S.No	Batches	Regd. Nos	Total No. of Students
1	**Batch A1**	**18761A0301,3G1,19761A0301– 315, 316– 332**	**29**

S.No.	Name of the experiment	No. of Classes Required	Tentative Date of Completion	Teaching Learning Methods
1	**Introduction to Robotics and Simulation Lab, Demonstration of all experiments, CEOs, and COs of the Laboratory**	3	16-07-2022	TLM4
Cycle I				
2	Program for commands like joint command, circle command	3	23-07-2022	TLM4
3	Program for commands SPLINE command (continues path)	3	30-07-2022	TLM4
4	Program for PTP command	3	06-08-2022	TLM4
5	Palletizing	3	20-08-2022	TLM4
6	Loading / Unloading	3	27-08-2022	TLM4
Cycle II				
7	Gluing	3	03-09-2022	TLM4
8	Spray painting, Polishing	3	17-09-2022	TLM4
	I Mid Exams	19-09-2022 to 26-09-2022		
9	Simulation of Robot with 2 Dof, 3 Dof, 4 Dof using ROBOANALYZER	3	01-10-2022	TLM4
10	Simulation of SCARA, PUMA using ROBOANALYZER	3	15-10-2022	TLM4
11	Simulate forward and inverse kinematics RR Manipulator using MATLAB	3	22-10-2022	TLM4
12	Simulate forward and inverse kinematics RP Manipulator using MATLAB	3	29-10-2022	TLM4
13	Design of Robotic System	3	05-11-2022	TLM4
14	Revision	3	12-11-2022	TLM4
15	Internal Exam	3	19-11-2022	TLM4
	II Mid Exams	**21-11-2022 to 26-11-2022**		
	Preparation and Practicals	**28-11-2022 to 03-12-2022**		
	Semester End Exams	**05-12-2022 to 17-12-2022**		

Lab instructor (s) **Head of the Department**

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DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code : 17ME72(R 17 Reg) **Lab: Robotics and Simulation Lab**
A.Y. : 2022-2023 **Class: B. Tech – VII Semester (Section – A)**
Lab/Practicals : 3 hrs/ Week **Continuous Internal Assessment** : 40
Credits : 01 **Semester End Examination** : 60
Name of the Faculty : J. Subba Reddy (Associate Professor) / K. Karthik (Assistant Professor)

Schedule of Experiments (Section – A: A2 Batch)

S.No	Batches	Regd.Nos	Total No. of Students
1	Batch A2	19761A0333–347, 20765A0301-315	29

S.No.	Name of the experiment	No. of Classes Required	Tentative Date of Completion	Teaching Learning Methods
1	**Introduction to Robotics and Simulation Lab, Demonstration of all experiments, CEOs, and COs of the Laboratory**	3	12-07-2022	TLM4
Cycle I				
2	Program for commands like joint command, circle command	3	19-07-2022	TLM4
3	Program for commands SPLINE command (continues path)	3	26-07-2022	TLM4
4	Program for PTP command	3	02-08-2022	TLM4
	Palletizing	3	09-08-2022	TLM4
5	Loading / Unloading		16-08-2022	TLM4
6	Gluing	3	23-08-2022	TLM4
7	Circular Motion	3	30-08-2022	TLM4
Cycle II				
8	Spray painting, Polishing	3	06-09-2022	TLM4
9	Simulation of Robot with 2 Dof, 3 Dof, 4 Dof using ROBOANALYZER	3	13-09-2022	TLM4
	I Mid Exams	19-09-2022 to 26-09-2022		
10	Simulation of SCARA, PUMA using ROBOANALYZER	3	27-09-2022	TLM4
11	Simulate forward and inverse kinematics RR Manipulator using MATLAB	3	11-10-2022	TLM4
12	Simulate forward and inverse kinematics RP Manipulator using MATLAB	3	18-10-2022	TLM4
13	Welding Applications	3	25-10-2022	TLM4
14	Collaboration of Robots	3	01-11-2022	TLM4
15	Revision	3	08-11-2022	TLM4
15	Internal Exam	3	15-11-2022	TLM4
	II Mid Exams	**21-11-2022 to 26-11-2022**		
	Preparation and Practicals	**28-11-2022 to 03-12-2022**		
	Semester End Exams	**05-12-2022 to 17-12-2022**		

Lab instructor (s) **Head of the Department**

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

DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code : 17ME72(R 17 Reg) **Lab: Robotics and Simulation Lab**

A.Y. : 2022-2023 **Class: B. Tech – VII Semester (Section – A)**

Lab/Practicals : 3 hrs/ Week **Continuous Internal Assessment** : 40

Credits : 01 **Semester End Examination** : 60

Name of the Faculty : J. Subba Reddy (Associate Professor) / K. Karthik (Assistant Professor)

Evaluation Criterion for Laboratory

EVALUATION PROCESS:

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

Lab instructor (s) **Head of the Department**

LAKIREDDY BALI REDDY COLLEGE OF 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.**

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

Laboratory Code	**: 17ME73(R 17 Reg)**	**Lab:Metrology and Instrumentation Lab**	
A.Y.	**: 2022-23**	**Class: B. Tech – VII Semester (Section – A)**	
Lab/Practicals	**: 6 hrs/ Week**	**Continuous Internal Assessment**	**: 40**
Credits	**: 02**	**Semester End Examination**	**: 60**
Name of the Faculty	**: B.SUDHEER KUMAR (Sr.Asst Professor) /B.KAMALA PRIYA (Assistant Professor)**		

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

PRE-REQUISITES :METROLOGY & INSTRUMENTATION

COURSE EDUCATIONAL OBJECTIVES:

The objectives of this laboratory course is to enable the students learn the basic principles of metrological instruments and perform their calibration tests for industrial needs.

COURSE OUTCOMES:

After completion of the course student will be able to:

CO1. Perform linear, angular and gear measurements in manufacturing industries.

CO2. Analyze the measurement of the surface roughness and perform alignment tests.

CO3. Calibrate the displacement, load and speed measuring instruments

CO4. Measure the pressure, flow and vibration measuring instruments.

Mapping of COs with POs and PSOs:

LABORATORY COURSE ARTICULATION MATRIX (Correlation between COs and POs and PSOs):

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) & PSOs – Metrology and Instrumentation Lab (L 160)															
		POs												**PSOs**	
		1	**2**	**3**	**4**	**5**	**6**	**7**	**8**	**9**	**10**	**11**	**12**	**PSO 1**	**PSO 2**	**PSO 3**
COs	CO1	2	3	2	2					2			1		3	
	CO2	2	3	2	2					2			1		3	
	CO3	2	2		2					2			1		3	
	CO4	2	2		2					2			1		3	
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)															

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

LAKIREDDY BALI REDDY COLLEGE OF 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.**

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

PROGRAM OUTCOMES (POs):

Engineering Graduates will be able to:

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

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

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

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

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

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

7.Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8.Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9.Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10.Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11.Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

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

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

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

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L B Reddy Nagar, Mylavaram-521 230, Krishna District, Andhra Pradesh.**

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

Laboratory Code	**: 17ME73(R 17 Reg)**	**Lab:Metrology and Instrumentation Lab**	
A.Y.	**: 2022-23**	**Class: B. Tech – VII Semester (Section – A)**	
Lab/Practicals	**: 6 hrs/ Week**	**Continuous Internal Assessment**	**: 40**
Credits	**: 02**	**Semester End Examination**	**: 60**
Name of the Faculty	**: B.SUDHEER KUMAR (Sr.Asst Professor) / B.KAMALA PRIYA (Assistant Professor)**		

LIST OF EXPERIMENTS

At least 06 Experiments from each laboratory and 12 overallshould be conducted

PART-A: METROLOGY LAB

At least SIX experiments may be conducted.

1. Measurement of lengths, heights, diameters by vernier calipers and micrometers.
2. Measurement of bores by dial bore indicators.
3. Taper measurement by using balls and rollers.
4. Use of gear teeth vernier calipers and checking the chordal addendum and chordalheight of spur gear.
5. Machine tool alignment of test on the lathe or milling machine.
6. Measurement of screw thread parameters using Tool makers microscope.
7. Angle and taper measurements by Bevel protractor, Sine bars, etc.
8. Thread measurement by three wire method.
9. Surface roughness measurement by Tally Surf.

PART-B: INSTRUMENTATION LAB

At least SIX experiments may be conducted.

1. Calibration of Pressure Gauges
2. Study and calibration of LVDT transducer for displacement measurement.
3. Calibration of strain gauge for load measurement.
4. Calibration of capacitive transducer for linear displacement.
5. Study and calibration of photo and magnetic speed pickups for the measurement ofspeed.
6. Study and calibration of a rotameter for flow measurement.
7. Study of Piezo-electric transducer.
8. Study and use of a Seismic pickup for the measurement of vibration amplitude of anengine bed at various loads.
9. Study and calibration of McLeod gauge for low pressure.
10. Study and calibration of RTD for temperature measurement

REFERENCE: Metrology and Instrumentation Lab Manuals

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

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

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L B Reddy Nagar, Mylavaram-521 230, Krishna District, Andhra Pradesh.

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

Laboratory Code : 17ME73(R 17 Reg) **Lab:Metrology and Instrumentation Lab**
A.Y. : 2022-23 **Class: B. Tech – VII Semester (Section – A)**
Lab/Practicals : 6 hrs/ Week **Continuous Internal Assessment** : 40
Credits : 02 **Semester End Examination** : 60
Name of the Faculty : B.SUDHEER KUMAR (Sr.Asst Professor) / B.KAMALA PRIYA (Assistant Professor)

Batches (Section – A)

S.No	Batches	Regd.Nos	Total No. of Students
1	B. Tech – A/S	18761A0301,3G1 , 19761A0301 – 303 & 305,19761A0307- 311, 19761A0313 – 319, 18761A0321- 324,19761A0326-345 ,19761A0347,20765A0301 – 315	58
2	Batch A1	18761A0301 , 18761A03G1 , 19761A0301 – 303 & 305, 19761A0307-311, 19761A0313 – 319, 19761A0321- 332	29
3	Batch A2	19761A0333- 345, 19761A0347,20765A0301 – 315	29

Sub Batch of A11:
18761A0301 , 18761A03G1 , 19761A0301 – 316 (15)

S. No	Batch	Registered Nos	Total
1	A111	18761A0301, 3G1 ,19761A0301	03
2	A112	19761A0302 – 303 & 305	03
3	A113	19761A0307 – 309	03
4	A114	19761A0310 –311 & 313	03
5	A115	19761A0314–316	03
Total (A11)			15

Sub Batch of A12:
19761A0317 – 18761A0332 (14)

S. No	Batch	Registered Nos	Total
1	A121	19761A0317 – 319	03
2	A122	19761A0321 – 323	03
3	A123	19761A0324 -327	03
4	A124	19761A0328 -330	03
5	A125	19761A0331 -332	02
Total (A12)			14

Sub Batches of A21:
18761A0333- 345, 347, 20765A0301(15)

S. No	Batch	Registered Nos	Total
1	B211	19761A0333 – 335	03
2	B212	19761A0336 – 338	03
3	B213	19761A0339 – 341	03
4	B214	19761A0342 – 344	03
5	B215	19761A0345, 347 20765A0301	03
Total (A21)			15

Sub Batches of A22:
20765A0302 – 20765A0315(14)

S. No	Batch	Registered Nos	Total
1	B221	20765A0302 – 304	03
2	B222	20765A0305 – 307	03
3	B223	20765A0308 – 310	03
4	B224	20765A0311 – 313	03
5	B225	20765A0314 – 315	02
Total (A22)			14

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

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L B Reddy Nagar, Mylavaram-521 230, Krishna District, Andhra Pradesh.**

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

Laboratory Code	**: 17ME73(R 17 Reg)**	**Lab:Metrology and Instrumentation Lab**	
A.Y.	**: 2022-23**	**Class: B. Tech – VII Semester (Section – A)**	
Lab/Practicals	**: 6 hrs/ Week**	**Continuous Internal Assessment**	**: 40**
Credits	**: 02**	**Semester End Examination**	**: 60**
Name of the Faculty	**: B.SUDHEER KUMAR (Sr.Asst Professor) / B.KAMALA PRIYA (Assistant Professor)**		

Notification of Cycles (Section – B)

Cycle – I:METROLOGY LAB

At least SIX experiments may be conducted.

1. Measurement of lengths, heights, diameters by vernier calipers and micrometers.
2. Measurement of bores by dial bore indicators.
3. Taper measurement by using balls and rollers.
4. Use of gear teeth vernier calipers and checking the chordal addendum and chordalheight of spur gear.
5. Machine tool alignment of test on the lathe or milling machine.
6. Measurement of screw thread parameters using Tool makers microscope.
7. Angle and taper measurements by Bevel protractor, Sine bars, etc.
8. Thread measurement by three wire method.
9. Surface roughness measurement by Taly Surf.

Cycle – II: INSTRUMENTATION LAB

At least SIX experiments may be conducted.

1. Calibration of Pressure Gauges
2. Study and calibration of LVDT transducer for displacement measurement.
3. Calibration of strain gauge for load measurement.
4. Calibration of capacitive transducer for linear displacement.
5. Study and calibration of photo and magnetic speed pickups for the measurement ofspeed.
6. Study and calibration of a rotameter for flow measurement.
7. Study of Piezo-electric transducer.
8. Study and use of a Seismic pickup for the measurement of vibration amplitude of anengine bed at various loads.
9. Study and calibration of McLeod gauge for low pressure.
10. Study and calibration of RTD for temperature measurement

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

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

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L B Reddy Nagar, Mylavaram-521 230, Krishna District, Andhra Pradesh.

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

Laboratory Code	**: 17ME73(R 17 Reg)**	**Lab:Metrology and Instrumentation Lab**	
A.Y.	**: 2022-23**	**Class: B. Tech – VII Semester**	
Lab/Practicals	**: 6 hrs/ Week**	**Continuous Internal Assessment**	**: 40**
Credits	**: 02**	**Semester End Examination**	**: 60**
Name of the Faculty	**: B.SUDHEER KUMAR (Sr.Asst Professor) / B.KAMALA PRIYA (Assistant Professor)**		

Lab Occupancy Time Table (B.Tech Mech Engg- VIISem:Section – A)

↓Day/Date→	*9.00 – 9.50*	*9.50 - 10.40*	*10.50 - 11.40*	*11.40 - 12.30*	*12.30 - 13.30*	*13.30 - 14.20*	*14.20 - 15.10*	*15.10 - 16.00*
Monday					*LUNCH*			
Tuesday	*M & I Lab – VI A/S – A1*					*M & I Lab – VI C/S – C1*		
Wednesday								
Thursday		*M & I Lab – VI A/S – B1*						
Friday							*M & I Lab – VI C/S – C2*	
Saturday		*M & I Lab – VI A/S – A2*				*M & I Lab – VI A/S – B2*		

Faculty – In Charges:

S.No	Class	Section	Lab Instructors	Faculty – In Charge
1	B.Tech – VII Semester	*A / S*	Md. Jony	Mr.B.Sudheer Kumar [T542] Mrs. B. Kamala Priya [T792]
2		*B / S*	Md. Jony	Mr. V.Sankara Rao [T721] Mrs. B. Kamala Priya [T792]
3		*C / S*	Md. Jony	Mr. K.Lakshmi Prasad [T686] Ms.P . Mounika [T872]

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

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

Laboratory Code	**: 17ME73(R 17 Reg)**	**Lab:Metrology and Instrumentation Lab**	
A.Y.	**: 2022-23**	**Class: B. Tech – VII Semester (Section – A)**	
Lab/Practicals	**: 6 hrs/ Week**	**Continuous Internal Assessment**	**: 40**
Credits	**: 02**	**Semester End Examination**	**: 60**
Name of the Faculty	**: B.SUDHEER KUMAR (Sr.Asst Professor) / B.KAMALA PRIYA (Assistant Professor)**		

Schedule of Experiments (Section – A: A1 Batch)

S.No	Batches	Regd.Nos	Total No. of Students
1	**Batch A1**	**18761A0301 , 18761A03G1 , 19761A0301 – 303 & 305, 19761A0307- 311, 19761A0313 – 319, 19761A0321- 332**	**29**

Date	Experiment (Batch)					
	Ex - 1	**Ex – 2**	**Ex – 3**	**Ex – 4**	**Ex – 5**	**Ex – 6**
12-07-2022	**Demonstration of all experiments, CEOs and COs of the Laboratory (Ex – 01 to 06)**					
METROLOGY LAB						
19-07-2022	A111	A112	A113	A114	A115	
26-07-2022	A112	A113	A114	A115	A111	
02-08-2022	A113	A114	A115	A111	A112	
16-08-2022	A114	A115	A111	A112	A113	
23-08-2022	A115	A111	A112	A113	A114	
Date	**Ex - 1**	**Ex – 2**	**Ex – 3**	**Ex – 4**	**Ex – 5**	**Ex – 6**
30-08-2022	A121	A122	A123	A124	A125	
CRT CLASSES:05-09-2022 TO 17-09-2022						
19-09-2022 TO 24-09-2022: *I Mid Examination*						
27-09-2022	A122	A123	A124	A125	A121	
01-11-2022	A123	A124	A125	A121	A122	
08-11-2022	A124	A125	A121	A122	A123	
15-11-2022	A125	A121	A122	A123	A124	
15-11-2022	Backlog experiments / Additional Experiments Viva – Voce and Repetition / Beyond the Syllabus					
21-11-2022 to 26-11-2022: *II Mid Examinations*						
28-11-2022 to 03-12-2022	**Preparation and Practical's**					
05-12-2022 to 17-12-2022	**Semester End Examinations**					

Lab in charge **Head of the Department**

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

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L B Reddy Nagar, Mylavaram-521 230, Krishna District, Andhra Pradesh.

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

Laboratory Code	**: 17ME73(R 17 Reg)**	**Lab:Metrology and Instrumentation Lab**	
A.Y.	**: 2022-23**	**Class: B. Tech – VII Semester (Section – A)**	
Lab/Practicals	**: 6 hrs/ Week**	**Continuous Internal Assessment**	**: 40**
Credits	**: 02**	**Semester End Examination**	**: 60**
Name of the Faculty	**: B.SUDHEER KUMAR (Sr.Asst Professor) / B.KAMALA PRIYA (Assistant Professor)**		

Schedule of Experiments (Section – A: A1 Batch)

S.No	Batches	Regd.Nos	Total No. of Students
1	**Batch A1**	**18761A0301 , 18761A03G1 , 19761A0301 – 303 & 305, 19761A0307- 311, 19761A0313 – 319, 19761A0321- 332**	**29**

Date	Experiment (Batch)					
	Ex - 1	**Ex – 2**	**Ex – 3**	**Ex – 4**	**Ex – 5**	**Ex – 6**
12-07-2022	**Demonstration of all experiments, CEOs and COs of the Laboratory (Ex – 01 to 06)**					
INSTRUMENTATION LAB						
19-07-2022	A121	A122	A123	A124	A125	
26-07-2022	A122	A123	A124	A125	A121	
02-08-2022	A123	A124	A125	A121	A122	
16-08-2022	A124	A125	A121	A122	A123	
23-08-2022	A125	A121	A122	A123	A124	
Date	**Ex - 1**	**Ex – 2**	**Ex – 3**	**Ex – 4**	**Ex – 5**	**Ex – 6**
30-08-2022	A111	A112	A113	A114	A115	
CRT CLASSES:05-09-2022 TO 17-09-2022						
19-09-2022 TO 24-09-2022: *I Mid Examination*						
27-09-2022	A112	A113	A114	A115	A111	
01-11-2022	A113	A114	A115	A111	A112	
08-11-2022	A114	A115	A111	A112	A113	
15-11-2022	A115	A111	A112	A113	A114	
15-11-2022	Backlog experiments / Additional Experiments Viva – Voce and Repetition / Beyond the Syllabus					
21-11-2022 to 26-11-2022: *II Mid Examinations*						
28-11-2022 to 03-12-2022	**Preparation and Practical's**					
05-12-2022 to 17-12-2022	**Semester End Examinations**					

Lab in charge **Head of the Department**

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

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

Laboratory Code	**: 17ME73(R 17 Reg)**	**Lab:Metrology and Instrumentation Lab**	
A.Y.	**: 2022-23**	**Class: B. Tech – VII Semester (Section – A)**	
Lab/Practicals	**: 6 hrs/ Week**	**Continuous Internal Assessment**	**: 40**
Credits	**: 02**	**Semester End Examination**	**: 60**
Name of the Faculty	**: B.SUDHEER KUMAR (Sr.Asst Professor) / B.KAMALA PRIYA (Assistant Professor)**		

Schedule of Experiments (Section – A: A2 Batch)

S.No	Batches	Regd.Nos	Total No. of Students
1	**Batch A2**	**19761A0333- 345, 19761A0347,20765A0301 – 315**	**29**

Date	Experiment (Batch)					
	Ex - 1	**Ex – 2**	**Ex – 3**	**Ex – 4**	**Ex – 5**	**Ex – 6**
16-07-2022	**Demonstration of all experiments, CEOs and COs of the Laboratory (Ex – 01 to 06)**					
METROLOGY LAB						
23-07-2022	A211	A212	A213	A214	A215	
30-07-2022	A215	A211	A212	A213	A214	
06-08-2022	A214	A215	A211	A212	A213	
20-08-2022	A213	A214	A215	A211	A212	
27-08-2022	A212	A213	A214	A215	A211	
Date	**Ex - 1**	**Ex – 2**	**Ex – 3**	**Ex – 4**	**Ex – 5**	**Ex – 6**
03-09-2022	A221	A222	A223	A224	A225	
CRT CLASSES:05-09-2022 TO 17-09-2022						
19-09-2022 TO 24-09-2022: *I Mid Examination*						
10-09-2022	A225	A221	A222	A223	A224	
17-09-2022	A224	A225	A221	A222	A223	
01-10-2022	A223	A224	A225	A221	A222	
15-10-2022	A222	A223	A224	A225	A221	
22-10-2022 & 29-10-2022	Backlog experiments / Additional Experiments Viva – Voce and Repetition / Beyond the Syllabus					
21-11-2022 to 26-11-2022: *II Mid Examinations*						
28-11-2022 to 03-12-2022	**Preparation and Practical's**					
05-12-2022 to 17-12-2022	**Semester End Examinations**					

Lab in charge **Head of the Department**

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

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L B Reddy Nagar, Mylavaram-521 230, Krishna District, Andhra Pradesh.

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

Laboratory Code : 17ME73(R 17 Reg) **Lab:Metrology and Instrumentation Lab**
A.Y. : 2022-23 **Class: B. Tech – VII Semester (Section – A)**
Lab/Practicals : 06 hrs/Week **Continuous Internal Assessment** : 40
Credits : 02 **Semester End Examination** : 60
Name of the Faculty : B.SUDHEER KUMAR (Sr.Asst Professor) / B.KAMALA PRIYA (Assistant Professor)

Schedule of Experiments (Section – B: B2 Batch)

S.No	Batches	Regd.Nos	Total No. of Students
1	Batch A2	19761A0333- 345, 19761A0347,20765A0301 – 315	29

Date	Experiment (Batch)					
	Ex - 1	Ex – 2	Ex – 3	Ex – 4	Ex – 5	Ex – 6
16-07-2022	Demonstration of all experiments, CEOs and COs of the Laboratory (Ex – 01 to 06)					
INSTRUMENTATION LAB						
23-07-2022	A221	A222	A223	A224	A225	
30-07-2022	A225	A221	A222	A223	A224	
06-08-2022	A224	A225	A221	A222	A223	
20-08-2022	A223	A224	A225	A221	A222	
27-09-2022	A222	A223	A224	A225	A221	
Date	Ex - 1	Ex – 2	Ex – 3	Ex – 4	Ex – 5	Ex – 6
03-09-2022	A211	A212	A213	A214	A215	
CRT CLASSES:05-09-2022 TO 17-09-2022						
19-09-2022 TO 24-09-2022: *I Mid Examination*						
10-09-2022	A215	A211	A212	A213	A214	
17-09-2022	A214	A215	A211	A212	A213	
01-10-2022	A213	A214	A215	A211	A212	
15-10-2022	A212	A213	A214	A215	A211	
22-10-2022 & 29-10-2022	Backlog experiments / Additional Experiments Viva – Voce and Repetition / Beyond the Syllabus					
21-11-2022 to 26-11-2022: *II Mid Examinations*						
28-11-2022 to 03-12-2022	Preparation and Practical's					
05-12-2022 to 17-12-2022	Semester End Examinations					

Lab in charge **Head of the Department**

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

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : A NageswaraRao
Course Name & Code : CIM & 17ME92
L-T-P Structure : 3-0-0 Credits : 3
Program/Sem/Sec : B.Tech., MECH., VII-Sem., Sections- A A.Y : 2022-23

PRE-REQUISITE:CAD/CAM

COURSE EDUCATIONAL OBJECTIVES (CEOs): The main objective of this course is to control the entire production process using computers. This integration allows individual processes to exchange information with each other and initiate actions.

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

CO 1	Understand the basics of production and derive production metrics.
CO 2	Prepare CNC programs for manufacturing of different geometries on milling and lathe Machines.
CO 3	Apply group technology concepts for parts classification.
CO 4	Select layouts of FMS for industrial applications.
CO 5	Develop a CAPP system for rotational and prismatic parts.

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 1. Mikell P Groover, Automation, production Systems and Computer Integrated Manufacturing, 3rd Edition, Prentice Hall Inc., New Delhi, 2007.
T2 2. P. Radhakrishnan, "Computer Numerical Control ", New Central Book Agency, 1992.

REFERENCE BOOKS:

R1 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: Introduction

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
258.	Production Systems	1	13.07.2022			
259.	production facilities	1	14.07.2022			
260.	Manufacturing operations	1	15.07.2022			
261.	manufacturing models and metrics	1	16.07.2022			
262.	Examples of Manufacturing problems	1	20.07.2022			
263.	CIM Definition	1	21.07.2022			
264.	CIM components	1	22.07.2022			
265.	Evolution of CIM, needs of CIM	1	23.07.2022			
266.	Benefits of CIM	1	27.07.2022			
267.	Overview of CIM software and Hardware	1	28.07.2022			
No. of classes required to complete UNIT-I:10				No. of classes taken:		

UNIT-II: 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
35.	Basic components of NC system	1	29.07.2022			
36.	NC motion control system	1	30.07.2022			
37.	Applications of NC, advantages and disadvantages of NC	1	03.08.2022			
38.	computer Numerical control	1	04.08.2022			
39.	functions and advantages of CNC	1	05.08.2022			
40.	Direct Numerical Control, components of a DNC system	1	06.08.2022			
41.	Functions and advantages of DNC	1	10.08.2022			
42.	NC part programming.	1	11.08.2022			
43.	NC part programming turn	1	12.08.2022			
44.	NC part programming mill		13.08.2022			
No. of classes required to complete UNIT-II:10				No. of classes taken:		

UNIT-III: CELLULAR MANUFACTURING SYSTEMS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
31.	Part Families, Parts Classification and Coding	1	28-09-2022			
32.	Features of Parts Classification and Coding Systems	1	30.09.2022			
33.	Opitz of Parts Classification and Coding Systems	1	01.10.2022			
34.	Production Flow Analysis	1	06.10.2022			
35.	Composite Part Concept,	1	07.10.2022			
36.	Machine Cell Design	1	08.10.2022			
37.	Applications Of Group Technology	1	12.10.2022			
38.	Quantitative analysis of cellular manufacturing	1	13.10.2022			
39.	Rank Order Clustering Method, Arranging Machines in a GT cell	2	14.10.2022			
40.	HollierMethod, Simple Problems		15.10.2022			
No. of classes required to complete UNIT-III:10				No. of classes taken:		

UNIT-IV :FLEXIBLE MANUFACTURING SYSTEMS (FMS)

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
29.	Flexibility	1	19.10.2022			
30.	Types of FMS	1	20.10.2022			
31.	FMS Components	1	21.10.2022			
32.	FMS Application & Benefits	1	22.10.2022			
33.	FMS Planning and implementation issues	1	26.10.2022			
34.	Quantitative analysis of FMS	1	27.10.2022			
35.	Simple Problems.	1	28.10.2022			
36.	FMS software	1	29.10.2022			
37.	FMS hardware	1	02.11.2022			
38.	Implementation issues FMS	1	03.11.2022			
No. of classes required to complete UNIT-IV:10				No. of classes taken:		

UNIT-V :PROCESS PLANNING AND CONCURRENT ENGINEERING

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
51.	Process planning for parts	1	04.11.2022			
52.	Process planning for assemblies	1	05.11.2022			
53.	Make or buy decisions	1	09.11.2022			
54.	Computer aided process planning	1	10.11.2022			
55.	Retrieval and generative CAPP systems	1	11.11.2022			
56.	Concurrent engineering	1	12.11.2022			
57.	design for manufacturing	1	16.11.2022			
58.	Advanced manufacturing planning	1	17.11.2022			
59.	lean production and JIT & production systems	1	18.11.2022			
60.	Lean principles	1	19.11.2022			
No. of classes required to complete UNIT-V:08				No. of classes taken:		

Teaching Learning Methods			
TLM1	Chalk and Talk	**TLM4**	Demonstration (Lab/Field Visit)
TLM2	PPT	**TLM5**	ICT (NPTEL/SwayamPrabha/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

LAKKIREDDY BALI REDDY COLLEGE OF ENGINEERING
DEPARTMENT OF MECHANICAL ENGINEERING
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L B Reddy Nagar, Mylavaram-521 230, Krishna District, Andhra Pradesh.

COURSE HANDOUT

PROGRAM : B.Tech., VII-Sem.,(B/S) ME

ACADEMIC YEAR : 2022-2023

COURSE NAME & CODE : Refrigeration and Air-Conditioning - 17ME28

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

COURSE CREDITS : 3

COURSE INSTRUCTOR : **Dr. V. DHANA RAJU**

COURSE COORDINATOR : **Dr. V. DHANA RAJU**

PRE-REQUISITE: Thermodynamics

COURSE OBJECTIVE: In a broader way, this course provides the simple understanding of refrigeration and air conditioning fundamentals. First, it covers the different refrigeration cycles and its analysis. Then the concepts of psychrometry and psychrometry processes used for air conditioning are imparted. Finally, the concepts of comfort air conditioning, cooling load design and its estimation are addressed.

COURSE OUTCOMES (CO)

CO1: Describe the basic concepts of refrigeration and its applications.
CO2: Evaluate the performance parameters of refrigeration systems.
CO3: Identify the desirable refrigerants and its use in various refrigeration systems.
CO4: Analyze the psychrometric properties and processes used in Air Conditioning systems.
CO5: Design of Air Conditioning systems for thermal comfort conditions.

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

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

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

BOS APPROVED TEXT BOOKS:

T1 C. P. Arora. , Refrigeration and air conditioning - TMH, 2nd Edition, 2000.

T2 R. Dossat, Principles of Refrigeration - - Pearson 4th Edition 2001.

BOS APPROVED REFERENCE BOOKS:

R1 S. C. Arora, Domkundwar, A course in refrigeration and air conditioning-Dhanapat Rai& sons 5th Edition 1997.

R2 Wilbert F.Stoecker, Jerold W. J.Jones, MGH, 1986.

R3 Manohar Prasad, Refrigeration and Air conditioning, New Age international, 2003

COURSE DELIVERY PLAN (LESSON PLAN): Section-B

UNIT-I FUNDAMENTALS OF REFRIGERATION

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome Cos	Textbook followed	HOD Sign Weekly
1.	**Introduction:** Refrigeration, CEOs, Course Outcomes, POs and PSOs	1	11-07-22		**TLM2**	CO1	**T1**	
2.	Applications of refrigeration	1	12-07-22		**TLM2**	CO2	**T1**	
3.	Unit of refrigeration and COP	1	13-07-22		**TLM2**	CO1	**T1**	
4.	Heat Engine, Refrigerator and Heat pump	1	14-07-22		**TLM2**	CO1	**T1**	
5.	Types of Refrigeration systems	1	16-07-22		**TLM2, TLM 4**	CO2	**T1**	
6.	Problems on refrigeration basics	1	18-07-22		**TLM2, TLM 4**	CO2	**T1**	
7.	**Refrigerant:** Desirable characteristics of ideal refrigerant	1	19-07-22		**TLM2**	CO3	**T1**	
8.	Classification of refrigerants- Desirable Properties-Nomenclature, Refrigerant Designation	1	20-07-22		**TLM 1**	CO3	**T1**	
9.	Commonly used refrigerants, Alternate refrigerants, Green House effect& Global	1	21-07-22		**TLM 1**	CO3	**T1**	
10.	**Air refrigeration system**: working on Reversed Carnot cycle	1	23-07-22		**TLM 1**	CO2	**T1**	
11.	Air refrigeration system working on Bell Coleman cycle	1	25-07-22		**TLM 1**	CO2	**T1**	
12.	Air refrigeration Problems	1	26-07-22		**TLM 1**	CO2	**T1**	
13.	COP- Open and Dense air systems Problems	1	27-07-22		**TLM 1**	CO2	**T1**	
14.	**Tutorial**	1	28-07-22		**TLM 1**	CO2	**T1**	
No. of classes required to complete UNIT-I = 14			No. of classes taken:					

UNIT-II VAPOUR COMPRESSION REFRIGERATION SYSTEM & COMPONENTS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome Cos	Text Book followed	HOD Sign Weekly
15	**Introduction to VCR system:** Essential components of the VCR plant	1	30-07-22		**TLM 1**	CO1	**T1**	
16	, Simple vapour compression refrigeration cycle, COP	1	01-08-22		**TLM 1**	CO1	**T2**	
17	Representation of cycle on	1	02-08-22		**TLM 1**	CO1	**T2**	

	T-S and p-h Charts							
18	VCR numerical problems	1	03-08-22		**TLM 1**	CO1	**T2**	
19	Tutorial	1	04-08-22		**TLM 1**	CO1	**T2**	
20	Effect of sub cooling and superheating,	1	06-08-22		**TLM 1**	CO1	**T2**	
21	Effect of condenser and evaporator pressure	1	08-08-22		**TLM 1**	CO1	**T2**	
22	Actual VCR and theoretical VCR, Tutorial	1	10-08-22		**TLM 1**	CO1	**T2**	
23	**VCR-System Components**: Compressors -Classification-Working Principles	1	11-08-22		**TLM 1**	CO1	**R1**	
24	Work expression for the reciprocating compressor	1	17-08-22		**TLM 1**	CO1	**R1**	
25	Rotary compressors, Problems	1	20-08-22		**TLM 1**	CO1	**R1**	
26	Condensers – Classification-working principle,	1	22-08-22		**TLM 1**	CO1	**R1**	
27	Evaporators-Classification-Expansion valve – Classification-working principle-, **Tutorial**	1	23-08-22		**TLM 1**	CO1	**R1**	
No. of classes required to complete UNIT-II = 13			No. of classes taken:					

UNIT-III VAPOUR ABSORPTION, STEAM JET & NON-CONVENTIONAL REFRIGERATION SYSTEM

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome Cos	Text Book followed	HOD Sign Weekly
28	Introduction to VAR system and its working principle,	1	24-08-22		**TLM 1**	CO1	**T2**	
29	Max. COP derivation for the VAR system and VAR problems	1	25-08-22		**TLM 1**	CO1	**T2**	
30	Description and working of NH_3-Water system, Refrigerant-Absorbent solution requirements	1	27-08-22		**TLM 1**	CO1	**T2**	
31	LiBr-Water (Two shell & Four shell) System, **Tutorial**	1	29-08-22		**TLM 1**	CO1	**T2**	
32	Principle of operation of Three fluid absorption systems, Salient features	1	30-08-22		**TLM 1**	CO1	**T2**	
33	**Steam Jet Refrigeration System:** Working Principle, Basic Analysis- Applications	1	01-09-22		**TLM 1**	CO1	**T2**	
34	. **Non-Conventional Refrigeration Systems:** Thermo electric refrigeration, Vortex tube refrigeration, Adiabatic Demagnetization refrigeration, **Tutorial**	1	03-09-22		**TLM 1**	CO1	**T2**	
	CRT Classes	**10**	**05-09-2022 to 17-09-2022**					

	I Mid Examinations	5	19-09-2022 to 24-09-2022
No. of classes required to complete UNIT-III = 07			No. of classes taken:

UNIT-IV PSYCHROMETRY & HUMAN COMFORT

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome Cos	Text Book followed	HOD Sign Weekly
35	**Psychrometry**: Introduction,	1	26-09-22		**TLM 1**	CO4	**T1**	
36	Psychometric properties and relations	1	27-09-22		**TLM 1**	CO4	**T1**	
37	Psychometric problems	1	28-09-22		**TLM 1**	CO4	**T1**	
38	Psychometric problems		29-09-22		**TLM 1**	CO4	**T1**	
39	Psychometric chart and its analysis,	1	01-10-22		**TLM 1**	CO4	**T1**	
40	Psychometric processes and its analysis	1	06-10-22		**TLM 1**	CO4	**T1**	
41	**Tutorial**	1	10-10-22		**TLM 1**	CO4	**T1**	
42	Psychometric processes and its analysis	1	11-10-22		**TLM 1**	CO4	**T1**	
43	Sensible, Latent and Total heat,	1	12-10-22		**TLM 1**	CO4	**T1**	
44	Sensible Heat Factor and Bypass Factor,	1	13-10-22		**TLM 1**	CO4	**T1**	
45	Solving Problems	1	15-10-22		**TLM 1**	CO4	**T1**	
46	**Human Comfort:** Thermodynamics of human body	1	17-10-22		**TLM 1**	CO4	**T1**	
47	Factors affecting the human comfort and its analysis.	1	18-10-22		**TLM 1**	CO4	**T1**	
48	Effective temperature –	1	19-10-22		**TLM 1**	CO4	**T1**	
49	Comfort chart	1	20-10-22		**TLM 1**	CO4	**T1**	
50	**Tutorial**	1	22-10-22		**TLM 1**	CO4	**T1**	
No. of classes required to complete UNIT-IV = 16			No. of classes taken:					

UNIT-V AIR CONDITIONING SYSTEMS AND DESIGN

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
51	**Introduction**: Air Conditioning Systems,	1	25-10-22		**TLM 1**	CO5	**T1**	
52	Components of Air conditioning	1	26-10-22		**TLM 1**	CO5	**T1**	
53	Classification of air conditioning system	1	27-10-22		**TLM 1**	CO5	**T1**	
54	Central and Unitary systems, Winter and Year-round systems	1	29-10-22		**TLM 1**	CO5	**T1**	
55	Cooling load estimation and its procedure	1	31-10-22		**TLM 1**	CO5	**T1**	
56	Cooling load components	1	01-11-22		**TLM 1**	CO5	**R1**	
57	Infiltration load, Design of Air Condition Systems,	1	02-11-22		**TLM 1**	CO5	**R1**	
58	Bypass factor-circulated air	1	03-11-22		**TLM 1**	CO5	**T1**	

	with ADP, System with Ventilated and re-circulation,							
59	RSHF, GSHF and ESHF, Solving cooling load Problems	1	05-11-22		**TLM 1**	CO5	**R1**	
60	Solving cooling load Problems	1	07-11-22		**TLM 1**	CO5	**R1**	
61	Solving cooling load Problems	1	08-11-22		**TLM 1**	CO5	**R1**	
62	Solving cooling load Problems	1	09-11-22		**TLM 1**	CO5	**R1**	
63	Solving cooling load Problems	1	10-11-22		**TLM 1**	CO5	**R1**	
64	Solving cooling load Problems	1	10-11-22		**TLM 1**	CO5	**R1**	
65	**Tutorial**	1	10-11-22		**TLM 1**	CO5	**R1**	
No. of classes required to complete UNIT-V = 15			No. of classes taken:					

Contents beyond the Syllabus

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
66	Air craft Refrigeration System and Cryogenics	**1**	16-11-22		**TLM2**	**CO1,CO 4**	**R3**	
67	Eco friendly refrigerants	**1**	17-11-22		**TLM2**	**CO4**	**R3**	
68	Advanced refrigeration methods	**1**	19-11-22		**TLM2**	**CO5**	**R3**	

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

ACADEMIC CALENDER:

Commencement of Class work		**11-07-2022**	
I Phase of Instructions	11-07-2022	03-09-2022	8 Weeks
CRT Classes	05-09-2022	17-09-2022	2 weeks
I Mid Examinations	19-09-2022	24-09-2022	1 Week
II Phase of Instructions	26-09-2022	19-11-2022	8 Weeks
II Mid Examinations	21-11-2022	26-11-2022	1 Week
Preparation and Practical's	28-11-2022	03-12-2022	1 Week
Semester End Examinations	05-12-2022	17-12-2022	2 Weeks

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
Dr.V.Dhana Raju	Dr.V.Dhana Raju	Dr. P.Vijay Kumar	Dr. S. Pichi Reddy

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
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L.B.Reddy Nagar, Mylavaram-521230, Krishna Dist, Andhra Pradesh, India

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART - A

PROGRAM	**: B.Tech. - VII-Sem.- MechanicalEngineering – B Section**
ACADEMIC YEAR	**:** 2022-23
COURSE NAME & CODE	**: ROBOTICS–17ME29**
L-T-P STRUCTURE	**:** 3-0-0
COURSE CREDITS	**:** 3
COURSE INSTRUCTOR	**: K.Venkateswara Reddy, Assistant Professor**
COURSE COORDINATOR	**: J.Subba Reddy, Associate Professor**
PER-REQUISITE	**:** Engineering Mechanics & Kinematics of Machines

COURSE EDUCATIONAL OBJECTIVES:

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

COURSE OUTCOMES:

After completion of the course student will be able to:

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

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

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

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

BOS APPROVED TEXT BOOKS:

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

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

BOS APPROVED REFERENCE BOOKS:

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

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

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

COURSE DELIVERY PLAN (LESSON PLAN): ROBOTICS (17ME29)

PART - B

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

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
1.	**Introduction to Robotics**	1	11-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
2.	CEOs, Course Outcomes, POs and PSOs	1	12-07-2022		**TLM2**	-	-	
3.	Basic concepts – Robot anatomy	1	13-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
4.	Components of robots, **Tutorial**	1	15-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
5.	Robot motions	1	16-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
6.	Number of D.O.F – Work volume	1	18-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
7.	Robot applications in Material transfer and machine loading / unloading applications	1	19-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
8.	Robot applications in Processing operations – Assembly and inspection – Future applications	1	20-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
9.	**Robot End Effectors –**Introduction, **Tutorial**	1	22-07-2022		**TLM3**	CO1	T1, T2, R1, R2	
10.	Types of end effectors – Mechanical grippers	1	23-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
11.	Vacuum cups, magnetic grippers, adhesive gripers and others	1	25-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
12.	Robot / End effectors interface	1	26-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
13.	Considerations in gripper selection and design	1	27-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
14.	Case Studies, Numericals, **Tutorial**	1	29-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
15.	Numericals	1	30-07-2022		**TLM3**	CO1	T1, T2, R1, R2	
No. of classes required to complete UNIT-I:		**15**			**No. of classes taken:**			

UNIT-II: ROBOT ACTUATORS AND SENSORS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
16.	Introduction to Actuators	1	01-08-2022		**TLM2**	CO2	T1,R1	
17.	Characteristics of Actuating System	1	02-08-2022		**TLM2**	CO2	T1,R1	
18.	Pneumatic Actuators	1	03-08-2022		**TLM2**	CO2	T1,R1	
19.	Hydraulic Actuators, **Tutorial**	1	05-08-2022		**TLM2**	CO2	T1,R1	
20.	Electric Motors	1	06-08-2022		**TLM2**	CO2	T1,R1	
21.	Introduction to Sensors	1	08-08-2022		**TLM3**	CO2	T1,R1	
22.	Sensor characteristics	1	10-08-2022		**TLM1**	CO2	T1,R1	
23.	Position sensors: Potentiometers, LVDT	1	12-08-2022		**TLM1**	CO2	T1,R1	
24.	Resolvers, Encoders, **Tutorial**	1	13-08-2022		**TLM1**	CO2	T1,R1	
25.	Magnetostrictive Displacement Transducers (MDT)	1	16-08-2022		**TLM1**	CO2	T1,R1	
26.	Velocity Sensors: Encoders	1	17-08-2022		**TLM1**	CO2	T1,R1	
27.	Tachometers	1	19-08-2022		**TLM1**	CO2	T1,R1	
28.	Industrial Applications, **Tutorial**	1	20-08-2022		**TLM2**	CO2	T1,R1	
29.	Case Studies	1	22-08-2022		**TLM2**	CO2	T1,R1	
No. of classes required to complete UNIT-II		**14**		**No. of classes taken:**				

UNIT-III: MANIPULATOR KINEMATICS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
30.	Introduction to Manipulator Kinematics , Coordinate Frames	1	23-08-2022		**TLM2**	CO3	T1,R1	
31.	Description of Objects in space	1	24-08-2022		**TLM2**	CO3	T1,R1	
32.	Transformation of vectors, **Tutorial**	1	26-08-2022		**TLM2**	CO3	T1,R1	
33.	Numericals	1	27-08-2022		**TLM1**	CO3	T1,R1	
34.	Inverting a Homogeneous Transform	1	29-08-2022		**TLM3**	CO3	T1,R1	
35.	Numericals	1	30-08-2022		**TLM2**	CO3	T1,R1	
36.	Fundamental Rotation Matrices, Numericals, **Tutorial**	1	02-09-2022		**TLM2**	CO3	T1,R1	
37.	D-H representation	1	03-09-2022		**TLM2**	CO3	T1,R1	
38.	**CRT Classes**	**10**	**05-09-2022 to 17-09-2022**					
39.	**I Mid Examinations**	**5**	**19-09-2022 to 24-09-2022**					
40.	Problems on Forward Kinematics	1	26-09-2022		**TLM2**	CO3	T1,R1	
41.	Numericals	1	27-09-2022		**TLM2**	CO3	T1,R1	
42.	Numericals	1	28-09-2022		**TLM2**	CO3	T1,R1	
43.	Numericals, **Tutorial**	1	30-09-2022		**TLM2**	CO3	T1,R1	
44.	Numericals	1	01-10-2022		**TLM2**	CO3	T1,R1	
No. of classes required to complete UNIT-III		**15**			**No. of classes taken:**			

UNIT-IV: ROBOT DYNAMICS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
45.	Introduction to Dynamics of Robots	1	04-10-2022		**TLM2**	CO4	T1,R1	
46.	Differential transformations	1	07-10-2022		**TLM2**	CO4	T1,R1	
47.	Numericals	1	08-10-2022		**TLM2**	CO4	T1,R1	
48.	Numericals, **Tutorial**	1	10-10-2022		**TLM2**	CO4	T1,R1	
49.	Numericals	1	11-10-2022		**TLM2**	CO4	T1,R1	
50.	Numericals	1	12-10-2022		**TLM2**	CO4	T1,R1	
51.	Jacobian Matrix	1	14-10-2022		**TLM2**	CO4	T1,R1	
52.	Numericals	1	15-10-2022		**TLM1**	CO4	T1,R1	
53.	Numericals, **Tutorial**	1	17-10-2022		**TLM2**	CO4	T1,R1	
54.	Numericals	1	18-10-2022		**TLM1**	CO4	T1,R1	
55.	Lagrange Euler formulation	1	19-10-2022		**TLM2**	CO4	T1,R1	
56.	Numericals	1	21-10-2022		**TLM2**	CO4	T1,R1	
57.	Numericals	1	22-10-2022		**TLM1**	CO4	T1,R1	
58.	Numericals, **Tutorial**	1	25-10-2022		**TLM2**	CO4	T1,R1	
59.	Numericals	1	26-10-2022		**TLM1**	CO4	T1,R1	
No. of classes required to complete UNIT-IV		**15**			**No. of classes taken:**			

UNIT-V: TRAJECTORY PLANNING

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
60.	Introduction to Trajectory Planning	1	28-10-2022		**TLM2**	CO5	T1,R1	
61.	Considerations on Trajectory Planning	1	29-10-2022		**TLM2**	CO5	T1,R1	
62.	Joint Interpolated Trajectory	1	31-10-2022		**TLM2**	CO5	T1,R1	
63.	Numericals	1	01-11-2022		**TLM2**	CO5	T1,R1	
64.	Numericals, **Tutorial**	1	02-11-2022		**TLM3**	CO5	T1,R1	
65.	Numericals	1	04-11-2022		**TLM2**	CO5	T1,R1	
66.	Numericals	1	05-11-2022		**TLM2**	CO5	T1,R1	
67.	Cartesian Path Trajectory	1	07-11-2022		**TLM2**	CO5	T1,R1	
68.	Numericals, **Tutorial**	1	08-11-2022		**TLM2**	CO5	T1,R1	
69.	Numericals	1	09-11-2022		**TLM2**	CO5	T1,R1	
70.	Numericals	1	11-11-2022		**TLM2**	CO5	T1,R1	
71.	Numericals, **Tutorial**	1	12-11-2022		**TLM2**	CO5	T1,R1	
72.	Numericals	1	14-11-2022		**TLM2**	CO5	T1,R1	
73.	**Robot Programming**	1	15-11-2022		**TLM2**	CO5	T1,R1	
74.	**Robot Programming**	1	16-11-2022		**TLM2**	CO5	T1,R1	
75.	**Robot Programming**	1	18-11-2022		**TLM2**	CO5	T1,R1	
76.	**Robot Programming, Tutorial**	1	19-11-2022		**TLM2**	CO5	T1,R1	
No. of classes required to complete UNIT-V		**15 + 04 (Beyond Syllabus)**			**No. of classes taken:**			
II Mid Examinations – 21-11-2022 to 26-11-2022								

TEACHING LEARNING METHODS:

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

ACADEMIC CALENDER:

Commencement of Class work		**11-07-2022**	
I Phase of Instructions	11-07-2022	03-09-2022	8 Weeks
CRT Classes	05-09-2022	17-09-2022	2 Weeks
I Mid Examinations	19-09-2022	24-09-2022	1 Week
II Phase of Instructions	26-09-2022	19-11-2022	8 Weeks
II Mid Examinations	21-11-2022	26-11-2022	1 Week
Preparation and Practicals	28-11-2022	03-12-2022	1 Week
Semester End Examinations	05-12-2022	17-12-2022	2 Weeks

PART – C

EVALUATION PROCESS:

Evaluation Task	**COs**	**Marks**
Assignment/Quiz – 1	1	A1=05
Assignment/Quiz – 2	2	A2=05
I-Mid Examination	1,2	B1=20
I-Online Mid Examination	1,2	C1=10
Assignment/Quiz – 3	3	A3=05
Assignment/Quiz – 4	4	A4=05
Assignment/Quiz – 5	5	A5=05
II-Mid Examination	3,4,5	B2=20
II-Online Mid Examination	3,4,5	C2=10
Evaluation of Assignment/Quiz Marks: A=(A1+A2+A3+A4+A5)/5	1,2,3,4,5	**A=05**
Evaluation of Mid Marks: B=75% of Max(B1,B2)+25% of Min(B1,B2)	1,2,3,4,5	**B=20**
Evaluation of Online Mid Marks: C=75% of Max(C1,C2)+25% of Min(	1,2,3,4,5	**C=10**
Attendance: D (≥95% =**5M**; 90%≤A<95%=**4M;** 85%≤A<90%=**3M;** 80%≤A<85%=**2M;** 75%≤A<80%=**1M; <75%=0M)**	-	**D=05**
Cumulative Internal Examination: A+B+C+D	**1,2,3,4,5**	**A+B+C+D=40**
Semester End Examinations: E	**1,2,3,4,5**	**E=60**
Total Marks: A+B+C+D+E	**1,2,3,4,5**	**100**

PART – D

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

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

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

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

PROGRAMME OUTCOMES (POs):

Engineering Graduates will be able to:

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

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

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

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

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

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

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

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

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

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

LAKKIREDDY 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

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

ACADEMIC YEAR : 2022-23

COURSE NAME & CODE : Metrology and Instrumentation (17ME30)

L-T-P STRUCTURE : 4-0-0

COURSE CREDITS : 3

COURSE INSTRUCTOR : **V.Sankararao**

COURSE COORDINATOR : **B.Sudheer Kumar**

PRE-REQUISITE: Modern Machining Processes

COURSE OBJECTIVE : The main objective of this course is to ascertain basic principles of measurements and calibrate the instruments.

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

CO:1	Apply different measuring techniques in quality control departments of industries and to ensure quality of products.
CO:2	Measure the dimensions using linear, angular and optical measuring instruments.
CO:3	Analyze measuring systems of surface roughness and perform alignment / acceptance test effectively.
CO:4	Design the instruments for the measurement of stress, strain, force, torque etc.
CO:5	Analyze measuring systems of Pressure, Fluid flow and Temperature.

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

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

BOS APPROVED TEXT BOOKS:

T1 D.S.Kumar, Mechanical Measurements and Controls, 4th Edition, Metropolitan Book Co-Private Ltd.

T2 R.K.Jain, Engineering Metrology, Khanna Publishers.3rd edition,2003

T3 BeckWith, Marangoni,Linehard, Mechanical Measurements, Person Education Asia.6th edition,2011.

BOS APPROVED REFERENCE BOOKS:

R1 A.K, Sawhneypuneet " A course in Mechanical Measurements and instrumentation control" DhanpatRai publications, 12thEdition, 2012

R2 J.P. Holman, Experimental Methods for Engineers, McGraw Hill.

R3 Ernest O. Doebelin, Measurement systems Application and Design, International Student Edition, 4thEdition, McGraw-Hill Book Company, 1998.

R4 M. Mahajan, A text book of Metrology, DhanpatRai& Co.

R5 I C Gupta, Engineering Metrology, DanpathRai

COURSE DELIVERY PLAN (LESSON PLAN): M&I

UNIT-I

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
1.	INTRODUCTION TO SUBJECT	1	13/07/2022		**TLM2**	CO1	-	
2.	COURSE OUTCOMES	1	14/07/2022		**TLM2**	CO1	-	
3.	**BASIC CONCEPTS** INTRODUCTION				**TLM2**	CO1	**T2**	
4.	FUNDAMENTAL MEASURING PROCESSES AND METHODS	1	15/07/2022		**TLM1**	CO1	**R4, T3**	
5.	GENERALISED MEASUREMENT SYSTEM AND ITS FUNCTIONAL ELEMENTS	1	16/07/2022		**TLM1**	CO1	**T3**	
6.	PERFORMANCE CHARACTERISTICS	2	20/07/2022		**TLM1**	CO1	**R4**	
7.	**ANALYSIS OF EXPERIMENTAL DATA:** CAUSES AND TYPES OF EXPERIMENTAL ERRORS	1	21/07/2022		**TLM1**	CO1	**T1**	
8.	TREATMENT OF EXPERIMENTAL DATA	1	22/07/2022		**TLM1**	CO1	**T1**	
9.	METHOD OF LEAST SQUARES	1	23/07/2022		**TLM1**	CO1	**T1**	
10.	GRAPHICAL ANALYSIS AND CURVE FITTING.	2	27/07/2022		**TLM1**	CO1	**T1**	
No. of classes required to completeUNIT-I		11			No. of classes taken:			

UNIT-II

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
11.	**LINEAR MEASUREMENT** STANDARDS OF MEASUREMENTS LINE AND END STANDARD.	1	28/07/2022		**TLM1**	CO2	**R5,T2**	
12.	BASIC PRINCIPLE AND APPLICATIONS OF SLIP GAUGES	1	29/07/2022		**TLM2**	CO2	**R5,T2**	
13.	DIAL INDICATOR AND MICROMETERS	1	30/07/2022		**TLM2**	CO2	**R5,T2**	
14.	**ANGULAR MEASUREMENTS** BEVEL PROTRACTOR – ANGLE SLIP GAUGES	1	03/08/2022		**TLM2**	CO2	**R5,T2**	
15.	SINE BAR, ROLLERS AND SPHERES USED TO DETERMINE THE TAPERS	2	04/08/2022		**TLM2**	CO2	**R5,T2**	
16.	APPLICATIONS OF ANGULAR MEASUREMENT	1	05/08/2022		**TLM2**	CO2	**R5,T2**	
17.	**OPTICAL MEASURING INSTRUMENTS** TOOL MAKER'S MICROSCOPE AND ITS USES	1	06/08/2022		**TLM2**	CO2	**R5,T2**	
18.	COLLIMATORS, OPTICAL PROJECTOR	1	10/08/2022		**TLM2**	CO2	**R5,T2**	
19.	OPTICAL FLATS AND THEIR USES	1	11/08/2022		**TLM2**	CO2	**R5,T2**	
20.	INTERFEROMETER, AND THOSE APPLICATIONS	1	12/08/2022		**TLM2**	CO2	**R5,T2**	

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

UNIT-III

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
21.	**SURFACE TEXTURE** FACTORS EFFECTING SURFACE ROUGHNESS	1	17/08/2022		**TLM2**	CO3	**R5,T2**	
22.	REASONS FOR CONTROLLING SURFACE TEXTURE	1	18/08/2022		**TLM2**	CO3	**R5,T2**	
23.	DIFFERENCES BETWEEN SURFACE ROUGHNESS AND SURFACE WAVINESS	1	20/08/2022		**TLM2**	CO3	**R5,T2**	
24.	ELEMENTS OF SURFACE TEXTURE NUMERICAL ASSESSMENT OF SURFACE FINISH – CLA, R, R.M.S VALUES – RA VALUES, AND RZ VALUES	1	24/08/2022		**TLM2**	CO3	**R5,T2**	
25.	BASIC PRINCIPLE OF PROFILE METER AND TOMLINSON SURFACE METER	1	25/08/2022		**TLM2**	CO3	**R5,T2**	
26.	ISI SYMBOLS FOR INDICATION OF SURFACE FINISH	1	26/08/2022		**TLM2**	CO3	**R5,T2**	
27.	APPLICATIONS SURFACE TEXTURE	1	27/08/2022		**TLM2**	CO3	**R5,T2**	
28.	**LIMITS AND FITS** INTRODUCTION, NORMAL SIZE, TOLERANCE LIMITS, DEVIATIONS, ALLOWANCE	2	01/09/2022		**TLM2**	CO3	**R5,T2**	
29.	FITS AND THEIR TYPES – UNILATERAL AND BILATERAL TOLERANCE SYSTEM	1	02/09/2022		**TLM2**	CO3	**R5,T2**	
30.	HOLE AND SHAFT BASIS SYSTEMS	1	03/09/2022		**TLM2**	CO3	**R5,T2**	
31.	INTERCHANGEABILITY AND SELECTIVE ASSEMBLY	1	28/09/2022		**TLM2**	CO3	**R5,T2**	
32.	INDIAN STANDARD INSTITUTION SYSTEM	1	29/09/2022		**TLM2**	CO3	**R5,T2**	
No. of classes required to complete UNIT-III		13			No. of classes taken:			

UNIT-IV

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
33.	**MEASUREMENT OF DISPLACEMENT** INTRODUCTION, CLASSIFICATION	1	30/09/2022		**TLM2**	CO4	**T1,T3**	
34.	DIMENSIONAL MEASUREMENT, GAUGE BLOCKS	1	01/10/2022		**TLM2**	CO4	**T1,T3**	
35.	**CRT CLASSES 05-09-2022 TO 17-09-2022**							
36.	**I MID EXAMINATION 19-09-2022 TO 24-09-2022**							
37.	OPTICAL METHODS, PNEUMATIC GAUGE	1	12/10/2022		**TLM2**	CO4	**T1,T3**	

38.	APPLICATIONS OF DISPLACEMENT MEASUREMENT	1			**TLM2**	CO4	**T1,T3**	
39.	**MEASUREMENT OF STRESS AND STRAIN** INTRODUCTION, STRAIN MEASUREMENTS ELECTRICAL RESISTANCE STRAIN GAUGE, GAUGE FACTOR	1	13/10/2022		**TLM2**	CO4	**T1,T3**	
40.	MEASUREMENT OF RESISTANCE STRAIN-GAGE OUTPUTS	1	14/10/2022		**TLM2**	CO4	**T1,T3**	
41.	TEMPERATURE COMPENSATION	1	15/10/2022		**TLM1**	CO4	**T1,T3**	
42.	STRAIN GAGE ROSETTES, APPLICATIONS OF STRAIN MEASUREMENT	1	19/10/2022		**TLM2**	CO4	**T1,T3**	
43.	**MEASUREMENT OF FORCE AND TORQUE** INTRODUCTION, ELASTIC TRANSDUCER	1	20/10/2022		**TLM2**	CO4	**T1,T3**	
44.	STRAIN GAGE LOAD CELLS	1	21/10/2022		**TLM2**	CO4	**T1,T3**	
45.	DYNAMOMETERS-MECHANICAL, HYDRAULIC, ELECTRICAL	1	22/10/2022		**TLM2**	CO4	**T1,T3**	
46.	APPLICATIONS OF FORCE AND TORQUE MEASUREMENT	1	26/10/2022		**TLM2**	CO4	**T1,T3**	
No. of classes required to complete UNIT-IV		12			No. of classes taken:			

UNIT-V

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
47.	**MEASUREMENT OF PRESSURE** INTRODUCTION, MANOMETERS	1	27/10/2022		**TLM2**	CO5	**T1,T3**	
48.	DIAL TYPE PRESSURE GAUGE, PRESSURE TRANSDUCERS	1	28/10/2022		**TLM2**	CO5	**T1,T3**	
49.	PITOT, STATIC, AND PITOT-STATIC TUBE AND ITS CHARACTERISTICS	1	29/10/2022		**TLM2**	CO5	**T1,T3**	
50.	LOW PRESSURE MEASUREMENT GAUGES APPLICATIONS OF PRESSURE MEASUREMENT	1	02/11/2022		**TLM2**	CO5	**T1,T3**	
51.	**MEASUREMENT OF FLUID FLOW** INTRODUCTION, ROTAMETER	1	03/11/2022		**TLM2**	CO5	**T1,T3**	
52.	TURBINE FLOW METER, LASER DOPPLER	1	04/11/2022		**TLM2**	CO5	**T1,T3**	
53.	ANEMOMETER, HOT-WIRE ANEMOMETER, APPLICATIONS OF FLUID FLOW MEASUREMENT	1	05/11/2022		**TLM2**	CO5	**T1,T3**	
54.	**MEASUREMENT OF TEMPERATURE** INTRODUCTION, TYPES OF THERMOMETERS	1	09/11/2022		**TLM2**	CO5	**T1,T3**	
55.	THERMOCOUPLES, RTD	1	10/11/2022		**TLM2**	CO5	**T1,T3**	

56.	THERMISTERS, PYROMETERS. TEMPERATURE MEASUREMENT	1	11/11/2022		**TLM2**	CO5	**T1,T3**	
57.	TEMPERATURE MEASUREMENT	1	12/11/2022		**TLM2**	CO5	**T1,T3**	
No. of classes required to complete UNIT-V		11			No. of classes taken:			

CONTENTS BEYOND THE SYLLABUS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
58.	INTRODUCTION TO GEAR MEASUREMENTS	1	16/11/2022		**TLM2**	CO2	**T1,T3**	
59.	INTRODUCTION TO COMPARATORS	1	17/11/2022		**TLM2**	CO2	**T1,T3**	
60.	MEASUREMENT OF SPEED	1	18/11/2022		**TLM2**	CO4	**T1,T3**	

TEACHING LEARNING METHODS:

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

EVALUATION PROCESS:

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

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

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

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

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

PROGRAMME OUTCOMES (POs):

Engineering Graduates will be able to:

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

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

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

Course Instructor	**Course Coordinator**	**Module Coordinator**	**HOD**
V.Sankararao	**B.Sudheer Kumar**	**J.Subba Reddy**	**Dr.S.Pichi 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 Dhanunay Kumar
Course Name & Code : CIM & 17ME92
L-T-P Structure : 3-0-0 Credits : 3
Program/Sem/Sec : B.Tech., MECH., VII-Sem., Section- B A.Y : 2022-23

PRE-REQUISITE: CAD/CAM

COURSE EDUCATIONAL OBJECTIVES (CEOs): The main objective of this course is to control the entire production process using computers. This integration allows individual processes to exchange information with each other and initiate actions.

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

CO 1	Understand the basics of production and derive production metrics.
CO 2	Prepare CNC programs for manufacturing of different geometries on milling and lathe Machines.
CO 3	Apply group technology concepts for parts classification.
CO 4	Select layouts of FMS for industrial applications.
CO 5	Develop a CAPP system for rotational and prismatic parts.

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 1. Mikell P Groover, Automation, production Systems and Computer Integrated Manufacturing, 3rd Edition, Prentice Hall Inc., New Delhi, 2007.
T2 2. P. Radhakrishnan, "Computer Numerical Control ", New Central Book Agency, 1992.

REFERENCE BOOKS:

R1 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: Introduction

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Production Systems	1	12.07.2022			
2.	production facilities	1	14.07.2022			
3.	Manufacturing operations	1	15.07.2022			
4.	manufacturing models and metrics	1	16.07.2022			
5.	Examples of Manufacturing problems	1	19.07.2022			
6.	CIM Definition	1	20.07.2022			
7.	CIM components	1	22.07.2022			
8.	Evolution of CIM, needs of CIM	1	23.07.2022			
9.	Benefits of CIM	1	26.07.2022			
10.	Overview of CIM software and Hardware	1	28.07.2022			
No. of classes required to complete UNIT-I:10				No. of classes taken:		

UNIT-II: 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
1.	Basic components of NC system	1	29.07.2022			
2.	NC motion control system	1	30.07.2022			
3.	Applications of NC, advantages and disadvantages of NC	1	02.08.2022			
4.	computer Numerical control	1	03.08.2022			
5.	functions and advantages of CNC	1	05.08.2022			
6.	Direct Numerical Control, components of a DNC system	1	06.08.2022			
7.	Functions and advantages of DNC	1	09.08.2022			
8.	NC part programming.	1	10.08.2022			
9.	NC part programming turn	1	12.08.2022			
10.	NC part programming mill		16.08.2022			
No. of classes required to complete UNIT-II:10				No. of classes taken:		

UNIT-III: CELLULAR MANUFACTURING SYSTEMS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Part Families, Parts Classification and Coding	1	27-09-2022			
2.	Features of Parts Classification and Coding Systems	1	30.09.2022			
3.	Opitz of Parts Classification and Coding Systems	1	01.10.2022			
4.	Production Flow Analysis	1	07.10.2022			
5.	Composite Part Concept,	1	08.10.2022			
6.	Machine Cell Design					
7.	Applications Of Group Technology	1	12.10.2022			
8.	Quantitative analysis of cellular manufacturing	1	14.10.2022			
9.	Rank Order Clustering Method, Arranging Machines in a GT cell	2	15.10.2022			
10.	HollierMethod, Simple Problems		18.10.2022			
No. of classes required to complete UNIT-III:09				No. of classes taken:		

UNIT-IV :FLEXIBLE MANUFACTURING SYSTEMS (FMS)

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.	Flexibility	1	19.10.2022			
2.	Types of FMS	1	21.10.2022			
3.	FMS Components	1	22.10.2022			
4.	FMS Application & Benefits	1	25.10.2022			
5.	FMS Planning and implementation issues	1	26.10.2022			
6.	Quantitative analysis of FMS	1	28.10.2022			
7.	Simple Problems.	1	29.10.2022			
8.	FMS software	1	01.11.2022			
9.	FMS hardware	1	02.11.2022			
10.	Implementation issues FMS	1	04.11.2022			
No. of classes required to complete UNIT-IV:10				No. of classes taken:		

UNIT-V :PROCESS PLANNING AND CONCURRENT ENGINEERING

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.	Process planning for parts	1	05.11.2022			
2.	Process planning for assemblies	1	08.11.2022			
3.	Make or buy decisions	1	09.11.2022			
4.	Computer aided process planning	1	11.11.2022			
5.	Retrieval and generative CAPP systems	1	12.11.2022			
6.	Concurrent engineering	1	15.11.2022			
7.	design for manufacturing	1	16.11.2022			
8.	Advanced manufacturing planning	1	18.11.2022			
9.	lean production and JIT & production systems	1	19.11.2022			
10.	Lean principles					
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	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 Dhanunay Kumar	A NAGESWARA RAO	J SUBBAREDDY	Dr S PICHI REDDY

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DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART - A

PROGRAM	**: B.Tech. - VII-Sem.- MechanicalEngineering – B,C Sections**
ACADEMIC YEAR	**:** 2022-23
COURSE NAME & CODE	**: Total Quality management & 17ME36**
L-T-P STRUCTURE	**:** 3-0-0
COURSE CREDITS	**:** 3
COURSE INSTRUCTOR	**: Narayana Karagani, Assistant Professor**
COURSE COORDINATOR	**: Seelam Srinivasa Reddy, Associate Professor**
PER-REQUISITE	**:Industrial Management**

COURSE EDUCATIONAL OBJECTIVES: The main objective of this course is to familiarize the concepts of quality management techniques in industries

COURSE OUTCOMES:

After completion of the course student will be able to:

CO1: Comprehend the principles and strategies of quality control

CO2: Apply the principles of total quality management in an industry.

CO3: Analyze statistical quality control tools towards improving the quality.

CO4: Adopt the principles of Taguchi techniques for industrial needs.

CO5: Implement ISO quality standards in an organization.

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

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

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

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

BOS-APPROVED TEXTBOOKS:

T : Dale H. Besterfiled., Total Quality Management, Pearson Education, 3rd Edition 2010

BOS APPROVED REFERENCE BOOKS:

R1. James R. Evans & William M. Lidsay, The Management and Control of Quality, South-Western (Thomson Learning), 2002.

R2. Feigenbaum.A.V, Total Quality Management, MCGraw-Hill, 2005.

R3. Narayana V. and Sreenivasan, N.S, Quality Management- Concepts and Tasks, New Age International, 2006.

R4. Zeiri, Total Quality Management for Engineers, Wood Head Publishers, 2009.

COURSE DELIVERY PLAN (LESSON PLAN): ROBOTICS (17ME29)

PART - B

UNIT-I: INTRODUCTION TO TQM

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Textbook followed	HOD Sign Weekly
1.	**Introduction to TQM**	1	11-07-2022		TLM1	CO'1	T&R1	
2.	CEOs, Course Outcomes, POs and PSOs	1	13-07-2022		TLM1	CO'1	T&R1	
3.	INTRODUCTION: Evolution of total quality management	1	14-07-2022		TLM1	CO'1	T&R1	
4.	Definition of Quality	1	15-07-2022		TLM1	CO'1	T&R1	
5.	Quality costs,	1	18-07-2022		TLM2	CO'1	T&R1	
6.	Quality Council	1	20-07-2022		TLM2	CO'1	T&R1	
7.	Strategic Planning	1	21-07-2022		TLM2	CO'1	T&R1	
8.	Deming Philosophy	1	22-07-2022		TLM2	CO'1	T&R1	
9.	Barriers to TQM Implementation	1	25-07-2022		TLM2	CO'1	T&R1	
10.	Barriers to TQM Implementation	1	27-07-2022		TLM2	CO'1	T&R1	
11.	Revision	1	28-07-2022		TLM2	CO'1	T&R1	
12.	Quiz-1	1	29-07-2022		TLM6	CO'1	T&R1	
No. of classes required to complete UNIT-I:		**12**			**No. of classes taken:**			

UNIT-II: TQM PRINCIPLES

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Textbook followed	HOD Sign Weekly

13.	TQM Principles: Customer satisfaction.	1	01-08-2022		TLM1	CO2	T&R1	
14.	Types of Customers, customer supply chain	1	03-08-2022		TLM1	CO2	T&R1	
15.	Customer perception of quality, customer feedback.	1	04-08-2022		TLM2	CO2	T&R1	
16.	customer retention, Service quality.	1	05-08-2022		TLM2	CO2	T&R1	
17.	Employee Involvement, Motivation.	1	08-08-2022		TLM2	CO2	T&R1	
18.	Maslow ‘s hierarchy of needs, Herzberg theory,	1	10-08-2022		TLM2	CO2	T&R1	
19.	Empowerment and Teamwork, Performance appraisal, Benefits,	1	12-08-2022		TLM2	CO2	T&R1	
20.	Continuous process improvement- Juran Trilogy.	1	17-08-2022		TLM2	CO2	T&R1	
21.	PDSA cycle,	1	18-08-2022		TLM2	CO2	T&R1	
22.	5S, Kaizen, Supplier	1	22-08-2022		TLM2	CO2	T&R1	
23.	Partnership- Partnering, sourcing,	1	24-08-2022		TLM2	CO2	T&R1	
24.	supplier selection,	1	25-08-2022		TLM2	CO2	T&R1	
25.	Performance Measures-Basic Concepts,	1	26-08-2022		TLM2	CO2	T&R1	
26.	Strategy, Performance Measure	1	29-08-2022		TLM2	CO2	T&R1	
27.	Revision	1	01-09-2022		TLM2	CO2	T&R1	
28.	Quiz	1	02-09-2022		TLM6	CO2	T&R1	
No. of classes required to complete UNIT-II		**16**		**No. of classes taken:**				

UNIT-III: STATISTICAL PROCESS CONTROL

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
29.	STATISTICAL PROCESS CONTROL: The seven tools of quality,	1	26-09-2022		TLM1	CO3	T&R1	
30.	Statistical Fundamentals,	1	28-09-2022		TLM2	CO3	T&R1	
31.	Population and Sample,	1	29-09-2022		TLM2	CO3	T&R1	
32.	Normal curve,	1	30-09-2022		TLM2	CO3	T&R1	
33.	Control charts for variables and attributes,	1	06-10-2022		TLM2	CO3	T&R1	
34.	Process capability,	1	07-10-2022		TLM2	CO3	T&R1	
35.	Concepts of six sigma,	1	10-10-2022		TLM2	CO3	T&R1	
36.	New seven Management tools.	1	12-10-2022		TLM2	CO3	T&R1	
37.	Problems	1	13-10-2022		TLM3	CO3	T&R1	
38.	Revision & Quiz	1	14-10-2022		TLM2&6	CO3	T&R1	
No. of classes required to complete UNIT-III		**10**			**No. of classes taken:**			

UNIT-IV: TQM TOOLS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
39.	TQM TOOLS: Benchmarking,	1	17-10-2022		TLM1	CO4	T&R1	
40.	Benchmarking Process,	1	19-10-2022		TLM2	CO4	T&R1	
41.	Quality Function Deployment (QFD),	1	20-10-2022		TLM2	CO4	T&R1	
42.	House of Quality, QFD Process	1	21-10-2022		TLM2	CO4	T&R1	
43.	Taguchi Quality Loss Function,	1	24-10-2022		TLM2	CO4	T&R1	
44.	Total Productive Maintenance Concept,	1	26-10-2022		TLM2	CO4	T&R1	
45.	improvement needs,.	1	27-10-2022		TLM2	CO4	T&R1	
46.	FMEA- Stages of FMEA	1	28-10-2022		TLM2	CO4	T&R1	
47.	Revision	1	31-10-2022		TLM2	CO4	T&R1	
48.	Quiz	1	02-11-2022		TLM6	CO4	T&R1	
No. of classes required to complete UNIT-IV		**10**			**No. of classes taken:**			

UNIT-V: QUALITY SYSTEMS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
49.	QUALITY SYSTEMS: Need for ISO 9000 and other Quality systems,	1	03-11-2022		TLM1	CO5	T&R1	
50.								
51.	ISO 9000:2000 Quality System,	1	04-11-2022		TLM2	CO5	T&R1	
52.	Implementation of Quality system,	1	07-11-2022		TLM2	CO5	T&R1	
53.	Documentation,	1	09-11-2022		TLM2	CO5	T&R1	
54.	Quality Auditing,	1	10-11-2022		TLM2	CO5	T&R1	
55.	TS 16949, ISO 14000- concepts.	1	11-11-2022		TLM2	CO5	T&R1	
56.	Revision & Quiz	1	14-11-2022		TLM2	CO5	T&R1	
57.		1	16-11-2022		TLM2&6	CO5	T&R1	
58.		1	17-11-2022					
59.		1	18-11-2022					
No. of classes required to complete UNIT-V		**07 + 03 (Beyond Syllabus)**						
II Mid Examinations – 21-11-2022 to 26-11-2022								

TEACHING LEARNING METHODS:

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

ACADEMIC CALENDER:

Commencement of Class work		**11-07-2022**	
I Phase of Instructions	11-07-2022	03-09-2022	8 Weeks
CRT Classes	05-09-2022	17-09-2022	2 Weeks
I Mid Examinations	19-09-2022	24-09-2022	1 Week
II Phase of Instructions	26-09-2022	19-11-2022	8 Weeks
II Mid Examinations	21-11-2022	26-11-2022	1 Week
Preparation and Practicals	28-11-2022	03-12-2022	1 Week
Semester End Examinations	05-12-2022	17-12-2022	2 Weeks

PART – C

EVALUATION PROCESS:

Evaluation Task	**COs**	**Marks**
Assignment/Quiz – 1	1	A1=05
Assignment/Quiz – 2	2	A2=05
I-Mid Examination	1,2	B1=20
I-Online Mid Examination	1,2	C1=10
Assignment/Quiz – 3	3	A3=05
Assignment/Quiz – 4	4	A4=05
Assignment/Quiz – 5	5	A5=05
II-Mid Examination	3,4,5	B2=20
II-Online Mid Examination	3,4,5	C2=10
Evaluation of Assignment/Quiz Marks: A=(A1+A2+A3+A4+A5)/5	1,2,3,4,5	**A=05**
Evaluation of Mid Marks: B=75% of Max(B1,B2)+25% of Min(B1,B2	1,2,3,4,5	**B=20**
Evaluation of Online Mid Marks: C=75% of Max(C1,C2)+25% of Min(C1,C2)	1,2,3,4,5	**C=10**
Attendance: D (≥95% =**5M**; 90%≤A<95%=**4M;** 85%≤A<90%=**3M;** 80%≤A<85%=**2M;** 75%≤A<80%=**1M; <75%=0M)**	-	**D=05**
Cumulative Internal Examination: A+B+C+D	**1,2,3,4,5**	**A+B+C+D=40**
Semester End Examinations: E	**1,2,3,4,5**	**E=60**
Total Marks: A+B+C+D+E	**1,2,3,4,5**	**100**

PART – D

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

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

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

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

PROGRAMME OUTCOMES (POs):

Engineering Graduates will be able to:

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

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

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

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

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DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : KAMALA PRIYA B

Course Name & Code : POWER PLANT ENGINEERING

L-T-P Structure : 4-0-0 Credits : 3

Program/Sem/Sec : B.Tech., MECH., VII-Sem., A, B & C A.Y : 2022-23

PRE-REQUISITE: Thermodynamics, Thermal Engineering.

COURSE EDUCATIONAL OBJECTIVES (CEOs): To study the various power plant potentials and its working principles.

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

CO 1	Understand the basics of various energy sources and various circuits in steam power plant(Understanding level).
CO 2	Comprehend Diesel and Gas Turbine power generating plants (Remembering level).
CO 3	Analyze salient features of Hydroelectric and Nuclear power plants and interpret the data (Analysis level).
CO 4	Differentiates direct and indirect energy conversion systems (Understanding level).
CO5	Evaluate economics of power generation and pollution issues related to power plants (Apply level).

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

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	-	-	-	-	-	-	-	1	1	-	-
CO2	3	1	2	2	-	1	2	-	-	-	-	1	2	-	2
CO3	2	3	-	3	-	1	2	-	-	-	-	1	2	-	2
CO4	2	3	1	2	-	-	1	-	-	-	-	1	2	-	1
CO5	3	2	2	3	-	-	3	-	-	-	-	1	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 Arora &Domkundwar, A course in Power Plant Engineering- Dhanpat Rai & Company 5th Revised Reprint Edition, 2004.

T2 P.K.Nag, Power Plant Engineering,3rd Edition ,2008 TMH, New Delhi,

REFERENCE BOOKS:

R1 R.K.Rajput, A Text book of Power Plant Engineering, Laxmi Publications ,2nd Edition 2001

R2 M.M.ElWakil, Power plant technology, 3rd Edition 2010 TMH.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: STEAM POWER PLANT

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.	Course Outcomes	1	11-07-2022		TLM1	
2.	Introduction to Subject	1	13-07-2022		TLM1	
3.	Energy sources, Resources and Development of Power in India.	1	14-07-2022		TLM1	
4.	Steam power plant: Plant Layout, Working of Different circuits, factors to be considered for the selection of the plant	1	15-07-2022		TLM2	
5.	Types of Coal-Fuel handling systems-	1	18-07-2022		TLM1	

6.	Coal handling, choice of coal handling equipment, Coal Storage	2	20-07-2022		TLM1, TLM2	
7.	Ash handling systems	2	21-07-2022		TLM2	
8.	Overfeed and underfeed stokers	1	22-07-2022		TLM1, TLM2	
9.	Traveling grate stokers, Spreader stokers, Retort stokers	1	25-07-2022		TLM1, TLM2	
10.	Pulverized fuel burning system and, its components	2	27-07-2022		TLM2	
11.	Draught system, Cyclone furnace	1	28-07-2022		TLM1	
12.	Design and construction, Dust collectors,	1	29-07-2022		TLM1	
13.	Dust collectors, Electrostatic precipitator	1	01-08-2022		TLM2	
14.	Cooling towers and heat rejection	2	03-08-2022		TLM1, TLM2	
15.	TUTORIAL-1	1	04-08-2022		TLM3	
No. of classes required to complete UNIT-I: 15				No. of classes taken:		

UNIT-II: DIESEL POWER PLANT AND GAS TURBINE PLANT

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.	Plant layout with auxiliaries-Fuel storage	1	05-08-2022		TLM2	

2.	Fuel supply system-Air supply system-Exhaust system	1	08-08-2022		TLM2	
3.	Water cooling system-Lubrication system	1	10-08-2022		TLM2	
4.	Starting system-Supercharging	1	11-08-2022		TLM1	
5.	Advantages and Disadvantages of Diesel plants over Thermal plants	1	12-08-2022		TLM1	
6.	TUTORIAL-2	1	17-08-2022		TLM3	
7.	Introduction-Classification-Layout with auxiliaries	1	18-08-2022		TLM2	
8.	Principles of working of Closed and Open cycle gas turbines	1	22-08-2022		TLM1	
9.	Combined cycle power plants and comparison	1	24-08-2022		TLM1, TLM2	
10.	TUTORIAL-3	1	24-08-2022		TLM3	
No. of classes required to complete UNIT-II: 10				No. of classes taken:		

UNIT-III: HYDRO ELECTRIC POWER PLANT AND NUCLEAR POWER PLANT

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.	Hydrology-Hydrological cycle	1	25-08-2022		TLM1	
2.	Rainfall- Run off Hydrograph	1	26-08-2022		TLM1	
3.	Flow duration curve-	1	29-08-2022		TLM2	

	Mass curve					
4.	Site selection of hydro plant- Typical layout	1	01-09-2022		TLM1	
5.	Different types of hydro plants	2	02-09-2022		TLM2	
6.	TUTORIAL-4	1	26-09-2022		TLM3	
7.	Nuclear Fission and Fusion - Nuclear Fuels-	1	28-09-2022		TLM1	
8.	Breeding- Components of Reactor	1	29-09-2022		TLM1	
9.	Types of Nuclear Reactors- Pressurized water reactor(PWR)-	1	30-09-2022		TLM1	
10.	Boiling water reactor (BWR)	1	10-10-2022		TLM1	
11.	CANDU reactor-Gas cooled reactor	1	12-10-2022		TLM1	
12.	Liquid metal cooled reactor-Fast Breeder Reactor	1	13-10-2022		TLM1	
13.	Nuclear waste and its Disposal	1	14-10-2022		TLM1	
14.	TUTORIAL-5	1	17-10-2022		TLM3	
No. of classes required to complete UNIT-III: 14				No. of classes taken:		

UNIT-IV : POWER FROM NON-CONVENTIONAL SOURCES AND DIRECT ENERGY CONVERSION SYSTEMS

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

1.	Solar power plants- Utilization of Solar collectors.	1	19-10-2022		TLM1	
2.	Different types of solar collectors.	2	20-10-2022		TLM1, TLM2	
3.	Principle of working of Wind energy-Types	1	21-10-2022		TLM1	
4.	Tidal Energy	1	26-10-2022		TLM2	
5.	TUTORIAL-6	1	27-10-2022		TLM3	
6.	Solar cell- Fuel cell	1	28-10-2022		TLM1	
7.	Thermo Electric and Thermo ionic conversion system	1	31-10-2022		TLM1	
8.	MHD power generation	2	02-11-2022		TLM2	
9.	TUTORIAL-7	1	03-11-2022		TLM3	
No. of classes required to complete UNIT-IV:09				No. of classes taken:		

UNIT-V : POWER PLANT ECONOMICS AND POLLUTION & 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
1.	Fixed cost-Operating cost.- Fluctuating loads	1	04-11-2022		TLM1	
2.	General arrangement of Power Distribution- Load curves	1	07-11-2022		TLM1	
3.	Load duration curve and its problems	2	09-11-2022		TLM1	
4.	Various load factors in power plants	1	10-11-2022		TLM1	

5.	TUTORIAL-8	1	11-11-2022		TLM3	
6.	Particulate and gaseous pollutants	1	14-11-2022		TLM1	
7.	Air and Water pollution by Thermal plants	1	16-11-2022		TLM1	
8.	Acid rains -Methods to control pollution	1	17-11-2022		TLM1	
9.	Numerical Problems on economics of power generation	3	18-11-2022		TLM1	
10.	TUTORIAL-9	1	18-11-2022		TLM3	
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

ACADEMIC CALENDAR:

Description	**From**	**To**	**Weeks**
Commencement of Class Work: 11-07-2022			
I Phase of Instructions	11.07.2022	17.09.2022	7W
I Mid Examinations	19.09.2022	24.09.2022	1W
II Phase of Instructions	25.09.2022	19.11.2022	9W
II Mid Examinations	21.11.2022	26.11.2022	1W
Preparation and Practicals	28.11.2022	03.12.2022	1W
Semester End Examinations	05.12.2022	17.12.2022	2W

PART-C

EVALUATION PROCESS (R17 Regulations):

Evaluation Task	COs	Marks
Assignment/Quiz – 1	1	A1=05
Assignment/Quiz – 2	2	A2=05
I-Mid Examination	1,2	B1=20
I-Online Mid Examination	1,2	C1=10
Assignment/Quiz – 3	3	A3=05
Assignment/Quiz – 4	4	A4=05
Assignment/Quiz – 5	5	A5=05
II-Mid Examination	3,4,5	B2=20
II-Online Mid Examination	3,4,5	C2=10
Evaluation of Assignment/Quiz Marks: A=(A1+A2+A3+A4+A5)/5	1,2,3,4,5	**A=05**
Evaluation of Mid Marks: B=75% of Max(B1,B2)+25% of Min(B1	1,2,3,4,5	**B=20**
Evaluation of Online Mid Marks: C=75% of Max(C1,C2)+25% of Min(C1,C2)	1,2,3,4,5	**C=10**
Attendance: D (≥95% =**5M**; 90%≤A<95%=**4M;** 85%≤A<90%=**3M** 80%≤A<85%=**2M;** 75%≤A<80%=**1M; <75%=0M)**	-	**D=05**
Cumulative Internal Examination: A+B+C+D	**1,2,3,4,5**	**A+B+C+D=40**
Semester End Examinations: E	**1,2,3,4,5**	**E=60**
Total Marks: A+B+C+D+E	**1,2,3,4,5**	**100**

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
Kamala Priya B	Kamala Priya B	Dr. P.Vijay Kumar	Dr. S. Pichi Reddy

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Mrs.T.Nagadurga
Course Name & Code : Utilization of Electrical Energy & 17EE81
L-T-P Structure : 4-0-0 Credits : 3
Program/Sem/Sec : B.Tech., ME., VII-Sem., Sections- A&B A.Y:2022-23

PRE-REQUISITES: -

COURSE EDUCATIONAL OBJECTIVES (CEOs): This course enables the student to familiarize with characteristics of various drives, comprehend the different issues related to heating, welding and illumination.

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

CO 1	Choose a drive for particular application
CO 2	Identify a heating /welding scheme for a given application
CO 3	Illustrate the different schemes of traction and its main components
CO 4	Develop a lighting scheme for a given practical case
CO5	Assess the economic aspects in utilization of electrical energy

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

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	-	2	-	-	-	-	-	-	1	-	-	-	
CO2	3	2	1	2	-	-	-	-	-	-	-	1	-	-	-	
CO3	3	1	3	-	3	-	-	-	-	-	-	2	-	-	-	
CO4	3	2	2	2	-	-	-	-	-	-	-	1	-	-	-	
CO5	2		1		-	-		-				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).

TEXT BOOKS:

T1 C.L.Wadhwa "Generation,Distribution and Utilization of Electrical energy, New Age International Publishers,3rd Edition,2015.

T2 N.V.Suryanarayana "Utilization of electric power including electric drives and electric traction,New age international publishers New Delhi,2nd edition 2014.

REFERENCE BOOKS:

R1 Art & Science of Utilization of electrical Energy, Partab, Dhanpat Rai & Co., 2004.

R2 Utilization of Electric Energy, E. Openshaw Taylor and V. V. L. Rao, Universities Press, 2009.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: ELECTRIC HEATING AND WELDING:

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, CEO's &CO's	1	11/7/22		TLM1/TLM2	
2.	Advantages & applications of Electric heating	1	13/7/22		TLM1/TLM2	
3.	Classification of electric heating	1	14/7/22		TLM1/TLM2	
4.	Classification of electric heating	1	15/7/22		TLM1/TLM2	
5.	Requirement of good heating material	1	18/7/22		TLM1/TLM2	
6.	Electric Arc Furnace	1	20/7/22		TLM1/TLM2	
7.	Induction heating	1	21/7/22		TLM1/TLM2	
8.	Dielectric heating	1	22/7/22		TLM1/TLM2	
9.	Electric welding	1	25/7/22		TLM1/TLM2	
10.	Resistance welding	1	27/7/22		TLM1/TLM2	
11.	Arc welding	1	28/7/22		TLM1/TLM2	
No. of classes required to complete UNIT-I:11				No. of classes taken:		

UNIT-II: ILLUMINATION ENGINEERING:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction	1	29/7/22		TLM1/TLM2	
2.	Nature of light &Laws of illumination	1	1/8/22		TLM1/TLM2	
3.	Lighting schemes, sources of light	1	3/8/22		TLM1/TLM2	
4.	Fluorescent Lamps	1	4/8/22		TLM1/TLM2	
5.	Compact Fluorescent Lamps	1	5/8/22		TLM1/TLM2	
6.	LED Lamps discharge lamps	1	8/8/22		TLM1/TLM2	
7.	Sodium Vapour Lamp	1	10/8/22		TLM1/TLM2	
8.	mercury vapour lamps	1	11/8/22		TLM1/TLM2	
9.	Neon lamps	1	12/8/22		TLM1/TLM2	
10.	Comparison between tungsten &fluorescent tubes	1	17/8/22		TLM1/TLM2	
11.	Requirements of good lighting	1	18/8/22		TLM1/TLM2	

12.	Street lighting	1	19/8/22		TLM1/TLM2	
13.	Mid-I Exams	1	20/9/22			
14.	Mid-I Exams	1	21/9/22			
15.	Mid-I Exams	1	23/9/22			
16.	Mid-I Exams	1	24/9/22			
No. of classes required to complete UNIT-II: 12				No. of classes taken:		

UNIT-III: ELECTRIC DRIVES

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction	1	22/8/22		TLM1/TLM2	
2.	Factors affecting selection of motor	1	24/8/22		TLM1/TLM2	
3.	Types of loads	1	25/8/22		TLM1/TLM2	
4.	Elements of electric drive	1	26/8/22		TLM1/TLM2	
5.	Steady state characteristics of drives	1	29/8/22		TLM1/TLM2	
6.	Transient characteristics of drives	1	31/8/22		TLM1/TLM2	
7.	Size of motor	1	1/9/22		TLM1/TLM2	
8.	Load equalization	1	2/9/22		TLM1/TLM2	
9.	Industrial applications	1	26/9/22		TLM1/TLM2	
No. of classes required to complete UNIT-III:10				No. of classes taken:		

UNIT-IV: ELECTRIC TRACTION

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction	1	28/9/22		TLM1/TLM2	
2.	Requirement of an ideal traction system	1	3/10/22		TLM1/TLM2	
3.	Supply system for electric traction	1	7/10/22		TLM1/TLM2	
4.	Supply system for electric traction	1	13/10/22		TLM1/TLM2	
5.	Train movement	1	17/10/22		TLM1/TLM2	
6.	Mechanism of train movement	1	19/10/22		TLM1/TLM2	
7.	Traction motors	1	20/10/22		TLM1/TLM2	
8.	Modern trends in electric traction	1	21/10/22		TLM1/TLM2	
9.	Automation in electric traction	1	24/10/22		TLM1/TLM2	
10.	problems	1	26/10/22		TLM1/TLM2	
No. of classes required to complete UNIT-IV:10				No. of classes taken:		

UNIT-V: REFRIGERATION AND AIRCONDITIONING

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

1.	Introduction	1	27/10/22		TLM1/TLM2	
2.	Types of refrigeration	1	28/10/22		TLM1/TLM2	
3.	Compression refrigeration	1	1/11/22		TLM1/TLM2	
4.	Basic vapour compression cycle	1	3/11/22		TLM1/TLM2	
5.	Absorption refrigeration system	1	4/11/22		TLM1/TLM2	
6.	Operational features	1	7/11/22		TLM1/TLM2	
7.	household refrigerator	1	9/11/22		TLM1/TLM2	
8.	Air-conditioning	1	10/11/22		TLM1/TLM2	
9.	Types of air conditioning system	1	11/11/22		TLM1/TLM2	
10.	Room air conditioner	1	14/11/22		TLM1/TLM2	
11.	Summer & winter air conditioning systems	1	16/11/22		TLM1/TLM2	
12.	Cooling capacity of an air conditioner	1	17/11/22		TLM1/TLM2	
13.	Working of electrical system	1	18/11/22		TLM1/TLM2	
14.	Revision	1	18-11-2022		TLM1/TLM2	
15.	Mid-II Exams	1	22-11-2022			
16.	Mid-II Exams	1	23-11-2022			
17.	Mid-II Exams	1	25-11-2022			
18.	Mid-II Exams	1	26-11-2022			
No. of classes required to complete UNIT-V:				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
1.	Economic aspects in utilization of electrical energy	1	28-09-2022		TLM1/TLM2	

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

PART-C (EVALUATION PROCESS (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

ACADEMIC CALENDAR:

Description	From	To	Weeks
I Phase of Instructions-1	11-07-2022	03-09-2022	8W
CRT classes	05-09-2022	17-09-2022	2W
I Mid Examinations	19-09-2022	24-09-2022	1W
II Phase of Instructions	26-09-2022	19-11-2022	8W
II Mid Examinations	21-11-2022	26-11-2022	1W
Preparation and Practicals	28-11-2022	03-12-2022	1W
Semester End Examinations	5-12-2022	17-12-2022	2W

PART-D

PROGRAMME OUTCOMES (POs):

PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
PO 6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8	**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	Specify, design and analyze systems that efficiently generate, transmit and distribute electrical power
PSO 2	Design and analyze electrical machines, modern drive and lighting systems
PSO 3	Specify, design, implement and test analog and embedded signal processing electronic systems
PSO 4	Design controllers for electrical and electronic systems to improve their performance.

Course Instructor	Course Coordinator	Module Coordinator	HOD
T.Nagadurga	Mrs T.Naga Durga		Dr. J.Siva Vara Prasad

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DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : C.Rajamallu
Course Name & Code : **BASIC CIVIL ENGINEERING & 17CE80**
L-T-P Structure : 3-0-0 Credits : 3
Program/Sem/Sec : B.Tech., ME., VII-Sem., Sections- A-B-C- A.Y : 2022-23

PRE-REQUISITE: Nil

COURSE EDUCATIONAL OBJECTIVES (CEOs):. This course deals with the importance of building planning, properties and applications of various building materials, soil classification and different types of foundations, important aspects of surveying, levelling operations and identify the terminology in roadway and railway networks, principles of water resources and environmental engineering

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

CO 1	Recognize the importance of building planning for construction
CO 2	Identify appropriate building materials for construction purposes
CO 3	Distinguish the different types of soils and foundations required for specific usage
CO 4	Evaluate the basics of surveying and levelling operations for field application and categorize the important elements of roadway and railway networks
CO 5	Discriminate the importance of quantity and quality aspects of water in the society and priorities for sanitation management.

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

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1				2		2	1				2		2	1	3
CO2				2		2	1				2		2	1	3
CO3		1	1	2		2	1				2		2	1	3
CO4		1	1	2		2	1				2		2	1	3
CO5		1	1	2	2	2	1				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 1. M.S Palanichamy "Basic Civil Engineering", Tata McGraw Hill Publishing 2000.

REFERENCE BOOKS:

R1 1. S S Bhavikatti "Basic Civil Engineering", New age International Publications, 2010

R2 C P Kaushik& S S Bhavikatti "Basic Civil Engineering ", New age International Publications 2010.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Building Planning

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.	Building Planning- Role of a Civil Engineer	1	11-07-2022		TLM2	
2.	Inter connection among specializations in Civil Engineering	1	13-07-2022		TLM2	
3.	Elements of a Building, Basic Requirements of a Building	1	14-07-2022		TLM2	
4.	Planning- Hot and dry climates	1	15-07-2022		TLM1	
5.	Hot and wet climates, Cold climatic conditions	1	18-07-2022		TLM1	
6.	Aspect and Prospect, Roominess- Grouping, Privacy, circulation	1	20-07-2022		TLM1	
7.	Sanitation and ventilation	1	21-07-2022		TLM2	
8.	Orientation, Economy, Role of Bye-laws	1	22-07-2022		TLM2	
No. of classes required to complete UNIT-I:				No. of classes taken:		

UNIT-II: Building Materials

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.	Building Materials - Classification	1	25-07-2022		TLM1	
2.	Rocks, Bricks Classification, Composition, Properties, Commercial forms, Uses	1	27-07-2022		TLM2	
3.	Timber, Ply wood Classification, Composition, Properties, Commercial forms	1	28-07-2022		TLM2	
4.	Glass, Bitumen Classification, Composition, Properties, Commercial forms,	1	29-07-2022		TLM1	

5.	Aluminium, Cement Classification, Composition, Properties, Commercial forms,	1	01-08-2022		TLM1	
6.	Steel, Concrete Classification, Composition, Properties, Commercial forms, Uses	1	03-08-2022		TLM2	
7.	Mortar Classification, Composition, Properties, Commercial forms, Uses	1	04-08-2022		TLM2	
8.	Concept of eco-friendly materials, examples	1	05-08-2022		TLM1	
No. of classes required to complete UNIT-II:				No. of classes taken:		

UNIT-III: SOIL CLASSIFICATION AND FOUNDATION

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.	Types of soils, soil classification	1	8-08-2022		TLM1	
2.	Engineering properties	1	10-08-2022		TLM1	
3.	Bearing Capacity of soil, purpose and methods of improving bearing capacity	1	12-08-2022		TLM2	
4.	Foundations – Requirements	1	17-08-2022		TLM2	
5.	Loads, Types	1	22-08-2022		TLM1	
6.	for special structures-water tanks-	1	24-08-2022		TLM2	
7.	for special structures- silos, chimneys- transmission line towers- cooling towers, telecommunication towers	1	25-08-2022		TLM1	
No. of classes required to complete UNIT-III:07				No. of classes taken:		

UNIT-IV : SURVEYING, LEVELLING & HIGHWAY NETWORK

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.	Objective of surveying– Principles, applications and uses of - chain surveying	1	26-08-2022		TLM2	
2.	theodolite, levelling, contour maps, Planimeter, EDM concept	1	29-08-2022		TLM2	
3.	linear distance and area measurement	1	1-09-2022		TLM1	
4.	Total station- GIS-Concept and applications in civil engineering.	1	2-09-2022		TLM2	
5.	CRT Classes:5-9-2022 to 17-09-2022					
6.	MID-1 Examinations:19-09-2022 to 24-09-2022					
7.	Indian highways- Basic terminology- Classification of roads - PIEV theory - Traffic signs - IRC Code provisions	1	26-09-2022		TLM1	

8.	Indian railways –Permanent way and components of railway track	1	28-09-2022		TLM2	
9.	Gauges – Rails -Sleepers – Ballast.	1	29-09-2022		TLM2	
No. of classes required to complete UNIT-IV:07				No. of classes taken:		

UNIT-V : WATER RESOURCES AND ENVIRONMENTAL ENGINEERING

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.	Objectives of water supply system-Sources of water supply-Hydrologic cycle	1	30-09-2022		TLM1	
2.	Rainfall measurement - Purpose of dams, reservoirs, intakes, infiltration galleries	1	10-10-2022		TLM1	
3.	Water demands –Water quality parameters and their impacts - Principles of water treatment	1	12-10-2022		TLM2	
4.	Objectives of water distribution systems	1	13-10-2022		TLM2	
5.	Wastewater characteristics and their impacts	1	14-10-2022		TLM1	
6.	Principles of sewage treatment	1	17-10-2022		TLM2	
7.	Disposal of sewage	1	19-10-2022		TLM2	
8.	Water quality standards for – drinking purpose,	1	20-10-2022		TLM2	
9.	irrigation, -making	1	21-10-2022		TLM1	
10.	curing of concrete	1	26-10-2022		TLM1	
11.	methods of water distribution systems	1	27-10-2022		TLM2	
12.	Sewage generation in a society	1	28-10-2022		TLM2	
13.	Revision of Unit-1	1	2-11-2022		TLM2	
14.	Revision of Unit-1	1	3-11-2022		TLM2	
15.	Revision of Unit-2	1	4-11-2022		TLM1	
16.	Revision of Unit-2	1	7-11-2022		TLM1	
17.	Revision of Unit-3	1	9-11-2022		TLM1	
18.	Revision of Unit-3	1	10-11-2022		TLM1	
19.	Revision of Unit-4	1	11-11-2022		TLM2	
20.	Revision of Unit-4	1	14-11-2022		TLM2	
21.	Revision of Unit-5	1	16-11-2022		TLM2	
22.	Revision of Unit-5	1	17-11-2022		TLM1	
No. of classes required to complete UNIT-V:12				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

ACADEMIC CALENDAR:

Description	From	To	Weeks
I Phase of Instructions-1	11-07-2022	03-09-2022	6W
CRT Classes	05-09-2022	17-09-2022	2W
I Mid Examinations	19-09-2022	24-09-2022	1W
II Phase of Instructions	26-09-2022	19-11-2022	7W
II Mid Examinations	21-11-2022	26-11-2022	1W
Preparation and Practicals	28-11-2022	03-12-2022	1W
Semester End Examinations	05-12-2022	17-12-2022	2W

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	Possesses necessary skill set to analyze and design various systems using analytical and software tools related to civil engineering
PSO 2	Possesses ability to plan, examine and analyse the various laboratory tests required for the professional demands
PSO 3	Possesses basic technical skills to pursue higher studies and professional practice in civil engineering domain

Course Instructor	Course Coordinator	Module Coordinator	HOD
(C.Rajamallu)	(C.Rajamallu)	(B.Narasimha Rao)	(S.Pichi Reddy)

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DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code : 17ME72(R 17 Reg) **Lab: Robotics and Simulation Lab**
A.Y. : 2022-2023 **Class: B. Tech – VII Semester (Section B)**
Lab/Practicals : 3 hrs/ Week **Continuous Internal Assessment** : 40
Credits : 01 **Semester End Examination** : 60
Name of the Faculty : Mr. K.V.Viswanadh (Sr. Assistant Professor)
Mr. K. Venkateswara Reddy (Assistant Professor)

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

PRE-REQUISITES: Robotics, CAD/CAM

COURSE EDUCATIONAL OBJECTIVES:
The main objective of this course is to demonstrate and analysis of various types of robots.

COURSE OUTCOMES:
After completion of the course student will be able to:

CO1. Develop Robot Programmes to use to control commands
CO2. Experiment the robot operations like palletizing, gluing, spray painting, polishing, loading and unloading.
CO3. Simulate forward and inverse kinematic movements of a robot using MATLAB.
CO4. Perform the demo operations on SCARA and PUMA using Robo analysers.

Mapping of COs with POs and PSOs:

LABORATORY COURSE ARTICULATION MATRIX (Correlation between COs and POs and PSOs):

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) & PSOs – Robotics and SimulationLab (17ME72)															
		POs											PSOs		
		1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	PSO 3
COs	CO1	2	1			3							2		3	
	CO2	1	2	2		3							2		3	
	CO3	3	3		2	3							3			3
	CO4	1	1			3							2			3
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)															

Lab instructor (s) **Head of the Department**

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DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code	**: 17ME72(R 17 Reg)**	**Lab: Robotics and Simulation Lab**	
A.Y.	**: 2022-2023**	**Class: B. Tech – VII Semester (Section B)**	
Lab/Practicals	**: 3 hrs/ Week**	**Continuous Internal Assessment**	**: 40**
Credits	**: 01**	**Semester End Examination**	**: 60**
Name of the Faculty	**: Mr. K.V.Viswanadh (Sr. Assistant Professor)**		
	Mr. K. Venkateswara Reddy (Assistant Professor)		

PROGRAM OUTCOMES (POs):

Engineering Graduates will be able to:

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

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

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

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

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

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

7.Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8.Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9.Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10.Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11.Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

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

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

Lab instructor (s) **Head of the Department**

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
(AUTONOMOUS)
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Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada
L.B.Reddy Nagar, Mylavaram-521230, Krishna Dist, Andhra Pradesh, India
DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code	**: 17ME72(R 17 Reg)**	**Lab: Robotics and Simulation Lab**	
A.Y.	**: 2022-2023**	**Class: B. Tech – VII Semester (Section B)**	
Lab/Practicals	**: 3 hrs/ Week**	**Continuous Internal Assessment**	**: 40**
Credits	**: 01**	**Semester End Examination**	**: 60**
Name of the Faculty	**: Mr. K.V.Viswanadh (Sr. Assistant Professor)**		
	Mr. K. Venkateswara Reddy (Assistant Professor)		

LIST OF EXPERIMENTS

At least 10 Experiments from 12 overall should be conducted

LIST OF EXPERIMENTS:

1. Program for commands like joint command, circle command
2. Program for commands SPLINE command (continues path)
3. Program for PTP command
4. Palletizing
5. Loading / Unloading
6. Gluing
7. Spray painting
8. Polishing
9. Simulateof Robot with 2 Dof, 3 Dof, 4 Dof using ROBOANALYZER
10. SimulateSCARA,PUMA using ROBOANALYZER
11. Simulate forward and inverse kinematics RR Manipulator using MATLAB
12. Simulate forward and inverse kinematics RP Manipulator using MATLAB

SOFTWARE PACKAGES

ARISTO ROBOT, ROBOANALYZER, MATLAB, C Prog

REFERENCE: Robotics and Simulation Lab Manual

Lab instructor (s) **Head of the Department**

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Credits	**: 01**	**Semester End Examination**	**: 60**
Name of the Faculty	**: Mr. K.V.Viswanadh (Sr. Assistant Professor)**		
	Mr. K. Venkateswara Reddy (Assistant Professor)		

Notification of Cycles (Section –B)

At least TEN experiments may be conducted.

Cycle - I

1. Program for commands like joint command, circle command
2. Program for commands SPLINE command (continues path)
3. Program for PTP command
4. Palletizing
5. Loading / Unloading
6. Gluing

Cycle – II

7. Spray painting
8. Polishing
9. Simulation of Robot with 2 Dof, 3 Dof, 4 Dof using ROBOANALYZER
10. Simulation of SCARA,PUMA using ROBOANALYZER
11. Simulate forward and inverse kinematics RR Manipulator using MATLAB
12. Simulate forward and inverse kinematics RP Manipulator using MATLAB

SOFTWARE PACKAGES

ARISTO ROBOT, ROBOANALYZER, MATLAB

Lab instructor (s) **Head of the Department**

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Lab/Practicals : 3 hrs/ Week **Continuous Internal Assessment** : 40
Credits : 01 **Semester End Examination** : 60
Name of the Faculty : Mr. K.V.Viswanadh (Sr. Assistant Professor)
Mr. K. Venkateswara Reddy (Assistant Professor)

Lab Occupancy Time Table (B.Tech Mech Engg- VII Sem : Section – B / S)

↓Day/Date→	*9.00 – 9.50*	*9.50-10.40*	*10.50-11.40*	*11.40-12.30-*	*12.30-1.30*	*1.30-2.20*	*2.20-3.10*	*3.10-4.00*
Monday					*LUNCH BREAK*			
Tuesday								
Wednesday								
Thursday		*R&S –VII-B lab BATCH-B2*						
Friday								
saturday						*R&S –VII-B lab BATCH- B1*		

Faculty – In Charges:

S.No	Class	Section	Lab Assistant	Faculty – In Charge
1	B.Tech – VII Semester	*B / S*	Mr. P. Guna Sundar Reddy	Mr. K.V.Viswanadh Mr. K. Venkateswara Reddy

Lab instructor (s) **Head of the Department**

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Credits : 01 **Semester End Examination** : 60
Name of the Faculty : Mr. K.V.Viswanadh (Sr. Assistant Professor)
Mr. K. Venkateswara Reddy (Assistant Professor)

Batches (Section – B)

S.No	Batches	Regd.Nos	Total No. of Students
1	B. Tech –VII Sem - B/S	18765A0323,19761A0348- 363, 364 – 377, 378– 394, 20765A0316 – 330	59
2	Batch B1	18765A0323,19761A0348– 363, 364– 377	29
3	Batch B2	19761A0378–394, 20765A0316-330	30

Sub Batch of B11:
18765A0323,19761A0348– 363 (15)

S. No	Batch	Registered Nos	Total
1	B111	18765A0323,19761A0348-349	03
2	B112	197671A0350-352	03
3	B113	197671A0354-356	03
4	B114	197671A0357-358	02
5	B115	197671A0359-360	02
6	B116	197671A0361-363	02
Total (B11)			15

Sub Batch of B12:
19761A0364 – 377 (14)

S. No	Batch	Registered Nos	Total
1	B121	197671A0364-366	03
2	B122	197671A0367-369	03
3	B123	197671A0370-371	02
4	B124	197671A0372-373	02
5	B125	197671A0374-375	02
6	B126	197671A0376-377	02
Total (B12)			14

Sub Batches of B21:
19761A0378–394 (15)

S. No	Batch	Registered Nos	Total
1	B211	19761A0378-380	03
2	B212	19761A0381-384	03
3	B213	19761A0385-387	03
4	B214	19761A0388-389	02
5	B215	19761A0390-391	02
6	B216	19761A0393-394	02
Total (B21)			15

Sub Batches of B22:
20765A0316–330 (15)

S. No	Batch	Registered Nos	Total
1	B221	20765A0316-318	03
2	B222	20765A0319-321	03
3	B223	20765A0322-324	03
4	B224	20765A0325-326	02
5	B225	20765A0327-328	02
6	B226	20765A0329-330	02
Total (B22)			15

Lab instructor (s) **Head of the Department**

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A.Y. : 2022-2023 **Class: B. Tech – VII Semester (Section B)**
Lab/Practicals : 3 hrs/ Week **Continuous Internal Assessment** : 40
Credits : 01 **Semester End Examination** : 60
Name of the Faculty : Mr. K.V.Viswanadh (Sr. Assistant Professor)
Mr. K. Venkateswara Reddy (Assistant Professor)

Schedule of Experiments (Section – B: B1 Batch)

S.No	Batches	Regd. Nos	Total No. of Students
1	Batch B1	18765A0323,19761A0348– 363, 364– 377	29

S.No.	Name of the experiment	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	**Introduction to Robotics and Simulation Lab, Demonstration of all experiments, CEOs, and COs of the Laboratory**	3	16/07/2022		TLM4	
Cycle I						
2	Program for commands like joint command, circle command	3	16/07/2022		TLM4	
3	Program for commands SPLINE command (continues path)	3	23/07/2022		TLM4	
4	Program for PTP command	3	30/07/2022		TLM4	
5	Palletizing	3	06/08/2022		TLM4	
6	Loading / Unloading	3	20/08/2022		TLM4	
Cycle II						
7	Gluing	3	27/08/2022		TLM4	
8	Spray painting, Polishing	3	03/09/2022		TLM4	
I Mid Exams			19-09-2022 to 26-09-2022			
9	Simulation of Robot with 2 Dof, 3 Dof, 4 Dof using ROBOANALYZER	3	01/10/2022		TLM4	
10	Simulation of SCARA, PUMA using ROBOANALYZER	3	15/10/2022		TLM4	
11	Simulate forward and inverse kinematics RR Manipulator using MATLAB	3	22/10/2022		TLM4	
12	Simulate forward and inverse kinematics RP Manipulator using MATLAB	3	29/10/2022		TLM4	
13	Design of Robotic System	3	05/11/2022		TLM4	
14	Revision	3	12/11/2022		TLM4	
15	Internal Exam	3	19/11/2022		TLM4	
	II Mid Exams		**21-11-2022 to 26-11-2022**			
	Preparation and Practicals		**28-11-2022 to 03-12-2022**			
	Semester End Exams		**05-12-2022 to 17-12-2022**			

Lab instructor (s) **Head of the Department**

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A.Y. : 2022-2023 **Class: B. Tech – VII Semester (Section B)**
Lab/Practicals : 3 hrs/ Week **Continuous Internal Assessment** : 40
Credits : 01 **Semester End Examination** : 60
Name of the Faculty : Mr. K.V.Viswanadh (Sr. Assistant Professor)
Mr. K. Venkateswara Reddy (Assistant Professor)

Schedule of Experiments (Section – B: B2 Batch)

S.No	Batches	Regd.Nos	Total No. of Students
1	Batch B2	19761A0378–394, 20765A0316-330	30

S.No.	Name of the experiment	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1	**Introduction to Robotics and Simulation Lab, Demonstration of all experiments, CEOs, and COs of the Laboratory**	3	14/07/2022		TLM4	
	Cycle I					
2	Program for commands like joint command, circle command	3	14/07/2022		TLM4	
3	Program for commands SPLINE command (continues path)	3	21/07/2022		TLM4	
4	Program for PTP command	3	28/07/2022		TLM4	
	Palletizing	3	04/08/2022		TLM4	
5	Loading / Unloading		11/08/2022		TLM4	
6	Gluing	3	18/08/2022		TLM4	
7	Circular Motion	3	25/08/2022		TLM4	
	Cycle II					
8	Spray painting, Polishing	3	01/09/2022		TLM4	
	I Mid Exams		19-09-2022 to 26-09-2022			
9	Simulation of Robot with 2 Dof, 3 Dof, 4 Dof using ROBOANALYZER	3	29/09/2022		TLM4	
10	Simulation of SCARA, PUMA using ROBOANALYZER	3	13/10/2022		TLM4	
11	Simulate forward and inverse kinematics RR Manipulator using MATLAB	3	20/10/2022		TLM4	
12	Simulate forward and inverse kinematics RP Manipulator using MATLAB	3	27/10/2022		TLM4	
13	Welding Applications	3	03/11/2022		TLM4	
14	Collaboration of Robots	3	10/11/2022		TLM4	
15	Revision	3	17/11/2022		TLM4	
15	Internal Exam	3	17/11/2022		TLM4	
	II Mid Exams		**21-11-2022 to 26-11-2022**			
	Preparation and Practicals		**28-11-2022 to 03-12-2022**			
	Semester End Exams		**05-12-2022 to 17-12-2022**			

Lab instructor (s) **Head of the Department**

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Laboratory Code : 17ME72(R 17 Reg) **Lab: Robotics and Simulation Lab**
A.Y. : 2022-2023 **Class: B. Tech – VII Semester (Section B)**
Lab/Practicals : 3 hrs/ Week **Continuous Internal Assessment** : 40
Credits : 01 **Semester End Examination** : 60
Name of the Faculty : Mr. K.V.Viswanadh (Sr. Assistant Professor)
Mr. K. Venkateswara Reddy (Assistant Professor)

Evaluation Criterion for Laboratory

EVALUATION PROCESS:

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

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DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code	**: 17ME73 (R17 Reg)**	**Lab: Metrology and Instrumentation Lab**
A.Y.	**: 2022-23**	**Class: B. Tech – VII Semester (Section – B)**
Lab/Practicals	**: 6 hrs/ Week**	**Continuous Internal Assessment : 40**
Credits	**: 02**	**Semester End Examination : 60**
Name of the Faculty	**: V.Sankararao (Sr. Assistant Professor)/ B.Kamala Priya (Assistant Professor)**	

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

PRE-REQUISITES : METROLOGY & INSTRUMENTATION

COURSE EDUCATIONAL OBJECTIVES:

The objectives of this laboratory course is to enable the students learn the basic principles of metrological instruments and perform their calibration tests for industrial needs.

COURSE OUTCOMES:

After completion of the course student will be able to:
CO1. Perform linear, angular and gear measurements in manufacturing industries.
CO2. Analyze the measurement of the surface roughness and perform alignment tests.
CO3. Calibrate the displacement, load and speed measuring instruments
CO4. Measure the pressure, flow and vibration measuring instruments.
Mapping of COs with POs and PSOs:

LABORATORY COURSE ARTICULATION MATRIX (Correlation between COs and POs and PSOs):

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) & PSOs – Metrology and Instrumentation Lab (17ME73)															
		POs											PSOs		
		1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	PSO 3
COs	CO1	2	3	2	2					2			1		3	
	CO2	2	3	2	2					2			1		3	
	CO3	2	2		2					2			1		3	
	CO4	2	2		2					2			1		3	
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)															

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

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DEPARTMENT OF MECHANICAL ENGINEERING

PROGRAM OUTCOMES (POs):

Engineering Graduates will be able to:

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

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

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

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

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

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

7.Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8.Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9.Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10.Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11.Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

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

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

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Lab/Practicals	**: 6 hrs/ Week**	**Continuous Internal Assessment**	**: 40**
Credits	**: 02**	**Semester End Examination**	**: 60**
Name of the Faculty	**: V.Sankararao (Sr. Assistant Professor)/ B.Kamala Priya (Assistant Professor)**		

LIST OF EXPERIMENTS

At least 06 Experiments from each laboratory and 12 overall should be conducted

PART-A: METROLOGY LAB

At least SIX experiments may be conducted.

1. Measurement of lengths, heights, diameters by vernier calipers and micrometers.
2. Measurement of bores by dial bore indicators.
3. Taper measurement by using balls and rollers.
4. Use of gear teeth vernier calipers and checking the chordal addendum and chordalheight of spur gear.
5. Machine tool alignment of test on the lathe or milling machine.
6. Measurement of screw thread parameters using Tool makers microscope.
7. Angle and taper measurements by Bevel protractor, Sine bars, etc.
8. Thread measurement by three wire method.
9. Surface roughness measurement by Taly Surf.

PART-B: INSTRUMENTATION LAB

At least SIX experiments may be conducted.

1. Calibration of Pressure Gauges
2. Study and calibration of LVDT transducer for displacement measurement.
3. Calibration of strain gauge for load measurement.
4. Calibration of capacitive transducer for linear displacement.
5. Study and calibration of photo and magnetic speed pickups for the measurement ofspeed.
6. Study and calibration of a rotameter for flow measurement.
7. Study of Piezo-electric transducer.
8. Study and use of a Seismic pickup for the measurement of vibration amplitude of anengine bed at various loads.
9. Study and calibration of McLeod gauge for low pressure.
10. Study and calibration of RTD for temperature measurement

REFERENCE: Metrology and Instrumentation Lab Manuals

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

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Credits : 02 **Semester End Examination** : 60
Name of the Faculty : V.Sankararao (Sr. Assistant Professor)/ B.Kamala Priya (Assistant Professor)

Batches (Section – B)

S. No	Batches	Regd. Nos	Total No. of Students
1	B. Tech – B/S	18765A0323, 19761A0348 - 394, 20765A0316 – 330	59
2	Batch B1	18765A0323, 19761A0348 - 377	29
3	Batch B2	19761A0378 – 394, 20765A0316 – 330	30

Sub Batch of B11:
18765A0323, 19761A0348 – 363 (15)

S. No	Batch	Registered Nos	Total
1	B111	18765A0323, 19761A0348 – 349	03
2	B112	19761A0350 – 352	03
3	B113	19761A0354 – 356	03
4	B114	19761A0357 – 359	03
5	B115	19761A0360 – 363	03
Total (B11)			15

Sub Batch of B12:
19761A0364 – 377 (14)

S. No	Batch	Registered Nos	Total
1	B121	19761A0364 – 366	03
2	B122	19761A0367 – 369	03
3	B123	19761A0370 – 372	03
4	B124	19761A0373 – 375	03
5	B125	19761A0376 – 377	02
Total (B12)			14

Sub Batches of B21:
19761A0378 – 394 (15)

S. No	Batch	Registered Nos	Total
1	B211	19761A0378 – 380	03
2	B212	19761A0381 – 384	03
3	B213	19761A0385 – 387	03
4	B214	19761A0388 – 390	03
5	B215	19761A0391 – 394	03
Total (B21)			15

Sub Batches of B22:
20765A0316 – 330 (15)

S. No	Batch	Registered Nos	Total
1	B221	20765A0316 – 318	03
2	B222	20765A0319 – 321	03
3	B223	20765A0322 – 324	03
4	B224	20765A0325 – 327	03
5	B225	20765A0328 – 330	03
Total (B22)			15

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

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A.Y.	**: 2022-23**	**Class: B. Tech – VII Semester (Section – B)**
Lab/Practicals	**: 6 hrs/ Week**	**Continuous Internal Assessment : 40**
Credits	**: 02**	**Semester End Examination : 60**
Name of the Faculty	**: V.Sankararao (Sr. Assistant Professor)/ B.Kamala Priya (Assistant Professor)**	

Notification of Cycles (Section – B)

Cycle – I:METROLOGY LAB

At least SIX experiments may be conducted.

1. Measurement of lengths, heights, diameters by vernier calipers and micrometers.
2. Measurement of bores by dial bore indicators.
3. Taper measurement by using balls and rollers.
4. Use of gear teeth vernier calipers and checking the chordal addendum and chordalheight of spur gear.
5. Machine tool alignment of test on the lathe or milling machine.
6. Measurement of screw thread parameters using Tool makers microscope.
7. Angle and taper measurements by Bevel protractor, Sine bars, etc.
8. Thread measurement by three wire method.
9. Surface roughness measurement by Taly Surf.

Cycle – II: INSTRUMENTATION LAB

At least SIX experiments may be conducted.

1. Calibration of Pressure Gauges
2. Study and calibration of LVDT transducer for displacement measurement.
3. Calibration of strain gauge for load measurement.
4. Calibration of capacitive transducer for linear displacement.
5. Study and calibration of photo and magnetic speed pickups for the measurement ofspeed.
6. Study and calibration of a rotameter for flow measurement.
7. Study of Piezo-electric transducer.
8. Study and use of a Seismic pickup for the measurement of vibration amplitude of anengine bed at various loads.
9. Study and calibration of McLeod gauge for low pressure.
10. Study and calibration of RTD for temperature measurement

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

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(AUTONOMOUS)

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Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada

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

DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code : 17ME73 (R 17 Reg) **Lab: Metrology and Instrumentation Lab**
A.Y. : 2022-23 **Class: B. Tech – VII Semester (Section – B)**
Lab/Practicals : 6 hrs/ Week **Continuous Internal Assessment** : 40
Credits : 02 **Semester End Examination** : 60
Name of the Faculty : V.Sankararao (Sr. Assistant Professor)/ B.Kamala Priya (Assistant Professor)

Schedule of Experiments (Section – B: B1 Batch)

S.No	Batches	Regd. Nos	Total No. of Students
1	Batch B1	18765A0323, 19761A0348 – 377	29

Date	Experiment (Batch)					
	Ex - 1	Ex – 2	Ex – 3	Ex – 4	Ex – 5	Ex – 6
14-07-2022	CRT CLASSES					
METROLOGY LAB						
21-07-2022	CRT CLASSES					
28-07-2022						
04-08-2022	Demonstration of all experiments, CEOs and COs of the Laboratory (Ex – 01 to 06)					
11-08-2022	B111	B112	B113	B114	B115	
18-08-2022	B112	B113	B114	B115	B111	
25-08-2022	B113	B114	B115	B111	B112	
01-09-2022	B114	B115	B111	B112	B113	
08-09-2022	B115	B111	B112	B113	B114	
15-09-2022	Repetition					
19-09-2022 to 24-09-2022 *I Mid Examinations*						
	Ex - 1	Ex – 2	Ex – 3	Ex – 4	Ex – 5	Ex – 6
29-09-2022	Introduction to Cycle -II					
13-10-2022	B121	B122	B123	B124	B125	
20-10-2022	B122	B123	B124	B125	B121	
27-10-2022	B123	B124	B125	B121	B122	
03-11-2022	B124	B125	B121	B122	B123	
10-11-2022	B125	B121	B122	B123	B124	
17-11-2022	Backlog experiments / Additional Experiments/ Viva – Voce					
21-11-2022 to 26-11-2022: *II Mid Examinations*						
28-11-2022 to 03-12-2022	Preparation and Practicals					
05-12-2022 to 17-12-2022	Semester End Examinations					

Lab in charge **Head of the Department**

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Schedule of Experiments (Section – B: B1 Batch)

S.No	Batches	Regd. Nos	Total No. of Students
1	Batch B1	18765A0323, 19761A0348 – 377	29

Date	Experiment (Batch)					
	Ex - 1	Ex – 2	Ex – 3	Ex – 4	Ex – 5	Ex – 6
14-07-2022	CRT Classes					
INSTRUMENTATION LAB						
21-07-2022	CRT Classes					
28-07-2022						
04-08-2022	Demonstration of all experiments, CEOs and COs of the Laboratory (Ex – 01 to 06)					
11-08-2022	B121	B122	B123	B124	B125	
18-08-2022	B122	B123	B124	B125	B121	
25-08-2022	B123	B124	B125	B121	B122	
01-09-2022	B124	B125	B121	B122	B123	
08-09-2022	B125	B121	B122	B123	B124	
15-09-2022	Repetition					
19-09-2022 to 24-09-2022 *I Mid Examinations*						
	Ex - 1	Ex – 2	Ex – 3	Ex – 4	Ex – 5	Ex – 6
29-09-2022	Introduction to Cycle -II					
13-10-2022	B111	B112	B113	B114	B115	
20-10-2022	B112	B113	B114	B115	B111	
27-10-2022	B113	B114	B115	B111	B112	
03-11-2022	B114	B115	B111	B112	B113	
10-11-2022	B115	B111	B112	B113	B114	
17-11-2022	Backlog experiments / Additional Experiments/ Viva – Voce					
21-11-2022 to 26-11-2022: *II Mid Examinations*						
28-11-2022 to 03-12-2022	Preparation and Practicals					
05-12-2022 to 17-12-2022	Semester End Examinations					

Lab in charge **Head of the Department**

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A.Y. : 2022-23 **Class: B. Tech – VII Semester (Section – B)**
Lab/Practicals : 6 hrs/ Week **Continuous Internal Assessment** : 40
Credits : 02 **Semester End Examination** : 60
Name of the Faculty : V.Sankararao (Sr. Assistant Professor)/ B.Kamala Priya (Assistant Professor)

Schedule of Experiments (Section – B: B2 Batch)

S.No	Batches	Regd. Nos	Total No. of Students
1	Batch B2	19761A0378 – 394, 20765A0316 - 330	30

Date	Experiment (Batch)					
	Ex - 1	Ex – 2	Ex – 3	Ex – 4	Ex – 5	Ex – 6
27-09-2021	Demonstration of all experiments, CEOs and COs of the Laboratory (Ex – 01 to 06)					
METROLOGY LAB						
04-10-2021	B211	B212	B213	B214	B215	
11-10-2021	B215	B211	B212	B213	B214	
18-10-2021	B214	B215	B211	B212	B213	
25-10-2021	B213	B214	B215	B211	B212	
01-11-2021	B212	B213	B214	B215	B211	
08-11-2021 to 13-11-2021: *I Mid Examinations*						
	Ex - 1	Ex – 2	Ex – 3	Ex – 4	Ex – 5	Ex – 6
15-11-2021	B221	B222	B223	B224	B225	
22-11-2021	B225	B221	B222	B223	B224	
29-11-2021	B224	B225	B221	B222	B223	
06-12-2021	B223	B224	B225	B221	B222	
13-12-2021	B222	B223	B224	B225	B221	
20-12-2021 27-12-2021	Backlog experiments / Additional Experiments Viva – Voce and Repetition / Beyond the Syllabus					
03-01-2022 to 08-01-2022: *II Mid Examinations*						
10-01-2022 to 15-01-2022	Preparation and Practicals					
17-01-2022 to 29-01-2022	Semester End Examinations					

Lab in charge **Head of the Department**

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Credits : 02 **Semester End Examination** : 60
Name of the Faculty : V.Sankararao (Sr. Assistant Professor)/ B.Kamala Priya (Assistant Professor)

Schedule of Experiments (Section – B: B2 Batch)

S.No	Batches	Regd. Nos	Total No. of Students
1	Batch B2	19761A0378 – 394, 20765A0316 - 330	30

Date	Experiment (Batch)					
	Ex - 1	Ex – 2	Ex – 3	Ex – 4	Ex – 5	Ex – 6
27-09-2021	Demonstration of all experiments, CEOs and COs of the Laboratory (Ex – 01 to 06)					
INSTRUMENTATION LAB						
04-10-2021	B221	B222	B223	B224	B225	
11-10-2021	B225	B221	B222	B223	B224	
18-10-2021	B224	B225	B221	B222	B223	
25-10-2021	B223	B224	B225	B221	B222	
01-11-2021	B222	B223	B224	B225	B221	
08-11-2021 to 13-11-2021: *I Mid Examinations*						
	Ex - 1	Ex – 2	Ex – 3	Ex – 4	Ex – 5	Ex – 6
15-11-2021	B211	B212	B213	B214	B215	
22-11-2021	B215	B211	B212	B213	B214	
29-11-2021	B214	B215	B211	B212	B213	
06-12-2021	B213	B214	B215	B211	B212	
13-12-2021	B212	B213	B214	B215	B211	
20-12-2021 27-12-2021	Backlog experiments / Additional Experiments Viva – Voce and Repetition / Beyond the Syllabus					
06-12-2021 to 11-12-2021: *II Mid Examinations*						
10-01-2022 to 15-01-2022	Preparation and Practical's					
17-01-2022 to 29-01-2022	Semester End Examinations					

Lab in charge **Head of the Department**

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

COURSE HANDOUT

PROGRAM : B. Tech., VII-Sem., MECH/A

ACADEMIC YEAR : 2022-23

COURSE NAME & CODE : Refrigeration and Air-Conditioning – 17ME28

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

COURSE CREDITS : 3

COURSE INSTRUCTOR : **Mr. Mallikarjuna Rao Dandu**

COURSE COORDINATOR : **Mr. V. DHANA RAJU**

PRE-REQUISITE: Thermodynamics.

COURSE OBJECTIVE: In a broader way, this course provides the simple understanding of refrigeration and air conditioning fundamentals. First, it covers the different refrigeration cycles and its analysis. Then the concepts of psychrometry and psychrometry processes used for air conditioning are imparted. Finally, the concepts of comfort air conditioning, cooling load design and its estimation are addressed.

COURSE OUTCOMES(CO)

CO1: Describe the basic concepts of refrigeration and its applications.
CO2: Evaluate the performance parameters of refrigeration systems.
CO3: Identify the desirable refrigerants and its use in various refrigeration systems.
CO4: Analyze the psychrometric properties and processes used in Air Conditioning systems.
CO5: Design of Air Conditioning systems for thermal comfort conditions.

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

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

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

BOS APPROVED TEXT BOOKS:

T1 C. P. Arora. , Refrigeration and air conditioning - TMH, 2nd Edition, 2000.

T2 R. Dossat, Principles of Refrigeration - - Pearson 4th Edition 2001.

BOS APPROVED REFERENCE BOOKS:

R1 S. C. Arora, Domkundwar, A course in refrigeration and air conditioning-Dhanapat Rai& sons 5th Edition 1997.

R2 Wilbert F.Stoecker, Jerold W. J.Jones, MGH, 1986.

R3 Manohar Prasad, Refrigeration and Air conditioning, New Age international, 2003

COURSE DELIVERY PLAN (LESSON PLAN): Section-C

UNIT-I
FUNDAMENTALS OF REFRIGERATION, REFRIGERANT & AIR- REFRIGERATION SYSTEM -14

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome Cos	Text Book followed	HOD Sign Weekly
1.	**Introduction:** Refrigeration, Applications of refrigeration	1	25-07-2022		**TLM2**	CO1	**T1**	
2.	Unit of refrigeration and COP	1	26-07-2022		**TLM2**	CO1	**T1**	
3.	Heat Engine, Refrigerator and Heat pump	1	28-07-2022		**TLM2**	CO1	**T1**	
4.	Types of Refrigeration systems, Problems on refrigeration basics	1	28-07-2022		**TLM2, TLM4**	CO2	**T1**	
5.	**TUTORIAL-01**	1	30-07-2022		**TLM3**	CO1	**T1**	
6.	**Refrigerant:** Desirable characteristics of ideal refrigerant	1	01-08-2022		**TLM2**	CO3	**T1/R1**	
7.	Classification of refrigerants- Desirable Properties-Nomenclature, Refrigerant Designation	1	02-08-2022		**TLM 2, TLM 4**	CO3	**T1**	
8.	Commonly used refrigerants, Alternate refrigerants,	1	04-08-2022		**TLM 2**	CO3	**T1**	
9.	Green House effect& Global	1	04-08-2022		**TLM 7**	CO3	**T1**	
10.	**Air refrigeration system**: working on Reversed Carnot cycle	1	06-08-2022		**TLM 2**	CO1	**T1**	
11.	Air refrigeration system working on Bell Coleman cycle	1	08-08-2022		**TLM 2**	CO1	**T1**	
12.	COP- Open and Dense air systems Problems	1	11-08-2022		**TLM 2 TLM 4**	CO2	**T1**	
13.	Solving Problems	1	11-08-2022		**TLM 4**	CO2	**T1**	
14.	**TUTORIAL-02** Assignment-I/Quiz-I	1	16-08-2022		**TLM 3, TLM 6**	CO2	**T1**	
No. of classes required to complete UNIT-I = 14			No. of classes taken:					

UNIT-II VAPOUR COMPRESSION REFRIGERATION SYSTEM & COMPONENTS -10

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome Cos	Text Book followed	HOD Sign Weekly
15.	**Introduction to VCR system:** Essential components of the VCR plant	1	16-08-2022		**TLM 2**	CO1	**T2**	
16.	Simple vapour compression refrigeration cycle, COP	1	18-08-2022		**TLM 2**	CO1	**T2**	
17.	Representation of cycle on T-S and p-h Charts	1	18-08-2022		**TLM 2**	CO1	**T2**	

18.	Effect of sub cooling and superheating	1	20-08-2022		**TLM 2**	CO1	**R1**	
19.	Solving Problems	1	22-08-2022		**TLM 4**	CO2	**R1**	
20.	**TUTORIAL-03**	1	23-08-2022		**TLM 3**	CO2	**T2**	
21.	**VCR-System Components**: Compressors -Classification-Working Principles	1	25-08-2022		**TLM 2, TLM8**	CO1	**T2**	
22.	Condensers – Classification-working principle	1	25-08-2022		**TLM 2, TLM8**	CO1	**T2**	
23.	Evaporators-Classification-working principle	1	27-08-2022		**TLM 2, TLM8**	CO1	**T2**	
24.	Expansion valve – Classification-working principle-	1	29-08-2022		**TLM 2, TLM8**	CO1	**T2**	
25.	Advantages and disadvantages Assignment-2/Quiz-2	1	30-08-2022		**TLM 2, TLM 6**	CO1	**T2**	
No. of classes required to complete UNIT-II = 10			No. of classes taken:					

UNIT-III

VAPOUR ABSORPTION, STEAM JET & NON-CONVENTIONAL REFRIGERATION SYSTEM -07

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome Cos	Text Book followed	HOD Sign Weekly
26.	**Vapour Absorption Refrigeration system**: working principle	1	01-09-2022		**TLM 2**	CO1	**T1**	
27.	Max. COP derivation for the VAR system and problems	1	01-09-2022		**TLM 2, TLM 4**	CO2	**T1**	
28.	Description and working of NH_3-Water system	1	03-09-2022		**TLM 2**	CO1	**T1**	
29.	LiBr-Water (Two shell & Four shell) System	1	26-09-2022		**TLM 2**	CO1	**T1**	
30.	**TUTORIAL-04**	1	27-09-2022		**TLM 3**	CO3	**T1**	
31.	Principle of operation of Three fluid absorption systems, Salient features.	1	29-09-2022		**TLM 2**	CO1	**T1**	
32.	**Steam Jet Refrigeration System:** Working Principle	1	29-09-2022		**TLM 2**	CO1	**T1**	
33.	Basic Analysis- Applications	1	01-10-2022		**TLM 2**	CO1	**T1**	
34.	Solving Problems	1	10-10-2022		**TLM 4**	CO2	**T1**	
35.	**Non-Conventional Refrigeration Systems:** Thermo electric refrigeration, Vortex tube refrigeration	1	11-10-2022		**TLM 2**	CO1	**R1**	
36.	Adiabatic Demagnetization refrigeration	1	13-10-2022		**TLM 2**	CO1	**R1**	
37.	**TUTORIAL-05** Assignment-3/Quiz-3	1	13-10-2022		**TLM 3, TLM 6**	CO1	**T1**	
No. of classes required to complete UNIT-III = 06			No. of classes taken:					

UNIT-IV
PSYCHROMETRY & HUMAN COMFORT- 11

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome Cos	Text Book followed	HOD Sign Weekly
38.	**Psychrometry**: Introduction	1	15-10-2022		**TLM 2**	CO4	**T2**	
39.	Psychometric properties and relations	1	17-10-2022		**TLM 2**	CO4	**T2**	
40.	Psychometric problems	1	18-10-2022		**TLM 4**	CO4	**T2**	
41.	**TUTORIAL-06**	1	20-10-2022		**TLM 3**	CO4	**T2**	
42.	Psychometric chart and its analysis, Psychometric processes and its analysis	1	20-10-2022		**TLM 2**	CO4	**T2**	
43.	Sensible, Latent and Total heat	1	22-10-2022		**TLM 2**	CO4	**T2**	
44.	Sensible Heat Factor and Bypass Factor	1	25-10-2022		**TLM 2**	CO4	**T2**	
45.	Solving Problems	2	27-10-2022		**TLM 4**	CO4	**T2**	
46.	**TUTORIAL-07**	1	29-10-2022		**TLM 3**	CO4	**T2**	
47.	**Human Comfort:** Thermodynamics	1	31-10-2022		**TLM 2**	CO4	**T2**	
48.	Effective temperature – Comfort chart	1	01-11-2011		**TLM 2**	CO4	**T2**	
49.	Factors affecting the human comfort and its analysis Assignment-4/Quiz-4	1	03-11-2011		**TLM 2, TLM 6**	CO4	**T2**	
No. of classes required to complete UNIT-IV = 10			No. of classes taken:					

UNIT-V
AIR CONDITIONING SYSTEMS AND DESIGN -09

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
50.	**Introduction**: Air Conditioning Systems, Components of Air conditioning	1	03-11-2011		**TLM 2, TLM8**	CO5	**R1/T2**	
51.	Central and Unitary systems, Winter and Year-round systems	1	05-11-2011		**TLM 2, TLM8**	CO5	**R1/T1**	
52.	Cooling load estimation Solving Problems	1	07-11-2011		**TLM 2**	CO5	**R1/T1**	
53.	**TUTORIAL-08**	1	10-11-2011		**TLM 3**	CO5	**T1**	
54.	Design of Air Condition Systems	1	10-11-2022		**TLM 2**	CO5	**T1**	
55.	bypass factor-circulated air with ADP	1	12-11-2011		**TLM 2**	CO5	**T1**	
56.	System with Ventilated and re-circulation	1	14-11-2011		**TLM 2, TLM8**	CO5	**T1**	
57.	RSHF, GSHF and ESHF	1	15-11-2011		**TLM 2**	CO5	**T1**	
58.	Solving Problems	1	17-11-2011		**TLM 4**	CO5	**T1**	
59.	**TUTORIAL-09** Assignment-5/Quiz-5	1	19-11-2011		**TLM 3, TLM 6**	CO5	**T1**	
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	Learning Outcome COs	Text Book followed	HOD Sign Weekly
1.	Air craft Air-Refrigeration System	**1**	16-08-2022		**TLM2**	**CO1, CO4**	**R3**	
2.	Cryogenics	**1**	13-10-2022		**TLM2**	**CO1, CO3, CO5**	**R1& R2**	

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

ACADEMIC CALENDAR:

Description	From	To	Weeks
I Phase of Instructions-1	11-07-2022	03-09-2022	8W
I Mid Examinations	19-09-2022	24-09-2022	1W
II Phase of Instructions	26-09-2022	19-11-2022	8W
II Mid Examinations	21-11-2022	26-11-2022	1W
Preparation and Practical	28-11-2022	03-12-2022	1W
Semester End Examinations	05-12-2022	17-12-2022	2W

EVALUATION PROCESS:

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

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

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

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

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

PROGRAMME OUTCOMES (POs):

Engineering Graduates will be able to:

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

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

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

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

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

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

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

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

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

Course Instructor	Course Coordinator	Module Coordinator	HOD

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

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART - A

PROGRAM	**: B.Tech. - VII-Sem.- MechanicalEngineering – C Section**
ACADEMIC YEAR	: 2022-23
COURSE NAME & CODE	**: ROBOTICS–17ME29**
L-T-P STRUCTURE	: 3-0-0
COURSE CREDITS	: 3
COURSE INSTRUCTOR	**: Dr. Ch. Siva Sankara Babu, Sr.Assistant Professor**
COURSE COORDINATOR	**: J.Subba Reddy, Associate Professor**
PER-REQUISITE	: Engineering Mechanics & Kinematics of Machines

COURSE EDUCATIONAL OBJECTIVES:

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

COURSE OUTCOMES:

After completion of the course student will be able to:

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

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

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

CO4: Model the dynamic behavior of robot.

CO5: Analyze the trajectory of robotic motion.

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

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

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

BOS APPROVED TEXT BOOKS:

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

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

BOS APPROVED REFERENCE BOOKS:

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

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

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

COURSE DELIVERY PLAN (LESSON PLAN): ROBOTICS (17ME29)

PART - B

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

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
1.	**Introduction to Robotics**	1	11-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
2.	CEOs, Course Outcomes, POs and PSOs	1	12-07-2022		**TLM2**	-	-	
3.	Basic concepts – Robot anatomy	1	13-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
4.	Components of robots, **Tutorial**	1	14-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
5.	Robot motions	1	18-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
6.	Number of D.O.F – Work volume	1	19-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
7.	Robot applications in Material transfer and machine loading / unloading applications	1	20-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
8.	Robot applications in Processing operations – Assembly and inspection – Future applications	1	21-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
9.	**Robot End Effectors –**Introduction, **Tutorial**	1	23-07-2022		**TLM3**	CO1	T1, T2, R1, R2	
10.	Types of end effectors – Mechanical grippers	1	25-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
11.	Vacuum cups, magnetic grippers, adhesive gripers and others	1	26-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
12.	Robot / End effectors interface	1	27-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
13.	Considerations in gripper selection and design, **Tutorial**	1	28-07-2022		**TLM3**	CO1	T1, T2, R1, R2	
14.	Case Studies, Numericals	1	30-07-2022		**TLM2**	CO1	T1, T2, R1, R2	
15.	Numericals	1	01-08-2022		**TLM2**	CO1	T1, T2, R1, R2	
No. of classes required to complete UNIT-I:		**15**			**No. of classes taken:**			

UNIT-II: ROBOT ACTUATORS AND SENSORS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
16.	Introduction to Actuators	1	02-08-2022		**TLM2**	CO2	T1,R1	
17.	Characteristics of Actuating System	1	03-08-2022		**TLM2**	CO2	T1,R1	
18.	Pneumatic Actuators, **Tutorial**	1	04-08-2022		**TLM2,3**	CO2	T1,R1	
19.	Hydraulic Actuators	1	06-08-2022		**TLM2**	CO2	T1,R1	
20.	Electric Motors	1	08-08-2022		**TLM2**	CO2	T1,R1	
21.	Introduction to Sensors	1	10-08-2022		**TLM3**	CO2	T1,R1	
22.	Sensor characteristics, **Tutorial**	1	11-08-2022		**TLM1,3**	CO2	T1,R1	
23.	Position sensors: Potentiometers, LVDT	1	16-08-2022		**TLM1**	CO2	T1,R1	
24.	Resolvers, Encoders	1	17-08-2022		**TLM1**	CO2	T1,R1	
25.	Magnetostrictive Displacement Transducers (MDT)	1	18-08-2022		**TLM1**	CO2	T1,R1	
26.	Velocity Sensors: Encoders	1	20-08-2022		**TLM1**	CO2	T1,R1	
27.	Tachometers	1	22-08-2022		**TLM1**	CO2	T1,R1	
28.	Industrial Applications	1	23-08-2022		**TLM2**	CO2	T1,R1	
29.	Case Studies, **Tutorial**	1	24-08-2022		**TLM2,3**	CO2	T1,R1	
No. of classes required to complete UNIT-II		**14**		**No. of classes taken:**				

UNIT-III:MANIPULATOR KINEMATICS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
30.	Introduction to Manipulator Kinematics	1	25-08-2022		**TLM2**	CO3	T1,R1	
31.	Coordinate Frames	1	27-08-2022		**TLM2**	CO3	T1,R1	
32.	Description of Objects in space	1	29-08-2022		**TLM2**	CO3	T1,R1	
33.	Transformation of vectors	1	30-08-2022		**TLM2**	CO3	T1,R1	
34.	Numericals, **Tutorial**	1	01-09-2022		**TLM1,3**	CO3	T1,R1	
35.	Inverting a Homogeneous Transform	1	03-09-2022		**TLM2**	CO3	T1,R1	
	CRT Classes	**10**	**05-09-2022 to 17-09-2022**					
	I Mid Examinations	**5**	**19-09-2022 to 24-09-2022**					
36.	Numericals	1	26-09-2022		**TLM2**	CO3	T1,R1	
37.	Fundamental Rotation Matrices	1	27-09-2022		**TLM2**	CO3	T1,R1	
38.	Numericals, **Tutorial**	1	28-09-2022		**TLM2,3**	CO3	T1,R1	
39.	D-H representation	1	29-09-2022		**TLM2**	CO3	T1,R1	
40.	Problems on Forward Kinematics	1	01-10-2022		**TLM2**	CO3	T1,R1	
41.	Numericals	1	03-10-2022		**TLM2**	CO3	T1,R1	
42.	Numericals	1	04-10-2022		**TLM2**	CO3	T1,R1	
43.	Numericals, **Tutorial**	1	06-10-2022		**TLM2,3**	CO3	T1,R1	
No. of classes required to complete UNIT-III		**14**			**No. of classes taken:**			

UNIT-IV:ROBOT DYNAMICS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
44.	Introduction to Dynamics of Robots	1	10-10-2022		**TLM2**	CO4	T1,R1	
45.	Differential transformations	1	11-10-2022		**TLM2**	CO4	T1,R1	
46.	Numericals	1	12-10-2022		**TLM2**	CO4	T1,R1	
47.	Numericals, **Tutorial**	1	13-10-2022		**TLM2,3**	CO4	T1,R1	
48.	Numericals	1	15-10-2022		**TLM2**	CO4	T1,R1	
49.	Jacobian Matrix	1	17-10-2022		**TLM2**	CO4	T1,R1	
50.	Numericals	1	18-10-2022		**TLM1**	CO4	T1,R1	
51.	Numericals	1	19-10-2022		**TLM2**	CO4	T1,R1	
52.	Numericals, **Tutorial**	1	20-10-2022		**TLM1,3**	CO4	T1,R1	
53.	Lagrange Euler formulation	1	22-10-2022		**TLM2**	CO4	T1,R1	
54.	Numericals	1	25-10-2022		**TLM1**	CO4	T1,R1	
55.	Numericals	1	26-10-2022		**TLM2**	CO4	T1,R1	
56.	Numericals, **Tutorial**	1	27-10-2022		**TLM1,3**	CO4	T1,R1	
No. of classes required to complete UNIT-IV		**15**			**No. of classes taken:**			

UNIT-V:TRAJECTORY PLANNING

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
57.	Introduction to Trajectory Planning	1	29-10-2022		**TLM2**	CO5	T1,R1	
58.	Considerations on Trajectory Planning	1	31-10-2022		**TLM2**	CO5	T1,R1	
59.	Joint Interpolated Trajectory	1	01-11-2022		**TLM2**	CO5	T1,R1	
60.	Numericals	1	02-11-2022		**TLM2**	CO5	T1,R1	
61.	Numericals, **Tutorial**	1	03-11-2022		**TLM3**	CO5	T1,R1	
62.	Numericals	1	05-11-2022		**TLM2**	CO5	T1,R1	
63.	Numericals	1	07-11-2022		**TLM2**	CO5	T1,R1	
64.	Cartesian Path Trajectory	1	08-11-2022		**TLM2**	CO5	T1,R1	
65.	Numericals	1	09-11-2022		**TLM2**	CO5	T1,R1	
66.	Numericals, **Tutorial**	1	10-11-2022		**TLM3**	CO5	T1,R1	
67.	Numericals	1	14-11-2022		**TLM2**	CO5	T1,R1	
68.	Numericals	1	15-11-2022		**TLM2**	CO5	T1,R1	
69.	**Robot Programming (Beyond Syllabus)**	1	16-11-2022		**TLM2**	CO5	T1,R1	
70.	**Robot Programming (Beyond Syllabus)**	1	17-11-2022		**TLM2**	CO5	T1,R1	
71.	**Robot Programming (Beyond Syllabus)**	1	19-11-2022		**TLM2**	CO5	T1,R1	
No. of classes required to complete UNIT-V		**12 + 03 (Beyond Syllabus)**			**No. of classes taken:**			
II Mid Examinations – 21-11-2022 to 26-11-2022								

TEACHING LEARNING METHODS:

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

ACADEMIC CALENDER:

Commencement of Class work		**11-07-2022**	
I Phase of Instructions	11-07-2022	03-09-2022	8 Weeks
CRT Classes	05-09-2022	17-09-2022	2 Weeks
I Mid Examinations	19-09-2022	24-09-2022	1 Week
II Phase of Instructions	26-09-2022	19-11-2022	8 Weeks
II Mid Examinations	21-11-2022	26-11-2022	1 Week
Preparation and Practicals	28-11-2022	03-12-2022	1 Week
Semester End Examinations	05-12-2022	17-12-2022	2 Weeks

PART – C

EVALUATION PROCESS:

Evaluation Task	**COs**	**Marks**
Assignment/Quiz – 1	1	A1=05
Assignment/Quiz – 2	2	A2=05
I-Mid Examination	1,2	B1=20
I-Online Mid Examination	1,2	C1=10
Assignment/Quiz – 3	3	A3=05
Assignment/Quiz – 4	4	A4=05
Assignment/Quiz – 5	5	A5=05
II-Mid Examination	3,4,5	B2=20
II-Online Mid Examination	3,4,5	C2=10
Evaluation of Assignment/Quiz Marks: A=(A1+A2+A3+A4+A5)/5	1,2,3,4,5	**A=05**
Evaluation of Mid Marks: B=75% of Max(B1,B2)+25% of Min(B1,B2)	1,2,3,4,5	**B=20**
Evaluation of Online Mid Marks: C=75% of Max(C1,C2)+25% of Min(	1,2,3,4,5	**C=10**
Attendance: D (≥95% =**5M**; 90%≤A<95%=**4M;** 85%≤A<90%=**3M;** 80%≤A<85%=**2M;** 75%≤A<80%=**1M; <75%=0M)**	-	**D=05**
Cumulative Internal Examination: A+B+C+D	**1,2,3,4,5**	**A+B+C+D=40**
Semester End Examinations: E	**1,2,3,4,5**	**E=60**
Total Marks: A+B+C+D+E	**1,2,3,4,5**	**100**

PART – D

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

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

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

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

PROGRAMME OUTCOMES (POs):

Engineering Graduates will be able to:

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

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

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

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

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

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

7. Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8. Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9. Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10. Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11. Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

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

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

Signature				
Faculty Name	Dr. Ch. Siva Sankara Babu	J.Subba Reddy	J.Subba Reddy	Dr. S. Pichi Reddy
Designation	**Course Instructor**	**Course Coordinator**	**Module Coordinator**	**HOD**

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING
DEPARTMENT OF ELECTRONICS AND COMMUNICATION 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

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

ACADEMIC YEAR : 2022-23

COURSE NAME & CODE : Metrology and Instrumentation **(**17ME30)

L-T-P STRUCTURE : 4-0-0

COURSE CREDITS : 3

COURSE INSTRUCTOR : **B.SUDHEER KUMAR**

COURSE COORDINATOR : **K.Narayana**

PRE-REQUISITE: Modern Machining Processes

COURSE OBJECTIVE : The main objective of this course is to ascertain basic principles of measurements and calibrate the instruments.

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

CO:1	Apply different measuring techniques in quality control departments of industries and to ensure quality of products.
CO:2	Measure the dimensions using linear, angular and optical measuring instruments.
CO:3	Analyze measuring systems of surface roughness and perform alignment / acceptance test effectively.
CO:4	Design the instruments for the measurement of stress, strain, force, torque etc.
CO:5	Analyze measuring systems of Pressure, Fluid flow and Temperature.

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

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

BOS APPROVED TEXT BOOKS:

T1 D.S.Kumar, Mechanical Measurements and Controls, 4th Edition, Metropolitan Book Co-Private Ltd.

T2 R.K.Jain, Engineering Metrology, Khanna Publishers.3rd edition,2003

T3 BeckWith, Marangoni,Linehard, Mechanical Measurements, Person Education Asia.6th edition,2011.

BOS APPROVED REFERENCE BOOKS:

R1 A.K, Sawhneypuneet " A course in Mechanical Measurements and instrumentation control" DhanpatRai publications, 12thEdition, 2012

R2 J.P. Holman, Experimental Methods for Engineers, McGraw Hill.

R3 Ernest O. Doebelin, Measurement systems Application and Design, International Student Edition, 4thEdition, McGraw-Hill Book Company, 1998.

R4 M. Mahajan, A text book of Metrology, DhanpatRai& Co.

R5 I C Gupta, Engineering Metrology, DanpathRai

COURSE DELIVERY PLAN (LESSON PLAN): M&I

UNIT-I

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
1.	INTRODUCTION TO SUBJECT	1	13/07/2022		**TLM2**	CO1	-	
2.	COURSE OUTCOMES	1	14/07/2022		**TLM2**	CO1	-	
3.	**BASIC CONCEPTS** INTRODUCTION				**TLM2**	CO1	**T2**	
4.	FUNDAMENTAL MEASURING PROCESSES AND METHODS	1	15/07/2022		**TLM1**	CO1	**R4, T3**	
5.	GENERALISED MEASUREMENT SYSTEM AND ITS FUNCTIONAL ELEMENTS	1	16/07/2022		**TLM1**	CO1	**T3**	
6.	PERFORMANCE CHARACTERISTICS	2	20/07/2022		**TLM1**	CO1	**R4**	
7.	**ANALYSIS OF EXPERIMENTAL DATA:** CAUSES AND TYPES OF EXPERIMENTAL ERRORS	1	21/07/2022		**TLM1**	CO1	**T1**	
8.	TREATMENT OF EXPERIMENTAL DATA	1	22/07/2022		**TLM1**	CO1	**T1**	
9.	METHOD OF LEAST SQUARES	1	23/07/2022		**TLM1**	CO1	**T1**	
10.	GRAPHICAL ANALYSIS AND CURVE FITTING.	2	27/07/2022		**TLM1**	CO1	**T1**	
No. of classes required to completeUNIT-I		11			No. of classes taken:			

UNIT-II

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
11.	**LINEAR MEASUREMENT** STANDARDS OF MEASUREMENTS LINE AND END STANDARD.	1	28/07/2022		**TLM1**	CO2	**R5,T2**	
12.	BASIC PRINCIPLE AND APPLICATIONS OF SLIP GAUGES	1	29/07/2022		**TLM2**	CO2	**R5,T2**	
13.	DIAL INDICATOR AND MICROMETERS	1	30/07/2022		**TLM2**	CO2	**R5,T2**	
14.	**ANGULAR MEASUREMENTS** BEVEL PROTRACTOR – ANGLE SLIP GAUGES	1	03/08/2022		**TLM2**	CO2	**R5,T2**	
15.	SINE BAR, ROLLERS AND SPHERES USED TO DETERMINE THE TAPERS	2	04/08/2022		**TLM2**	CO2	**R5,T2**	
16.	APPLICATIONS OF ANGULAR MEASUREMENT	1	05/08/2022		**TLM2**	CO2	**R5,T2**	
17.	**OPTICAL MEASURING INSTRUMENTS** TOOL MAKER'S MICROSCOPE AND ITS USES	1	06/08/2022		**TLM2**	CO2	**R5,T2**	
18.	COLLIMATORS, OPTICAL PROJECTOR	1	10/08/2022		**TLM2**	CO2	**R5,T2**	
19.	OPTICAL FLATS AND THEIR USES	1	11/08/2022		**TLM2**	CO2	**R5,T2**	
20.	INTERFEROMETER, AND THOSE APPLICATIONS	1	12/08/2022		**TLM2**	CO2	**R5,T2**	

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

UNIT-III

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
21.	**SURFACE TEXTURE** FACTORS EFFECTING SURFACE ROUGHNESS	1	17/08/2022		**TLM2**	CO3	**R5,T2**	
22.	REASONS FOR CONTROLLING SURFACE TEXTURE	1	18/08/2022		**TLM2**	CO3	**R5,T2**	
23.	DIFFERENCES BETWEEN SURFACE ROUGHNESS AND SURFACE WAVINESS	1	20/08/2022		**TLM2**	CO3	**R5,T2**	
24.	ELEMENTS OF SURFACE TEXTURE NUMERICAL ASSESSMENT OF SURFACE FINISH – CLA, R, R.M.S VALUES – RA VALUES, AND RZ VALUES	1	24/08/2022		**TLM2**	CO3	**R5,T2**	
25.	BASIC PRINCIPLE OF PROFILE METER AND TOMLINSON SURFACE METER	1	25/08/2022		**TLM2**	CO3	**R5,T2**	
26.	ISI SYMBOLS FOR INDICATION OF SURFACE FINISH	1	26/08/2022		**TLM2**	CO3	**R5,T2**	
27.	APPLICATIONS SURFACE TEXTURE	1	27/08/2022		**TLM2**	CO3	**R5,T2**	
28.	**LIMITS AND FITS** INTRODUCTION, NORMAL SIZE, TOLERANCE LIMITS, DEVIATIONS, ALLOWANCE	2	01/09/2022		**TLM2**	CO3	**R5,T2**	
29.	FITS AND THEIR TYPES – UNILATERAL AND BILATERAL TOLERANCE SYSTEM	1	02/09/2022		**TLM2**	CO3	**R5,T2**	
30.	HOLE AND SHAFT BASIS SYSTEMS	1	03/09/2022		**TLM2**	CO3	**R5,T2**	
31.	INTERCHANGEABILITY AND SELECTIVE ASSEMBLY	1	28/09/2022		**TLM2**	CO3	**R5,T2**	
32.	INDIAN STANDARD INSTITUTION SYSTEM	1	29/09/2022		**TLM2**	CO3	**R5,T2**	
No. of classes required to complete UNIT-III		13			No. of classes taken:			

UNIT-IV

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
33.	**MEASUREMENT OF DISPLACEMENT** INTRODUCTION, CLASSIFICATION	1	30/09/2022		**TLM2**	CO4	**T1,T3**	
34.	DIMENSIONAL MEASUREMENT, GAUGE BLOCKS	1	01/10/2022		**TLM2**	CO4	**T1,T3**	
35.	**CRT CLASSES 05-09-2022 TO 17-09-2022**							
36.	**I MID EXAMINATION 19-09-2022 TO 24-09-2022**							
37.	OPTICAL METHODS, PNEUMATIC GAUGE	1	12/10/2022		**TLM2**	CO4	**T1,T3**	

38.	APPLICATIONS OF DISPLACEMENT MEASUREMENT	1			**TLM2**	CO4	**T1,T3**	
39.	**MEASUREMENT OF STRESS AND STRAIN** INTRODUCTION, STRAIN MEASUREMENTS ELECTRICAL RESISTANCE STRAIN GAUGE, GAUGE FACTOR	1	13/10/2022		**TLM2**	CO4	**T1,T3**	
40.	MEASUREMENT OF RESISTANCE STRAIN-GAGE OUTPUTS	1	14/10/2022		**TLM2**	CO4	**T1,T3**	
41.	TEMPERATURE COMPENSATION	1	15/10/2022		**TLM1**	CO4	**T1,T3**	
42.	STRAIN GAGE ROSETTES, APPLICATIONS OF STRAIN MEASUREMENT	1	19/10/2022		**TLM2**	CO4	**T1,T3**	
43.	**MEASUREMENT OF FORCE AND TORQUE** INTRODUCTION, ELASTIC TRANSDUCER	1	20/10/2022		**TLM2**	CO4	**T1,T3**	
44.	STRAIN GAGE LOAD CELLS	1	21/10/2022		**TLM2**	CO4	**T1,T3**	
45.	DYNAMOMETERS-MECHANICAL, HYDRAULIC, ELECTRICAL	1	22/10/2022		**TLM2**	CO4	**T1,T3**	
46.	APPLICATIONS OF FORCE AND TORQUE MEASUREMENT	1	26/10/2022		**TLM2**	CO4	**T1,T3**	
No. of classes required to complete UNIT-IV		12			No. of classes taken:			

UNIT-V

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
47.	**MEASUREMENT OF PRESSURE** INTRODUCTION, MANOMETERS	1	27/10/2022		**TLM2**	CO5	**T1,T3**	
48.	DIAL TYPE PRESSURE GAUGE, PRESSURE TRANSDUCERS	1	28/10/2022		**TLM2**	CO5	**T1,T3**	
49.	PITOT, STATIC, AND PITOT-STATIC TUBE AND ITS CHARACTERISTICS	1	29/10/2022		**TLM2**	CO5	**T1,T3**	
50.	LOW PRESSURE MEASUREMENT GAUGES APPLICATIONS OF PRESSURE MEASUREMENT	1	02/11/2022		**TLM2**	CO5	**T1,T3**	
51.	**MEASUREMENT OF FLUID FLOW** INTRODUCTION, ROTAMETER	1	03/11/2022		**TLM2**	CO5	**T1,T3**	
52.	TURBINE FLOW METER, LASER DOPPLER	1	04/11/2022		**TLM2**	CO5	**T1,T3**	
53.	ANEMOMETER, HOT-WIRE ANEMOMETER, APPLICATIONS OF FLUID FLOW MEASUREMENT	1	05/11/2022		**TLM2**	CO5	**T1,T3**	
54.	**MEASUREMENT OF TEMPERATURE** INTRODUCTION, TYPES OF THERMOMETERS	1	09/11/2022		**TLM2**	CO5	**T1,T3**	
55.	THERMOCOUPLES, RTD	1	10/11/2022		**TLM2**	CO5	**T1,T3**	

56.	THERMISTERS, PYROMETERS. TEMPERATURE MEASUREMENT	1	11/11/2022		**TLM2**	CO5	**T1,T3**	
57.	TEMPERATURE MEASUREMENT	1	12/11/2022		**TLM2**	CO5	**T1,T3**	
No. of classes required to complete UNIT-V		11			No. of classes taken:			

CONTENTS BEYOND THE SYLLABUS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
58.	INTRODUCTION TO GEAR MEASUREMENTS	1	16/11/2022		**TLM2**	CO2	**T1,T3**	
59.	INTRODUCTION TO COMPARATORS	1	17/11/2022		**TLM2**	CO2	**T1,T3**	
60.	MEASUREMENT OF SPEED	1	18/11/2022		**TLM2**	CO4	**T1,T3**	

TEACHING LEARNING METHODS:

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

EVALUATION PROCESS:

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

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

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

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

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

PROGRAMME OUTCOMES (POs):

Engineering Graduates will be able to:

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

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

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

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

DEPARTMENT OF MECHANICAL ENGINEERING

COURSE HANDOUT

PART - A

PROGRAM : **B.Tech. - VII-Sem. - Mechanical Engineering – C Section**
ACADEMIC YEAR : 2022-23
COURSE NAME & CODE : **PRODUCTION PLANNING AND CONTROL – 17ME33**
L-T-P STRUCTURE : 4-0-0
COURSE CREDITS : 3
COURSE INSTRUCTOR : **B.Udaya Lakshmi, Assistant Professor**
COURSE COORDINATOR : **J.Subba Reddy, Associate Professor**
PER-REQUISITE : **Industrial Management & Operational Research**

COURSE EDUCATIONAL OBJECTIVES:

The objectives of the course are to understand the basic concepts of production planning and control, familiarize with different forecasting techniques, familiarize the concepts of inventory management, understand the concepts of routing and scheduling and acquire basic knowledge in aggregate planning, expediting and follow up.

COURSE OUTCOMES:

After completion of the course student will be able to:

CO1: Exhibit the ability in developing production planning for operating economy, effectiveness and cost control.

CO2: Apply the forecasting techniques in estimating the number of products.

CO3: Use the inventory management techniques to determine the optimum quantity of material.

CO4: To develop the route sheet required for a production process/activities.

CO5: To decide the dispatch procedure required for a production processes and other activities.

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

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

BOS APPROVED TEXT BOOKS:

T1 R.Pannerselavn, Production and Operations Management, 2nd Edition, PHI,2007.
T2 P.Rama Murthy, Production and Operations Management, New Age Internationa, 2ndEdition, 2005

BOS APPROVED REFERENCE BOOKS:

R1 S.N.Chary, Production and Operations Management, TMcH, 4th Edition 2010.
R2 SamuelEilon, Elements of Production Planning and Control, Universal Publishing Corporation, 2004
R3 Seetharama L.N, Production Planning and Inventory Control, PHI, 2nd Edition1995

COURSE DELIVERY PLAN (LESSON PLAN): PPC [Program Elective – IV]

PART - B

UNIT-I: INTRODUCTION TO PRODUCTION PLANNING AND CONTROL (PPC)

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
1.	CEOs, Course Outcomes, POs and PSOs	1	11-7-2022		**TLM2**	CO1	R1, R2	
2.	**UNIT-I** Introduction to PPC	1	12-7-2022		**TLM2**	CO1	R1, R2	
3.	Definition-Objectives of PPC	1	13-7-2022		**TLM2**	CO1	R1, R2	
4.	Functions of production planning and control	1	16-7-2022		**TLM2**	CO1	R1, R2	
5.	Elements of production control	1	18-7-2022		**TLM2**	CO1	R1, R2	
6.	Types of production	1	19-7-2022		**TLM2**	CO1	R1, R2	
7.	Process chart	1	20-7-2022		**TLM2**	CO1	R1, R2	
8.	**Tutorial-I**	1	23-7-2022		**TLM3**	CO1	R1, R2	
9.	Product life cycle	1	25-7-2022		**TLM2**	CO1	R1, R2	
10.	Design of product	1	26-7-2022		**TLM2**	CO1	R1, R2	
11.	Product Analysis	1	27-7-2022		**TLM2**	CO1	R1, R2	
12.	Org. Chart for PPC	1	30-7-2022		**TLM2**	CO1	R1, R2	
13.	Case Studies	1	1-8-2022		**TLM2**	CO1	R1, R2	
14.	**Tutorial-II**	1	2-8-2022		**TLM3**	CO1	R1, R2	
No. of classes required to complete UNIT-I:		**14**			**No. of classes taken:**			

UNIT-II: FORECASTING

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
15.	**UNIT-II** Introduction to Forecasting	1	3-8-2022		**TLM2**	CO2	T1,R1	
16.	Importance of forecasting – sales forecasting	1	6-8-2022		**TLM2**	CO2	T1,R1	
17.	Types of forecasting	1	8-8-2022		**TLM2**	CO2	T1,R1	
18.	Qualitative methods	1	10-8-2022		**TLM2**	CO2	T1,R1	
19.	Quantities methods – Introduction	1	13-8-2022		**TLM2**	CO2	T1,R1	
20.	**Tutorial-III**	1	16-8-2022		**TLM3**	CO2	T1,R1	
21.	Moving Avg. method	1	17-8-2022		**TLM1**	CO2	T1,R1	
22.	weighted MAM	1	20-8-2022		**TLM1**	CO2	T1,R1	
23.	Exponential smoothing method	1	22-8-2022		**TLM1**	CO2	T1,R1	
24.	Errors in Forecasting	1	23-8-2022		**TLM1**	CO2	T1,R1	
25.	MAD, MAE, MAPE etc	1	24-8-2022		**TLM1**	CO2	T1,R1	
26.	Correlation and Regression Analysis	1	27-8-2022		**TLM1**	CO2	T1,R1	
27.	Delphi Method -Problems	1	29-8-2022		**TLM2**	CO2	T1,R1	
28.	Numericals, Industrial Applications, Tutorial-IV	1	30-8-2022		**TLM3**	CO2	T1,R1	
No. of classes required to complete UNIT-II		**14**		**No. of classes taken:**				

UNIT-III: INVENTORY MANAGEMENT

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
29.	**UNIT-III** Inventory of management – introduction	1	3-9-2022		**TLM2**	CO3	T1,R1	
30.	Types of Inventories	1	5-9-2022		**TLM2**	CO3	T1,R1	
31.	Functions of inventory management	1	6-9-2022		**TLM2**	CO3	T1,R1	
32.	Cost Associated with Inventories	1	7-9-2022		**TLM2**	CO3	T1,R1	
33.	EOQ model – Problem	1	10-9-2022		**TLM1**	CO3	T1,R1	
34.	Selective Control of Inventories	1	12-9-2022		**TLM3**	CO3	T1,R1	
35.	ABC analysis, VED analysis	1	13-9-2022		**TLM2**	CO3	T1,R1	
36.	HMI Analysis etc.	1	14-9-2022		**TLM2**	CO3	T1,R1	
37.	Inventory control systems	1	17-9-2022		**TLM2**	CO3	T1,R1	
38.	P-Systems	1	27-9-2022		**TLM2**	CO3	T1,R1	
39.	Q-Systems	1	28-9-2022		**TLM2**	CO3	T1,R1	
40.	Numericals	1	1-10-2022		**TLM2**	CO3	T1,R1	
41.	**Tutorial-V**	1	3-10-2022		**TLM1**	CO3	T1,R1	
42.	Introduction to MRP	1	4-10-2022		**TLM2**	CO3	T1,R1	
43.	objective of MRP	1	8-10-2022		**TLM2**	CO3	T1,R1	
44.	Inputs of MRP	1	10-10-2022		**TLM2**	CO3	T1,R1	
45.	Bill of Materials	1	11-10-2022		**TLM2**	CO3	T1,R1	
46.	Introduction to JIT inventory	1	12-10-2022		**TLM2**	CO3	T1,R1	
47.	Element of JIT	1	15-10-2022		**TLM2**	CO3	T1,R1	
48.	Japanese concepts, Kanban system	1	17-10-2022		**TLM2**	CO3	T1,R1	
49.	**Tutorial-VI**	1	17-10-2022		**TLM3**	CO3	T1,R1	
No. of classes required to complete UNIT-III		**21**			**No. of classes taken:**			

UNIT-IV: ROUTING

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
50.	**Unit-IV-** Routing, Routing procedure	1	18-10-2022		**TLM2**	CO4	T1,R1	
51.	Route sheets ,Maintanance Sheets	1	19-10-2022		**TLM2**	CO4	T1,R1	
52.	Factors affecting routing procedure	1	22-10-2022		**TLM2**	CO4	T1,R1	
53.	Definition of Scheduling	1	23-10-2022		**TLM2**	CO4	T1,R1	
54.	Forward and Backward Scheduling	1	25-10-2022		**TLM2**	CO4	T1,R1	
55.	Johnsons Rules	1	25-10-2022		**TLM1**	CO4	T1,R1	
56.	**Tutorial-VII**	1	26-10-2022		**TLM3**	CO4	T1,R1	
57.	Difference between loading & scheduling	1	29-10-2022		**TLM2**	CO4	T1,R1	
58.	Scheduling Policies	1	31-10-2022		**TLM2**	CO4	T1,R1	
59.	Techniques- Gant Chart, Gant Chart Symbols	1	1-11-2022		**TLM2**	CO4	T1,R1	
60.	Scheduling Methods	1	2-11-2022		**TLM2**	CO4	T1,R1	
61.	**Tutorial-VIII**	1	2-11-2022		**TLM3**	CO4	T1,R1	
No. of classes required to complete UNIT-IV		**12**			**No. of classes taken:**			

UNIT-V: AGGREGATE PLANNING

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
62.	Aggregate Planning	1	5-11-2022		**TLM2**	CO5	T1,R1	
63.	Stage of Aggregate Planning	1	6-11-2022		**TLM2**	CO5	T1,R1	
64.	Chase Planning	1	7-11-2022		**TLM2**	CO5	T1,R1	
65.	Expanding & Controlling Accepts	1	9-11-2022		**TLM2**	CO5	T1,R1	
66.	**Tutorial-IX**	1	9-11-2022		**TLM3**	CO5	T1,R1	
67.	Introduction to Dispatching	1	12-11-2022		**TLM2**	CO5	T1,R1	
68.	Activities of Dispatcher	1	12-11-2022		**TLM2**	CO5	T1,R1	
69.	Dispatching Procedure	1	13-11-2022		**TLM2**	CO5	T1,R1	
70.	Follow up definition, Types of Follow up	1	14-11-2022		**TLM2**	CO5	T1,R1	
71.	Reasons for existence of functions	1	14-11-2022		**TLM2**	CO5	T1,R1	
72.	Computer Applications in PPC	1	15-11-2022		**TLM2**	CO5	T1,R1	
73.	ERP Systems, ERP Modules, Basics of MRP-II	1	16-11-2022		**TLM2**	CO5	T1,R1	
74.	**Numericals, Tutorial-X**	1	19-11-2022		**TLM3**	CO5	T1,R1	
No. of classes required to complete UNIT-V		**13**			**No. of classes taken:**			

TEACHING LEARNING METHODS:

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

ACADEMIC CALENDER:

Commencement of Class work		10-12-2018	
I Phase of Instructions	25-11-2019	11-01-2020	7 Weeks
I Mid Examinations	20-01-2020	22-01-2020	½ Week
II Phase of Instructions	23-01-2020	25-03-2020	9 Weeks
II Mid Examinations	26-03-2020	28-03-2020	½ Week
Preparation and Practicals	30-03-2020	04-04-2020	1 Week
Semester End Examinations	06-04-2020	11-04-2020	1 Week

PART - C

EVALUATION PROCESS:

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

PART – D

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

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

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

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

PROGRAMME OUTCOMES (POs):

Engineering Graduates will be able to:

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

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

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

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

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

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

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

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

DEPARTMENT OF **MECHANICAL ENGINEERING**

COURSE HANDOUT

PART-A

Name of Course Instructor : A.Dhanunjay Kumar
Course Name & Code : CIM & 17ME92
L-T-P Structure : 3-0-0 Credits : 3
Program/Sem/Sec : B.Tech., MECH., VII-Sem., Sections-C A.Y : 2022-23

PRE-REQUISITE:CAD/CAM

COURSE EDUCATIONAL OBJECTIVES (CEOs): The main objective of this course is to control the entire production process using computers. This integration allows individual processes to exchange information with each other and initiate actions.

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

CO 1	Understand the basics of production and derive production metrics.
CO 2	Prepare CNC programs for manufacturing of different geometries on milling and lathe Machines.
CO 3	Apply group technology concepts for parts classification.
CO 4	Select layouts of FMS for industrial applications.
CO 5	Develop a CAPP system for rotational and prismatic parts.

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 1. Mikell P Groover, Automation, production Systems and Computer Integrated Manufacturing, 3rd Edition, Prentice Hall Inc., New Delhi, 2007.
T2 2. P. Radhakrishnan, "Computer Numerical Control ", New Central Book Agency, 1992.

REFERENCE BOOKS:

R1 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: Introduction

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Production Systems	1	11.07.2022		TLM2	
2.	production facilities	1	12.07.2022		TLM2	
3.	Manufacturing operations	1	13.07.2022		TLM2	
4.	manufacturing models and metrics	1	14.07.2022		TLM2	
5.	Examples of Manufacturing problems	1	18.07.2022		TLM2	
6.	CIM Definition	1	19.07.2022		TLM2	
7.	CIM components	1	20.07.2022		TLM2	
8.	Evolution of CIM, needs of CIM	1	21.07.2022		TLM2	
9.	Benefits of CIM	1	25.07.2022		TLM2	
10.	Overview of CIM software and Hardware	1	26.07.2022		TLM2	
No. of classes required to complete UNIT-I:10				No. of classes taken:		

UNIT-II: 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
1.	Basic components of NC system	1	27.07.2022		TLM2	
2.	NC motion control system	1	28.07.2022		TLM2	
3.	Applications of NC, advantages and disadvantages of NC	1	01.08.2022		TLM2	
4.	computer Numerical control	1	02.08.2022		TLM2	
5.	functions and advantages of CNC	1	03.08.2022		TLM2	
6.	Direct Numerical Control, components of a DNC system	1	04.08.2022		TLM2	
7.	Functions and advantages of DNC	1	08.08.2022		TLM2	
8.	NC part programming.	1	09.08.2022		TLM2	
9.	NC part programming turn	1	10.08.2022		TLM2	
10.	NC part programming mill		11.08.2022		TLM2	
No. of classes required to complete UNIT-II:10				No. of classes taken:		

UNIT-III: CELLULAR MANUFACTURING SYSTEMS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Part Families, Parts Classification and Coding	1	26-09-2022		TLM2	
2.	Features of Parts Classification and Coding Systems	1	27.09.2022		TLM2	
3.	Opitz of Parts Classification and Coding Systems	1	28.09.2022		TLM2	
4.	Production Flow Analysis	1	29.09.2022		TLM2	
5.	Composite Part Concept,	1	01.10.2022		TLM2	
6.	Machine Cell Design				TLM2	
7.	Applications Of Group Technology	1	06.10.2022		TLM2	
8.	Quantitative analysis of cellular manufacturing	1	10.10.2022		TLM2	
9.	Rank Order Clustering Method, Arranging Machines in a GT cell	2	11.10.2022		TLM2	
10.	HollierMethod, Simple Problems		12.10.2022		TLM2	
No. of classes required to complete UNIT-III:09				No. of classes taken:		

UNIT-IV :FLEXIBLE MANUFACTURING SYSTEMS (FMS)

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.	Flexibility	1	13.10.2022		TLM2	
2.	Types of FMS	1	17.10.2022		TLM2	
3.	FMS Components	1	18.10.2022		TLM2	
4.	FMS Application & Benefits	1	19.10.2022		TLM2	
5.	FMS Planning and implementation issues	1	20.10.2022		TLM2	
6.	Quantitative analysis of FMS	1	25.10.2022		TLM2	
7.	Simple Problems.	1	26.10.2022		TLM2	
8.	FMS software	1	27.10.2022		TLM2	
9.	FMS hardware	1	31.10.2022		TLM2	
10.	Implementation issues FMS	1	01.11.2022		TLM2	
No. of classes required to complete UNIT-IV:10				No. of classes taken:		

UNIT-V :PROCESS PLANNING AND CONCURRENT ENGINEERING

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.	Process planning for parts	1	02.11.2022		TLM2	
2.	Process planning for assemblies	1	03.11.2022		TLM2	
3.	Make or buy decisions	1	07.11.2022		TLM2	
4.	Computer aided process planning	1	08.11.2022		TLM2	
5.	Retrieval and generative CAPP systems	1	09.11.2022		TLM2	
6.	Concurrent engineering	1	10.11.2022		TLM2	
7.	design for manufacturing	1	14.11.2022		TLM2	
8.	Advanced manufacturing planning	1	15.11.2022		TLM2	
9.	lean production and JIT & production systems	2	17.11.2022		TLM2	
10.	Lean principles				TLM2	
No. of classes required to complete UNIT-V:10				No. of classes taken:		

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

PART-C

EVALUATION PROCESS (R17 Regulations):

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

PART-D

PROGRAMME OUTCOMES (POs):

PO 1	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

PROGRAM	**: B.Tech. - VII-Sem.- MechanicalEngineering – B,C Sections**
ACADEMIC YEAR	**:** 2022-23
COURSE NAME & CODE	**: Total Quality management & 17ME36**
L-T-P STRUCTURE	**:** 3-0-0
COURSE CREDITS	**:** 3
COURSE INSTRUCTOR	**: Narayana Karagani, Assistant Professor**
COURSE COORDINATOR	**: Seelam Srinivasa Reddy, Associate Professor**
PER-REQUISITE	**:Industrial Management**

COURSE EDUCATIONAL OBJECTIVES: The main objective of this course is to familiarize the concepts of quality management techniques in industries

COURSE OUTCOMES:

After completion of the course student will be able to:

CO1: Comprehend the principles and strategies of quality control

CO2: Apply the principles of total quality management in an industry.

CO3: Analyze statistical quality control tools towards improving the quality.

CO4: Adopt the principles of Taguchi techniques for industrial needs.

CO5: Implement ISO quality standards in an organization.

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

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

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

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

BOS-APPROVED TEXTBOOKS:

T : Dale H. Besterfiled., Total Quality Management, Pearson Education, 3rd Edition 2010

BOS APPROVED REFERENCE BOOKS:

R1. James R. Evans & William M. Lidsay, The Management and Control of Quality, South-Western (Thomson Learning), 2002.

R2. Feigenbaum.A.V, Total Quality Management, MCGraw-Hill, 2005.

R3. Narayana V. and Sreenivasan, N.S, Quality Management- Concepts and Tasks, New Age International, 2006.

R4. Zeiri, Total Quality Management for Engineers, Wood Head Publishers, 2009.

COURSE DELIVERY PLAN (LESSON PLAN): ROBOTICS (17ME29)

PART - B

UNIT-I: INTRODUCTION TO TQM

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Textbook followed	HOD Sign Weekly
1.	**Introduction to TQM**	1	11-07-2022		TLM1	CO'1	T&R1	
2.	CEOs, Course Outcomes, POs and PSOs	1	13-07-2022		TLM1	CO'1	T&R1	
3.	INTRODUCTION: Evolution of total quality management	1	14-07-2022		TLM1	CO'1	T&R1	
4.	Definition of Quality	1	15-07-2022		TLM1	CO'1	T&R1	
5.	Quality costs,	1	18-07-2022		TLM2	CO'1	T&R1	
6.	Quality Council	1	20-07-2022		TLM2	CO'1	T&R1	
7.	Strategic Planning	1	21-07-2022		TLM2	CO'1	T&R1	
8.	Deming Philosophy	1	22-07-2022		TLM2	CO'1	T&R1	
9.	Barriers to TQM Implementation	1	25-07-2022		TLM2	CO'1	T&R1	
10.	Barriers to TQM Implementation	1	27-07-2022		TLM2	CO'1	T&R1	
11.	Revision	1	28-07-2022		TLM2	CO'1	T&R1	
12.	Quiz-1	1	29-07-2022		TLM6	CO'1	T&R1	
No. of classes required to complete UNIT-I:		**12**			**No. of classes taken:**			

UNIT-II: TQM PRINCIPLES

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Textbook followed	HOD Sign Weekly

13.	TQM Principles: Customer satisfaction.	1	01-08-2022		TLM1	CO2	T&R1	
14.	Types of Customers, customer supply chain	1	03-08-2022		TLM1	CO2	T&R1	
15.	Customer perception of quality, customer feedback.	1	04-08-2022		TLM2	CO2	T&R1	
16.	customer retention, Service quality.	1	05-08-2022		TLM2	CO2	T&R1	
17.	Employee Involvement, Motivation.	1	08-08-2022		TLM2	CO2	T&R1	
18.	Maslow ‘s hierarchy of needs, Herzberg theory,	1	10-08-2022		TLM2	CO2	T&R1	
19.	Empowerment and Teamwork, Performance appraisal, Benefits,	1	12-08-2022		TLM2	CO2	T&R1	
20.	Continuous process improvement- Juran Trilogy.	1	17-08-2022		TLM2	CO2	T&R1	
21.	PDSA cycle,	1	18-08-2022		TLM2	CO2	T&R1	
22.	5S, Kaizen, Supplier	1	22-08-2022		TLM2	CO2	T&R1	
23.	Partnership- Partnering, sourcing,	1	24-08-2022		TLM2	CO2	T&R1	
24.	supplier selection,	1	25-08-2022		TLM2	CO2	T&R1	
25.	Performance Measures-Basic Concepts,	1	26-08-2022		TLM2	CO2	T&R1	
26.	Strategy, Performance Measure	1	29-08-2022		TLM2	CO2	T&R1	
27.	Revision	1	01-09-2022		TLM2	CO2	T&R1	
28.	Quiz	1	02-09-2022		TLM6	CO2	T&R1	
No. of classes required to complete UNIT-II		**16**		**No. of classes taken:**				

UNIT-III: STATISTICAL PROCESS CONTROL

S. No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
29.	STATISTICAL PROCESS CONTROL: The seven tools of quality,	1	26-09-2022		TLM1	CO3	T&R1	
30.	Statistical Fundamentals,	1	28-09-2022		TLM2	CO3	T&R1	
31.	Population and Sample,	1	29-09-2022		TLM2	CO3	T&R1	
32.	Normal curve,	1	30-09-2022		TLM2	CO3	T&R1	
33.	Control charts for variables and attributes,	1	06-10-2022		TLM2	CO3	T&R1	
34.	Process capability,	1	07-10-2022		TLM2	CO3	T&R1	
35.	Concepts of six sigma,	1	10-10-2022		TLM2	CO3	T&R1	
36.	New seven Management tools.	1	12-10-2022		TLM2	CO3	T&R1	
37.	Problems	1	13-10-2022		TLM3	CO3	T&R1	
38.	Revision & Quiz	1	14-10-2022		TLM2&6	CO3	T&R1	
No. of classes required to complete UNIT-III		**10**			**No. of classes taken:**			

UNIT-IV: TQM TOOLS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
39.	TQM TOOLS: Benchmarking,	1	17-10-2022		TLM1	CO4	T&R1	
40.	Benchmarking Process,	1	19-10-2022		TLM2	CO4	T&R1	
41.	Quality Function Deployment (QFD),	1	20-10-2022		TLM2	CO4	T&R1	
42.	House of Quality, QFD Process	1	21-10-2022		TLM2	CO4	T&R1	
43.	Taguchi Quality Loss Function,	1	24-10-2022		TLM2	CO4	T&R1	
44.	Total Productive Maintenance Concept,	1	26-10-2022		TLM2	CO4	T&R1	
45.	improvement needs,.	1	27-10-2022		TLM2	CO4	T&R1	
46.	FMEA- Stages of FMEA	1	28-10-2022		TLM2	CO4	T&R1	
47.	Revision	1	31-10-2022		TLM2	CO4	T&R1	
48.	Quiz	1	02-11-2022		TLM6	CO4	T&R1	
No. of classes required to complete UNIT-IV		**10**			**No. of classes taken:**			

UNIT-V: QUALITY SYSTEMS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Learning Outcome COs	Text Book followed	HOD Sign Weekly
49.	QUALITY SYSTEMS: Need for ISO 9000 and other Quality systems,	1	03-11-2022		TLM1	CO5	T&R1	
50.								
51.	ISO 9000:2000 Quality System,	1	04-11-2022		TLM2	CO5	T&R1	
52.	Implementation of Quality system,	1	07-11-2022		TLM2	CO5	T&R1	
53.	Documentation,	1	09-11-2022		TLM2	CO5	T&R1	
54.	Quality Auditing,	1	10-11-2022		TLM2	CO5	T&R1	
55.	TS 16949, ISO 14000- concepts.	1	11-11-2022		TLM2	CO5	T&R1	
56.	Revision & Quiz	1	14-11-2022		TLM2	CO5	T&R1	
57.		1	16-11-2022		TLM2&6	CO5	T&R1	
58.		1	17-11-2022					
59.		1	18-11-2022					
No. of classes required to complete UNIT-V		**07 + 03 (Beyond Syllabus)**						
II Mid Examinations – 21-11-2022 to 26-11-2022								

TEACHING LEARNING METHODS:

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

ACADEMIC CALENDER:

Commencement of Class work		**11-07-2022**	
I Phase of Instructions	11-07-2022	03-09-2022	8 Weeks
CRT Classes	05-09-2022	17-09-2022	2 Weeks
I Mid Examinations	19-09-2022	24-09-2022	1 Week
II Phase of Instructions	26-09-2022	19-11-2022	8 Weeks
II Mid Examinations	21-11-2022	26-11-2022	1 Week
Preparation and Practicals	28-11-2022	03-12-2022	1 Week
Semester End Examinations	05-12-2022	17-12-2022	2 Weeks

PART – C

EVALUATION PROCESS:

Evaluation Task	**COs**	**Marks**
Assignment/Quiz – 1	1	A1=05
Assignment/Quiz – 2	2	A2=05
I-Mid Examination	1,2	B1=20
I-Online Mid Examination	1,2	C1=10
Assignment/Quiz – 3	3	A3=05
Assignment/Quiz – 4	4	A4=05
Assignment/Quiz – 5	5	A5=05
II-Mid Examination	3,4,5	B2=20
II-Online Mid Examination	3,4,5	C2=10
Evaluation of Assignment/Quiz Marks: A=(A1+A2+A3+A4+A5)/5	1,2,3,4,5	**A=05**
Evaluation of Mid Marks: B=75% of Max(B1,B2)+25% of Min(B1,B2	1,2,3,4,5	**B=20**
Evaluation of Online Mid Marks: C=75% of Max(C1,C2)+25% of Min(C1,C2)	1,2,3,4,5	**C=10**
Attendance: D (≥95% =**5M**; 90%≤A<95%=**4M;** 85%≤A<90%=**3M;** 80%≤A<85%=**2M;** 75%≤A<80%=**1M; <75%=0M)**	-	**D=05**
Cumulative Internal Examination: A+B+C+D	**1,2,3,4,5**	**A+B+C+D=40**
Semester End Examinations: E	**1,2,3,4,5**	**E=60**
Total Marks: A+B+C+D+E	**1,2,3,4,5**	**100**

PART – D

PROGRAMME EDUCATIONAL OBJECTIVES (PEOs):

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

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

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

PROGRAMME OUTCOMES (POs):

Engineering Graduates will be able to:

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

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

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

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

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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 : KAMALA PRIYA B
Course Name & Code : POWER PLANT ENGINEERING
L-T-P Structure : 4-1-0 Credits : 3
Program/Sem/Sec : B.Tech., MECH., VIII-Sem., Sections- A,B&C A.Y : 2019-20

PRE-REQUISITE: Thermodynamics, Thermal Engineering.

COURSE EDUCATIONAL OBJECTIVES (CEOs): To study the various power plant potentials and its working principles.

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

CO 1	Understand the basics of various energy sources and various circuits in steam power plant(Understanding level).
CO 2	Comprehend Diesel and Gas Turbine power generating plants (Remembering level).
CO 3	Analyze salient features of Hydroelectric and Nuclear power plants and interpret the data (Analysis level).
CO 4	Differentiates direct and indirect energy conversion systems (Understanding level).
CO5	Evaluate economics of power generation and pollution issues related to power plants (Apply level).

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

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1	2	2	1	1	-	-	-	-	-	-	-	1	1	-	-
CO2	3	1	2	2	-	1	2	-	-	-	-	1	2	-	2
CO3	2	3	-	3	-	1	2	-	-	-	-	1	2	-	2
CO4	2	3	1	2	-	-	1	-	-	-	-	1	2	-	1
CO5	3	2	2	3	-	-	3	-	-	-	-	1	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 Arora &Domkundwar, A course in Power Plant Engineering- Dhanpat Rai & Company 5th Revised Reprint Edition, 2004.
T2 P.K.Nag, Power Plant Engineering,3rd Edition ,2008 TMH, New Delhi,

REFERENCE BOOKS:

R1 R.K.Rajput, A Text book of Power Plant Engineering, Laxmi Publications ,2nd Edition 2001
R2 M.M.ElWakil, Power plant technology, 3rd Edition 2010 TMH.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I:STEAM POWER PLANT

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.	Course Outcomes	1			TLM1	
2.	Introduction to Subject	1			TLM1	
3.	Energy sources, Resources and Development of Power in India.	1			TLM1	
4.	Steam power plant:Plant Layout, Working of Different circuits, factors to be considered for the selection of the plant	1			TLM2	
5.	Types of Coal-Fuel handling systems-	1			TLM1	
6.	Coal handling, choice of coal handling equipment, Coal Storage	2			TLM1, TLM2	
7.	Ash handling systems	2			TLM2	
8.	Overfeed and underfeed stokers	1			TLM1, TLM2	
9.	Traveling grate stokers, Spreader stokers, Retort stokers	1			TLM1, TLM2	
10.	Pulverized fuel burning system and, its components	2			TLM2	
11.	Draught system, Cyclone furnace	1			TLM1	
12.	Design and construction, Dust collectors,	1			TLM1	
13.	Dust collectors, Electrostatic precipitator	1			TLM2	
14.	Cooling towers and heat rejection	2			TLM1, TLM2	
15.	TUTORIAL-1	1			TLM3	
No. of classes required to complete UNIT-I: 19				No. of classes taken:		

UNIT-II:DIESEL POWER PLANT AND GAS TURBINE PLANT

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.	Plant layout with auxiliaries-Fuel storage	1			TLM2	
2.	Fuel supply system-Air supply system-Exhaust system	1			TLM2	
3.	Water cooling system-Lubrication system	1			TLM2	

4.	Starting system-Supercharging	1			TLM1	
5.	Advantages and Disadvantages of Diesel plants over Thermal plants	1			TLM1	
6.	TUTORIAL-2	1			TLM3	
7.	Introduction-Classification-Layout with auxiliaries	1			TLM2	
8.	Principles of working of Closed and Open cycle gas turbines	1			TLM1	
9.	Combined cycle power plants and comparison	1			TLM1, TLM2	
10.	TUTORIAL-3	1			TLM3	
No. of classes required to complete UNIT-II: 10				No. of classes taken:		

UNIT-III:HYDRO ELECTRIC POWER PLANT AND NUCLEAR POWER PLANT

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.	Hydrology-Hydrological cycle	1			TLM1	
2.	Rainfall- Run off Hydrograph	1			TLM1	
3.	Flow duration curve- Mass curve	1			TLM2	
4.	Site selection of hydro plant-Typical layout	1			TLM1	
5.	Different types of hydro plants	2			TLM2	
6.	TUTORIAL-4	1			TLM3	
7.	Nuclear Fission and Fusion - Nuclear Fuels-	1			TLM1	
8.	Breeding- Components of Reactor	1			TLM1	
9.	Types of Nuclear Reactors-Pressurized water reactor(PWR)-	1			TLM1	
10.	Boiling water reactor (BWR)	1			TLM1	
11.	CANDU reactor-Gas cooled reactor	1			TLM1	
12.	Liquid metal cooled reactor-Fast Breeder Reactor	1			TLM1	
13.	Nuclear waste and its Disposal	1			TLM1	
14.	TUTORIAL-5	1			TLM3	
No. of classes required to complete UNIT-III: 15				No. of classes taken:		

UNIT-IV :POWER FROM NON-CONVENTIONAL SOURCES AND DIRECT ENERGY CONVERSION SYSTEMS

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Solar power plants-Utilization of Solar collectors.	1			TLM1	
2.	Different types of solar collectors.	2			TLM1, TLM2	

3.	Principle of working of Wind energy-Types	1			TLM1	
4.	Tidal Energy	1			TLM2	
5.	TUTORIAL-6	1			TLM3	
6.	Solar cell- Fuel cell	1			TLM1	
7.	Thermo Electric and Thermo ionic conversion system	1			TLM1	
8.	MHD power generation	2			TLM2	
9.	TUTORIAL-7	1			TLM3	
No. of classes required to complete UNIT-IV:11				No. of classes taken:		

UNIT-V :POWER PLANT ECONOMICS AND POLLUTION & 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
1.	Fixed cost-Operating cost.-Fluctuating loads	1			TLM1	
2.	General arrangement of Power Distribution-Load curves	1			TLM1	
3.	Load duration curve and its problems	2			TLM1	
4.	Various load factors in power plants	1			TLM1	
5.	TUTORIAL-8	1			TLM3	
6.	Particulate and gaseous pollutants	1			TLM1	
7.	Air and Water pollution by Thermal plants	1			TLM1	
8.	Acid rains -Methods to control pollution	1			TLM1	
9.	Numerical Problems on economics of power generation	3			TLM1	
10.	TUTORIAL-9	1			TLM3	
11.	Revision	1				
12.	Revision	1				
13.	Revision	1				
No. of classes required to complete UNIT-V: 13				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
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
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
Cumulative Internal Examination (CIE) : A+M	25
Semester End Examination (SEE)	75
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
Kamala Priya B	Mr. K.Lakshmi Prasad	Dr. P.Vijay Kumar	Dr. S. Pichi Reddy

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE HANDOUT

PART-A

Name of Course Instructor : Mr..Imran Abdul
Course Name & Code : Utilization of Electrical Energy & 17EE81
L-T-P Structure : 4-0-0 Credits : 3
Program/Sem/Sec : B.Tech., ME., VII-Sem., Sections- B&C A.Y:2022-23

PRE-REQUISITES: -

COURSE EDUCATIONAL OBJECTIVES (CEOs): This course enables the student to familiarize with characteristics of various drives, comprehend the different issues related to heating, welding and illumination.

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

CO 1	Choose a drive for particular application
CO 2	Identify a heating /welding scheme for a given application
CO 3	Illustrate the different schemes of traction and its main components
CO 4	Develop a lighting scheme for a given practical case
CO5	Assess the economic aspects in utilization of electrical energy

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

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3	PSO4
CO1	3	2	3	-	2	-	-	-	-	-	-	1	-	-	-	
CO2	3	2	1	2	-	-	-	-	-	-	-	1	-	-	-	
CO3	3	1	3	-	3	-	-	-	-	-	-	2	-	-	-	
CO4	3	2	2	2	-	-	-	-	-	-	-	1	-	-	-	
CO5	2		1		-	-		-				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).

TEXT BOOKS:

T1 C.L.Wadhwa "Generation,Distribution and Utilization of Electrical energy, New Age International Publishers,3rd Edition,2015.

T2 N.V.Suryanarayana "Utilization of electric power including electric drives and electric traction,New age international publishers New Delhi,2nd edition 2014.

REFERENCE BOOKS:

R1 Art & Science of Utilization of electrical Energy, Partab, Dhanpat Rai & Co., 2004.

R2 Utilization of Electric Energy, E. Openshaw Taylor and V. V. L. Rao, Universities Press, 2009.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: ELECTRIC HEATING AND WELDING:

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, CEO's &CO's	1	11/7/22		TLM1/TLM2	
2.	Advantages & applications of Electric heating	1	13/7/22		TLM1/TLM2	
3.	Classification of electric heating	1	14/7/22		TLM1/TLM2	
4.	Classification of electric heating	1	15/7/22		TLM1/TLM2	
5.	Requirement of good heating material	1	18/7/22		TLM1/TLM2	
6.	Electric Arc Furnace	1	20/7/22		TLM1/TLM2	
7.	Induction heating	1	21/7/22		TLM1/TLM2	
8.	Dielectric heating	1	22/7/22		TLM1/TLM2	
9.	Electric welding	1	25/7/22		TLM1/TLM2	
10.	Resistance welding	1	27/7/22		TLM1/TLM2	
11.	Arc welding	1	28/7/22		TLM1/TLM2	
No. of classes required to complete UNIT-I:11				No. of classes taken:		

UNIT-II: ILLUMINATION ENGINEERING:

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction	1	29/7/22		TLM1/TLM2	
2.	Nature of light &Laws of illumination	1	1/8/22		TLM1/TLM2	
3.	Lighting schemes, sources of light	1	3/8/22		TLM1/TLM2	
4.	Fluorescent Lamps	1	4/8/22		TLM1/TLM2	
5.	Compact Fluorescent Lamps	1	5/8/22		TLM1/TLM2	
6.	LED Lamps discharge lamps	1	8/8/22		TLM1/TLM2	
7.	Sodium Vapour Lamp	1	10/8/22		TLM1/TLM2	
8.	mercury vapour lamps	1	11/8/22		TLM1/TLM2	
9.	Neon lamps	1	12/8/22		TLM1/TLM2	
10.	Comparison between tungsten &fluorescent tubes	1	17/8/22		TLM1/TLM2	
11.	Requirements of good lighting	1	18/8/22		TLM1/TLM2	

12.	Street lighting	1	19/8/22		TLM1/TLM2	
13.	Mid-I Exams	1	20/9/22			
14.	Mid-I Exams	1	21/9/22			
15.	Mid-I Exams	1	23/9/22			
16.	Mid-I Exams	1	24/9/22			
No. of classes required to complete UNIT-II: 12				No. of classes taken:		

UNIT-III: ELECTRIC DRIVES

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction	1	22/8/22		TLM1/TLM2	
2.	Factors affecting selection of motor	1	24/8/22		TLM1/TLM2	
3.	Types of loads	1	25/8/22		TLM1/TLM2	
4.	Elements of electric drive	1	26/8/22		TLM1/TLM2	
5.	Steady state characteristics of drives	1	29/8/22		TLM1/TLM2	
6.	Transient characteristics of drives	1	31/8/22		TLM1/TLM2	
7.	Size of motor	1	1/9/22		TLM1/TLM2	
8.	Load equalization	1	2/9/22		TLM1/TLM2	
9.	Industrial applications	1	26/9/22		TLM1/TLM2	
No. of classes required to complete UNIT-III:10				No. of classes taken:		

UNIT-IV: ELECTRIC TRACTION

S.No.	Topics to be covered	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	HOD Sign Weekly
1.	Introduction	1	28/9/22		TLM1/TLM2	
2.	Requirement of an ideal traction system	1	3/10/22		TLM1/TLM2	
3.	Supply system for electric traction	1	7/10/22		TLM1/TLM2	
4.	Supply system for electric traction	1	13/10/22		TLM1/TLM2	
5.	Train movement	1	17/10/22		TLM1/TLM2	
6.	Mechanism of train movement	1	19/10/22		TLM1/TLM2	
7.	Traction motors	1	20/10/22		TLM1/TLM2	
8.	Modern trends in electric traction	1	21/10/22		TLM1/TLM2	
9.	Automation in electric traction	1	24/10/22		TLM1/TLM2	
10.	problems	1	26/10/22		TLM1/TLM2	
No. of classes required to complete UNIT-IV:10				No. of classes taken:		

UNIT-V: REFRIGERATION AND AIRCONDITIONING

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

1.	Introduction	1	27/10/22		TLM1/TLM2	
2.	Types of refrigeration	1	28/10/22		TLM1/TLM2	
3.	Compression refrigeration	1	1/11/22		TLM1/TLM2	
4.	Basic vapour compression cycle	1	3/11/22		TLM1/TLM2	
5.	Absorption refrigeration system	1	4/11/22		TLM1/TLM2	
6.	Operational features	1	7/11/22		TLM1/TLM2	
7.	household refrigerator	1	9/11/22		TLM1/TLM2	
8.	Air-conditioning	1	10/11/22		TLM1/TLM2	
9.	Types of air conditioning system	1	11/11/22		TLM1/TLM2	
10.	Room air conditioner	1	14/11/22		TLM1/TLM2	
11.	Summer & winter air conditioning systems	1	16/11/22		TLM1/TLM2	
12.	Cooling capacity of an air conditioner	1	17/11/22		TLM1/TLM2	
13.	Working of electrical system	1	18/11/22		TLM1/TLM2	
14.	Revision	1	18-11-2022		TLM1/TLM2	
15.	Mid-II Exams	1	22-11-2022			
16.	Mid-II Exams	1	23-11-2022			
17.	Mid-II Exams	1	25-11-2022			
18.	Mid-II Exams	1	26-11-2022			
No. of classes required to complete UNIT-V:				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
1.	Economic aspects in utilization of electrical energy	1	28-09-2022		TLM1/TLM2	

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

PART-C (EVALUATION PROCESS (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

ACADEMIC CALENDAR:

Description	From	To	Weeks
I Phase of Instructions-1	11-07-2022	03-09-2022	8W
CRT classes	05-09-2022	17-09-2022	2W
I Mid Examinations	19-09-2022	24-09-2022	1W
II Phase of Instructions	26-09-2022	19-11-2022	8W
II Mid Examinations	21-11-2022	26-11-2022	1W
Preparation and Practicals	28-11-2022	03-12-2022	1W
Semester End Examinations	5-12-2022	17-12-2022	2W

PART-D

PROGRAMME OUTCOMES (POs):

PO 1	**Engineering knowledge**: Apply the knowledge of mathematics, science, engineering fundamentals, and an engineering specialization to the solution of complex engineering problems.
PO 2	**Problem analysis**: Identify, formulate, review research literature, and analyze complex engineering problems reaching substantiated conclusions using first principles of mathematics, natural sciences, and engineering sciences.
PO 3	**Design/development of solutions**: Design solutions for complex engineering problems and design system components or processes that meet the specified needs with appropriate consideration for the public health and safety, and the cultural, societal, and environmental considerations.
PO 4	**Conduct investigations of complex problems**: Use research-based knowledge and research methods including design of experiments, analysis and interpretation of data, and synthesis of the information to provide valid conclusions.
PO 5	**Modern tool usage**: Create, select, and apply appropriate techniques, resources, and modern engineering and IT tools including prediction and modelling to complex engineering activities with an understanding of the limitations
PO 6	**The engineer and society**: Apply reasoning informed by the contextual knowledge to assess societal, health, safety, legal and cultural issues and the consequent responsibilities relevant to the professional engineering practice
PO 7	**Environment and sustainability**: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

PO 8	**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	Specify, design and analyze systems that efficiently generate, transmit and distribute electrical power
PSO 2	Design and analyze electrical machines, modern drive and lighting systems
PSO 3	Specify, design, implement and test analog and embedded signal processing electronic systems
PSO 4	Design controllers for electrical and electronic systems to improve their performance.

Course Instructor	Course Coordinator	Module Coordinator	HOD
Imran Abdul	Mrs T.Naga Durga	Dr M. S. giridhar	Dr. J.Siva Vara Prasad

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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 : C.Rajamallu
Course Name & Code : **BASIC CIVIL ENGINEERING & 17CE80**
L-T-P Structure : 3-0-0 Credits : 3
Program/Sem/Sec : B.Tech., ME., VII-Sem., Sections- A-B-C- A.Y : 2022-23

PRE-REQUISITE: Nil

COURSE EDUCATIONAL OBJECTIVES (CEOs):. This course deals with the importance of building planning, properties and applications of various building materials, soil classification and different types of foundations, important aspects of surveying, levelling operations and identify the terminology in roadway and railway networks, principles of water resources and environmental engineering

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

CO 1	Recognize the importance of building planning for construction
CO 2	Identify appropriate building materials for construction purposes
CO 3	Distinguish the different types of soils and foundations required for specific usage
CO 4	Evaluate the basics of surveying and levelling operations for field application and categorize the important elements of roadway and railway networks
CO 5	Discriminate the importance of quantity and quality aspects of water in the society and priorities for sanitation management.

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

COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	PSO1	PSO2	PSO3
CO1				2		2	1				2		2	1	3
CO2				2		2	1				2		2	1	3
CO3		1	1	2		2	1				2		2	1	3
CO4		1	1	2		2	1				2		2	1	3
CO5		1	1	2	2	2	1				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 1. M.S Palanichamy "Basic Civil Engineering", Tata McGraw Hill Publishing 2000.

REFERENCE BOOKS:

R1 1. S S Bhavikatti "Basic Civil Engineering", New age International Publications, 2010

R2 C P Kaushik& S S Bhavikatti "Basic Civil Engineering ", New age International Publications 2010.

PART-B

COURSE DELIVERY PLAN (LESSON PLAN):

UNIT-I: Building Planning

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.	Building Planning- Role of a Civil Engineer	1	11-07-2022		TLM2	
2.	Inter connection among specializations in Civil Engineering	1	13-07-2022		TLM2	
3.	Elements of a Building, Basic Requirements of a Building	1	14-07-2022		TLM2	
4.	Planning- Hot and dry climates	1	15-07-2022		TLM1	
5.	Hot and wet climates, Cold climatic conditions	1	18-07-2022		TLM1	
6.	Aspect and Prospect, Roominess- Grouping, Privacy, circulation	1	20-07-2022		TLM1	
7.	Sanitation and ventilation	1	21-07-2022		TLM2	
8.	Orientation, Economy, Role of Bye-laws	1	22-07-2022		TLM2	
No. of classes required to complete UNIT-I:				No. of classes taken:		

UNIT-II: Building Materials

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.	Building Materials - Classification	1	25-07-2022		TLM1	
2.	Rocks, Bricks Classification, Composition, Properties, Commercial forms, Uses	1	27-07-2022		TLM2	
3.	Timber, Ply wood Classification, Composition, Properties, Commercial forms	1	28-07-2022		TLM2	
4.	Glass, Bitumen Classification, Composition, Properties, Commercial forms,	1	29-07-2022		TLM1	

5.	Aluminium, Cement Classification, Composition, Properties, Commercial forms,	1	01-08-2022		TLM1	
6.	Steel, Concrete Classification, Composition, Properties, Commercial forms, Uses	1	03-08-2022		TLM2	
7.	Mortar Classification, Composition, Properties, Commercial forms, Uses	1	04-08-2022		TLM2	
8.	Concept of eco-friendly materials, examples	1	05-08-2022		TLM1	
No. of classes required to complete UNIT-II:				No. of classes taken:		

UNIT-III: SOIL CLASSIFICATION AND FOUNDATION

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.	Types of soils, soil classification	1	8-08-2022		TLM1	
2.	Engineering properties	1	10-08-2022		TLM1	
3.	Bearing Capacity of soil, purpose and methods of improving bearing capacity	1	12-08-2022		TLM2	
4.	Foundations – Requirements	1	17-08-2022		TLM2	
5.	Loads, Types	1	22-08-2022		TLM1	
6.	for special structures-water tanks-	1	24-08-2022		TLM2	
7.	for special structures- silos, chimneys- transmission line towers- cooling towers, telecommunication towers	1	25-08-2022		TLM1	
No. of classes required to complete UNIT-III:07				No. of classes taken:		

UNIT-IV : SURVEYING, LEVELLING & HIGHWAY NETWORK

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.	Objective of surveying– Principles, applications and uses of - chain surveying	1	26-08-2022		TLM2	
2.	theodolite, levelling, contour maps, Planimeter, EDM concept	1	29-08-2022		TLM2	
3.	linear distance and area measurement	1	1-09-2022		TLM1	
4.	Total station- GIS-Concept and applications in civil engineering.	1	2-09-2022		TLM2	
5.	CRT Classes:5-9-2022 to 17-09-2022					
6.	MID-1 Examinations:19-09-2022 to 24-09-2022					
7.	Indian highways- Basic terminology- Classification of roads - PIEV theory - Traffic signs - IRC Code provisions	1	26-09-2022		TLM1	

8.	Indian railways –Permanent way and components of railway track	1	28-09-2022		TLM2	
9.	Gauges – Rails -Sleepers – Ballast.	1	29-09-2022		TLM2	
No. of classes required to complete UNIT-IV:07				No. of classes taken:		

UNIT-V : WATER RESOURCES AND ENVIRONMENTAL ENGINEERING

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.	Objectives of water supply system-Sources of water supply-Hydrologic cycle	1	30-09-2022		TLM1	
2.	Rainfall measurement - Purpose of dams, reservoirs, intakes, infiltration galleries	1	10-10-2022		TLM1	
3.	Water demands –Water quality parameters and their impacts - Principles of water treatment	1	12-10-2022		TLM2	
4.	Objectives of water distribution systems	1	13-10-2022		TLM2	
5.	Wastewater characteristics and their impacts	1	14-10-2022		TLM1	
6.	Principles of sewage treatment	1	17-10-2022		TLM2	
7.	Disposal of sewage	1	19-10-2022		TLM2	
8.	Water quality standards for – drinking purpose,	1	20-10-2022		TLM2	
9.	irrigation, -making	1	21-10-2022		TLM1	
10.	curing of concrete	1	26-10-2022		TLM1	
11.	methods of water distribution systems	1	27-10-2022		TLM2	
12.	Sewage generation in a society	1	28-10-2022		TLM2	
13.	Revision of Unit-1	1	2-11-2022		TLM2	
14.	Revision of Unit-1	1	3-11-2022		TLM2	
15.	Revision of Unit-2	1	4-11-2022		TLM1	
16.	Revision of Unit-2	1	7-11-2022		TLM1	
17.	Revision of Unit-3	1	9-11-2022		TLM1	
18.	Revision of Unit-3	1	10-11-2022		TLM1	
19.	Revision of Unit-4	1	11-11-2022		TLM2	
20.	Revision of Unit-4	1	14-11-2022		TLM2	
21.	Revision of Unit-5	1	16-11-2022		TLM2	
22.	Revision of Unit-5	1	17-11-2022		TLM1	
No. of classes required to complete UNIT-V:12				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

ACADEMIC CALENDAR:

Description	From	To	Weeks
I Phase of Instructions-1	11-07-2022	03-09-2022	6W
CRT Classes	05-09-2022	17-09-2022	2W
I Mid Examinations	19-09-2022	24-09-2022	1W
II Phase of Instructions	26-09-2022	19-11-2022	7W
II Mid Examinations	21-11-2022	26-11-2022	1W
Preparation and Practicals	28-11-2022	03-12-2022	1W
Semester End Examinations	05-12-2022	17-12-2022	2W

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	Possesses necessary skill set to analyze and design various systems using analytical and software tools related to civil engineering
PSO 2	Possesses ability to plan, examine and analyse the various laboratory tests required for the professional demands
PSO 3	Possesses basic technical skills to pursue higher studies and professional practice in civil engineering domain

Course Instructor	Course Coordinator	Module Coordinator	HOD
(C.Rajamallu)	(C.Rajamallu)	(B.Narasimha Rao)	(S.Pichi Reddy)

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DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code	**: 17ME72(R 17 Reg)**	**Lab: Robotics and Simulation Lab**	
A.Y.	**: 2022-2023**	**Class: B. Tech – VII Semester (Section – C)**	
Lab/Practicals	**: 3 hrs/ Week**	**Continuous Internal Assessment**	**: 40**
Credits	**: 01**	**Semester End Examination**	**: 60**
Name of the Faculty	**: Dr.M.B.S Sreekara Reddy(Associate Professor) / K. Karthik (Assistant Professor)**		

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

PRE-REQUISITES:Robotics, CAD/CAM

COURSE EDUCATIONAL OBJECTIVES:

The main objective of this course is to demonstrate and analysis of various types of robots.

COURSE OUTCOMES:

After completion of the course student will be able to:

CO1. Develop Robot Programmes to use to control commands

CO2. Experiment the robot operations like palletizing, gluing, spray painting, polishing, loading and unloading.

CO3. Simulate forward and inverse kinematic movements of a robot using MATLAB.

CO4. Perform the demo operations on SCARA and PUMA using Robo analysers.

Mapping of COs with POs and PSOs:

LABORATORY COURSE ARTICULATION MATRIX (Correlation between COs and POs and PSOs):

Mapping of Course Outcomes (COs) with Programme Outcomes (POs) & PSOs – Robotics and SimulationLab (17ME72)															
		POs											PSOs		
		1	2	3	4	5	6	7	8	9	10	11	12	PSO 1	PSO 2	PSO 3
COs	CO1	2	1			3							2		3	
	CO2	1	2	2		3							2		3	
	CO3	3	3		2	3							3			3
	CO4	1	1			3							2			3
1: Slight (Low) 2: Moderate (Medium) 3: Substantial (High)															

Lab instructor (s) **Head of the Department**

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Credits	**: 01**	**Semester End Examination**	**: 60**

Name of the Faculty : **Dr.M.B.S Sreekara Reddy (Associate Professor) / K. Karthik (Assistant Professor)**

PROGRAM OUTCOMES (POs):

Engineering Graduates will be able to:

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

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

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

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

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

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

7.Environment and sustainability: Understand the impact of the professional engineering solutions in societal and environmental contexts, and demonstrate the knowledge of, and need for sustainable development.

8.Ethics: Apply ethical principles and commit to professional ethics and responsibilities and norms of the engineering practice.

9.Individual and team work: Function effectively as an individual, and as a member or leader in diverse teams, and in multidisciplinary settings.

10.Communication: Communicate effectively on complex engineering activities with the engineering community and with society at large, such as, being able to comprehend and write effective reports and design documentation, make effective presentations, and give and receive clear instructions.

11.Project management and finance: Demonstrate knowledge and understanding of the engineering and management principles and apply these to one's own work, as a member and leader in a team, to manage projects and in multidisciplinary environments.

12. Life-long learning: Recognize the need for, and have the preparation and ability to engage in independent and life-long learning in the broadest context of technological change.

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

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

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

Lab instructor (s) **Head of the Department**

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Lab/Practicals	**: 3 hrs/ Week**	**Continuous Internal Assessment : 40**
Credits	**: 01**	**Semester End Examination : 60**
Name of the Faculty	**: Dr.M.B.S Sreekara Reddy (Associate Professor) / K. Karthik (Assistant Professor)**	

LIST OF EXPERIMENTS

At least 10 Experiments from 12 overall should be conducted

LIST OF EXPERIMENTS:

1. Program for commands like joint command, circle command
2. Program for commands SPLINE command (continues path)
3. Program for PTP command
4. Palletizing
5. Loading / Unloading
6. Gluing
7. Spray painting
8. Polishing
9. Simulateof Robot with 2 Dof, 3 Dof, 4 Dof using ROBOANALYZER
10. SimulateSCARA,PUMA using ROBOANALYZER
11. Simulate forward and inverse kinematics RR Manipulator using MATLAB
12. Simulate forward and inverse kinematics RP Manipulator using MATLAB

SOFTWARE PACKAGES

ARISTO ROBOT, ROBOANALYZER, MATLAB, C Prog

REFERENCE: Robotics and Simulation Lab Manual

Lab instructor (s) **Head of the Department**

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A.Y.	**: 2022-2023**	**Class: B. Tech – VII Semester (Section – C)**
Lab/Practicals	**: 3 hrs/ Week**	**Continuous Internal Assessment : 40**
Credits	**: 01**	**Semester End Examination : 60**
Name of the Faculty	**: Dr.M.B.S Sreekara Reddy (Associate Professor) / K. Karthik (Assistant Professor)**	

Notification of Cycles (Section –C)

At least TEN experiments may be conducted.

Cycle - I

1. Program for commands like joint command, circle command
2. Program for commands SPLINE command (continues path)
3. Program for PTP command
4. Palletizing
5. Loading / Unloading
6. Gluing

Cycle – II

7. Spray painting
8. Polishing
9. Simulation of Robot with 2 Dof, 3 Dof, 4 Dof using ROBOANALYZER
10. Simulation of SCARA,PUMA using ROBOANALYZER
11. Simulate forward and inverse kinematics RR Manipulator using MATLAB
12. Simulate forward and inverse kinematics RP Manipulator using MATLAB

SOFTWARE PACKAGES

ARISTO ROBOT, ROBOANALYZER, MATLAB

Lab instructor (s) **Head of the Department**

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DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code : 17ME72(R 17 Reg) — **Lab: Robotics and Simulation Lab**

A.Y. : 2022-2023 — **Class: B. Tech – VII Semester (Section – C)**

Lab/Practicals : 3hrs/ Week — **Continuous Internal Assessment** : 40

Credits : 01 — **Semester End Examination** : 60

Name of the Faculty : Dr.M.B.S Sreekara Reddy (Associate Professor) / K. Karthik (Assistant Professor)

Lab Occupancy Time Table (B.Tech Mech Engg- VIISem:Section – C/ S)

↓Day/Date →	*9.00 – 9.50*	*9.50-10.40*	*10.50-11.40*	*11.40-12.30-*	*12.30-1.30*	*1.30-2.20*	*2.20-3.10*	*3.10-4.00*
Monday					*LUNCH BREAK*			
Tuesday						*R&S LAB BATCH-B2*		
Wednesday								
Thursday								
Friday						*R&S LAB BATCH-B1*		
Saturday								

Faculty – In Charges:

S.No	Class	Section	Lab Assistant	Faculty – In Charge
1	B.Tech – VII Semester	*C/ S*	Mr. P. Guna Sundar Reddy	Dr.M.B.S Sreekara Reddy Reddy Mr. K. Karthik

Lab instructor (s) **Head of the Department**

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Laboratory Code : 17ME72(R 17 Reg) — **Lab: Robotics and Simulation Lab**

A.Y. : 2022-2023 — **Class: B. Tech – VII Semester (Section – C)**

Lab/Practicals : 3 hrs/ Week — **Continuous Internal Assessment** : 40

Credits : 01 — **Semester End Examination** : 60

Name of the Faculty : Dr.M.B.S Sreekara Reddy (Associate Professor) / K. Karthik (Assistant Professor)

Batches (Section – C)

S.No	Batches	Regd.Nos	Total No. of Students
1	B. Tech –VII Sem - C/S	18761A0317,17-3F0,19761A0396-3A0,19761A03A1- 3A9, 3B0 – 3B5,3B6-3C4, 3C5 – 3D0, 3D1-3E0,20765A0331-344	61
2	Batch A1	18761A0317,17761A03F0,19761A0396– 399, 3A0– 3A9,3B0-3C4	31
3	Batch A2	19761A03C5–3E0, 20765A0331-344	30

Sub Batch of A11:
18761A0317,17-3F0,19761A0396– 3A8 (15)

S. No	Batch	Registered Nos	Total
1	A111	18761A0317,17-3F0,19761A0396	03
2	A112	197671A0397-399	03
3	A113	197671A03A0-3A2	03
4	A114	197671A03A3-3A5	03
5	A115	197671A03A6-3A7	02
6	A116	197671A03A8	01
Total (A11)			15

Sub Batch of A12:
19761A03A9 – 3C4 (16)

S. No	Batch	Registered Nos	Total
1	A121	197671A03A9-3B1	03
2	A122	197671A03B2-3B4	03
3	A123	197671A03B5-3B7	03
4	A124	197671A03B8-3C0	03
5	A125	197671A03C1-3C2	02
6	A126	197671A03C3-3C4	02
Total (A12)			16

Sub Batches of A21:
19761A03C5–3D9 (15)

S. No	Batch	Registered Nos	Total
1	A211	19761A03C5-3C7	03
2	A212	19761A03C8-3D0	03
3	A213	19761A03D1-3D3	03
4	A214	19761A03D4-3D6	03
5	A215	19761A03D7-3D8	02
6	A216	19761A03D9	01
Total (A21)			15

Sub Batches of A22:
19761A03E0,20765A0331-344 (15)

S. No	Batch	Registered Nos	Total
1	A221	19761A03E0-20765A0332	03
2	A222	20765A0333-335	03
3	A223	20765A0336-338	03
4	A224	20765A0339-340	02
5	A225	20765A0341-342	02
6	A226	20765A0343-344	02
Total (A22)			15

Lab instructor (s) **Head of the Department**

LAKIREDDY BALI REDDY COLLEGE OF ENGINEERING

(AUTONOMOUS)

Accredited by NAAC & NBA (CSE, IT, ECE, EEE & ME)

Approved by AICTE, New Delhi and Affiliated to JNTUK, Kakinada

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

DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code : 17ME72(R 17 Reg) **Lab: Robotics and Simulation Lab**
A.Y. : 2022-2023 **Class: B. Tech – VII Semester (Section – C)**
Lab/Practicals : 3 hrs/ Week **Continuous Internal Assessment : 40**
Credits : 01 **Semester End Examination : 60**
Name of the Faculty : Dr.M.B.S Sreekara Reddy (Associate Professor) / K. Karthik (Assistant Professor)

Schedule of Experiments (Section – C: C1 Batch)

S.No	Batches	Regd. Nos	Total No. of Students
1	**Batch A1**	**18761A0317,17761A03F0,19761A0396– 399, 3A0– 3A9,3B0-3C4**	**31**

S.No.	Name of the experiment	No. of Classes Required	Tentative Date of Completion	Teaching Learning Methods
1	**Introduction to Robotics and Simulation Lab, Demonstration of all experiments, CEOs, and COs of the Laboratory**	2	15-7-2022	TLM4
Cycle I				
2	Program for commands like joint command, circle command	2	22-07-2022	TLM4
3	Program for commands SPLINE command (continues path)	2	29-7-2022	TLM4
4	Program for PTP command	2	5-8-2022	TLM4
5	Palletizing	2	12-8-2022	TLM4
6	Loading / Unloading	2	26-8-2022	TLM4
	I Mid Exams	19-09-2022 to 26-09-2022		
7	Gluing	2	2-09-2022	TLM4
Cycle II				
8	Spray painting, Polishing	2	09-09-2022	TLM4
9	Simulation of Robot with 2 Dof, 3 Dof, 4 Dof using ROBOANALYZER	2	16-9-2022	TLM4
10	Simulation of SCARA, PUMA using ROBOANALYZER	2	23-9-2022	TLM4
11	Simulate forward and inverse kinematics RR Manipulator using MATLAB	2	14-10-2022	TLM4
12	Simulate forward and inverse kinematics RP Manipulator using MATLAB	2	4-11-2022	TLM4
13	Internal Exam	2	18-11-2022	TLM4
	II Mid Exams	**21-11-2022 to 26-11-2022**		
	Preparation and Practicals	**28-11-2022 to 03-12-2022**		
	Semester End Exams	**05-12-2022 to 17-12-2022**		

Lab instructor (s) **Head of the Department**

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DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code : 17ME72(R 17 Reg) **Lab: Robotics and Simulation Lab**

A.Y. : 2022-2023 **Class: B. Tech – VII Semester (Section – C)**

Lab/Practicals : 3 hrs/ Week **Continuous Internal Assessment** : 40

Credits : 01 **Semester End Examination** : 60

Name of the Faculty :Dr.M.B.S Sreekara Reddy (Associate Professor) / K. Karthik (Assistant Professor)

Schedule of Experiments (Section – C: C2 Batch)

S.No	Batches	Regd.Nos	Total No. of Students
1	Batch A2	19761A03C5–3E0, 20765A0331-344	30

S.No.	Name of the experiment	No. of Classes Required	Tentative Date of Completion	Teaching Learning Methods
1	**Introduction to Robotics and Simulation Lab, Demonstration of all experiments, CEOs, and COs of the Laboratory**	2	12-07-2022	TLM4
Cycle I				
2	Program for commands like joint command, circle command	2	19-07-2022	TLM4
3	Program for commands SPLINE command (continues path)	2	26-07-2022	TLM4
4	Program for PTP command	2	02-08-2022	TLM4
5	Palletizing	2	16-08-2022	TLM4
6	Loading / Unloading	2	23-08-2022	TLM4
	I Mid Exams	19-09-2022 to 26-09-2022		
7	Gluing	2	30-08-2022	TLM4
Cycle II				
8	Spray painting, Polishing	2	6-09-2022	TLM4
9	Simulation of Robot with 2 Dof, 3 Dof, 4 Dof using ROBOANALYZER	2	13-09-2022	TLM4
10	Simulation of SCARA, PUMA using ROBOANALYZER	2	20-09-2022	TLM4
11	Simulate forward and inverse kinematics RR Manipulator using MATLAB	2	11-10-2022	TLM4
12	Simulate forward and inverse kinematics RP Manipulator using MATLAB	2	01-11-2022	TLM4
13	Internal Exam	2	15-11-2022	TLM4
	II Mid Exams	**21-11-2022 to 26-11-2022**		
	Preparation and Practicals	**28-11-2022 to 03-12-2022**		
	Semester End Exams	**05-12-2022 to 17-12-2022**		

Lab instructor (s) **Head of the Department**

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DEPARTMENT OF MECHANICAL ENGINEERING

Laboratory Code	**: 17ME72(R 17 Reg)**	**Lab: Robotics and Simulation Lab**	
A.Y.	**: 2022-2023**	**Class: B. Tech – VII Semester (Section – C)**	
Lab/Practicals	**: 3 hrs/ Week**	**Continuous Internal Assessment**	**: 40**
Credits	**: 01**	**Semester End Examination**	**: 60**
Name of the Faculty	**:Dr.M.B.S Sreekara Reddy (Associate Professor) / K. Karthik (Assistant Professor)**		

Evaluation Criterion for Laboratory

EVALUATION PROCESS:

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

Lab instructor (s) **Head of the Department**

DEPARTMENT OF MECHANICAL ENGINEERING
COURSE HANDOUT

PROGRAM : B.Tech. VII-Sem., ME – C/S

ACADEMIC YEAR : 2022-23

COURSE NAME & CODE : **M & I Lab, 17ME73**

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

COURSE CREDITS : 1

COURSE INSTRUCTOR : K. Lakshmi Prasad/P. Mounika

COURSE COORDINATOR :

PRE-REQUISITE: Metrology & Instrumentation

COURSE OBJECTIVE:

The main objective of this course is to provide hands on experience in using metrological instruments and calibrate them.

COURSE OUTCOMES (CO)

CO 1	Perform linear, angular and gear measurements in manufacturing industries.
CO 2	Analyze the measurement of the surface roughness and perform alignment tests.
CO 3	Calibrate the displacement, load and speed measuring instruments.
CO 4	Calibrate pressure, flow and vibration measuring instruments.

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

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

REFERENCE:

R1	Lab Manual

COURSE DELIVERY PLAN (LESSON PLAN): Section-C

Batch: C1 (17761A03F0, 19761A0396 TO 19761A03C4)

S.No.	Experiment to be conducted	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Reference	HOD Sign Weekly
1.	Introduction	3	12.07.22		TLM8	-	
2.	Demonstration	3	19.07.22		TLM8	R1	
3.	Experiment-1	3	26.07.22		TLM8	R1	
4.	Experiment-2	3	02.08.22		TLM8	R1	
5.	Experiment-3	3	16.08.22		TLM8	R1	
6.	Experiment-4	3	23.08.22		TLM8	R1	
7.	Experiment-5	3	30.08.22		TLM8	R1	
8.	Demonstration	3	27.09.22		TLM8	-	
9.	Experiment-6	3	04.10.22		TLM8	R1	
10.	Experiment-7	3	11.10.22		TLM8	R1	
11.	Experiment-8	3	18.10.22		TLM8	R1	
12.	Experiment-9	3	25.10.22		TLM8	R1	
13.	Experiment-10	3	01.11.22		TLM8	R1	
14.	Repetition	3	08.11.22		TLM8	R1	
15.	Internal Exam	3	15.11.22		TLM8	R1	

DETAILS:

Batch No.	Reg. No. of Students	Number of Students
C1A	17761A03F0, 19761A0396,397	3
C1B	19761A0398-3A0	3
C1C	19761A03A1-3A3	3
C1D	19761A03A4-3A6	3
C1E	19761A03A7-3A9	3

Batch No.	Reg. No. of Students	Number of Students
C1F	19761A03B0-3B2	3
C1G	19761A03B3-3B5	3
C1H	19761A03B6-3B8	3
C1I	19761A03B9-3C1	3
C1J	19761A03C2-3C4	3

Batch:C2 (19761A03C5 TO 19761A03E0, 20765A0331 TO 20765A0344)

S.No.	Experiment to be conducted	No. of Classes Required	Tentative Date of Completion	Actual Date of Completion	Teaching Learning Methods	Reference	HOD Sign Weekly
1.	Introduction		15.07.22		TLM8	R1	
2.	Demonstration	3	22.07.22		TLM8	-	
3.	Experiment-1	3	29.07.22		TLM8	R1	
4.	Experiment-2	3	05.08.22		TLM8	R1	
5.	Experiment-3	3	12.08.22		TLM8	R1	
6.	Experiment-4	3	26.08.22		TLM8	R1	
7.	Experiment-5	3	02.09.22		TLM8	R1	
8.	Demonstration	3	30.09.22		TLM8	-	
9.	Experiment-6	3	07.10.22		TLM8	R1	
10.	Experiment-7	3	14.10.22		TLM8	R1	
11.	Experiment-8	3	21.10.22		TLM8	R1	
12.	Experiment-9	3	28.10.22		TLM8	R1	
13.	Experiment-10	3	04.11.22		TLM8	R1	
14.	Repetition	3	11.11.22		TLM8	R1	
15.	Internal Exam	3	18.11.22		TLM8	R1	

DETAILS:

Batch No.	Reg. No. of Students	Number of Students
C2A	19761A03C5-3C7	3
C2B	19761A03C8-3D0	3
C2C	19761A03D1-3D3	3
C2D	19761A03D4-3D6	3
C2E	19761A03D7-3D9	3

Batch No.	Reg. No. of Students	Number of Students
C2F	19761A03E0,20765A0331, 332	3
C2G	20765A0333--335	3
C2H	20765A0336-338	3
C2I	20765A0339-341	3
C2J	20765A0342-344	3

Schedule:

Batch No:	Exp. 01	Exp. 02	Exp. 03	Exp. 04	Exp. 05	Exp. 06	Exp. 07	Exp. 08	Exp. 09	Exp. 10
C1A/C2A	MET1	MET2	MET3	MET4	MET5	INT6	INT7	INT8	INT9	INT10
C1B/C2B	MET2	MET3	MET4	MET5	MET1	INT7	INT8	INT9	INT10	INT6
C1C/C2C	MET3	MET4	MET5	MET1	MET2	INT8	INT9	INT10	INT6	INT7
C1D/C2D	MET4	MET5	MET1	MET2	MET3	INT9	INT10	INT6	INT7	INT8
C1E/C2E	MET5	MET1	MET2	MET3	MET4	INT10	INT6	INT7	INT8	INT9
C1F/C2F	INT6	INT7	INT8	INT9	INT10	MET1	MET2	MET3	MET4	MET5
C1G/C2G	INT7	INT8	INT9	INT10	INT6	MET2	MET3	MET4	MET5	MET1
C1H/C2H	INT8	INT9	INT10	INT6	INT7	MET3	MET4	MET5	MET1	MET2
C1I/C2I	INT9	INT10	INT6	INT7	INT8	MET4	MET5	MET1	MET2	MET3
C1J/C2J	INT10	INT6	INT7	INT8	INT9	MET5	MET1	MET2	MET3	MET4

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

ACADEMIC CALENDAR:

Description	From	To	Weeks
I Phase of Instructions-1	11.07.22	03.09.22	8
CRT Classes	05.09.22	17.09.22	2
I Mid Examinations	19.09.22	24.09.22	1
II Phase of Instructions	26.09.22	19.11.22	8
II Mid Examinations	21.11.22	26.11.22	1
Preparation and Practical	28.11.22	03.12.22	1
Semester End Examinations	05.12.22	17.12.22	2

EVALUATION PROCESS:

Evaluation Task	Cos	Marks
Day to Day Evaluation: A	1,2,3,4	A=20
Internal Lab Exams: B	1,2,3,4	B=10
Viva Marks: C	1,2,3,4	C=5
Attendance	1,2,3,4	D=5
Cumulative Internal Examination : CIE=A+B+C+D	**1,2,3,4**	**CIE=40**
Semester End Examinations: SEE	**1,2,3,4**	**SEE=60**
Total Marks: CIE+SEE	**1,2,3,4**	**100**

LIST OF EXPERIMENTS:

Exp.No.	Name of the Experiment	Related CO
MET1	Measurement of lengths, heights, diameters by Vernier calipers and micrometers.	CO1
MET2	Measurement of bores by dial bore indicators.	CO1
MET3	Taper measurement by using balls and rollers.	CO1
MET4	Use of gear teeth Vernier calipers and checking the chordal addendum and chordal height of spur gear.	CO2
MET5	Machine tool alignment of test on the lathe or milling machine	CO2
INT6	Calibration of Pressure Gauges	CO4
INT7	Study and calibration of LVDT transducer for displacement measurement.	CO3
INT8	Calibration of strain gauge for load measurement.	CO3
INT9	Study and calibration of photo and magnetic speed pickups for the measurement of speed.	CO3
INT10	Calibration of capacitive transducer for linear displacement.	CO3

NOTIFICATION OF CYCLE

Exp.No.	Name of the Experiment	Related CO
MET1	Measurement of lengths, heights, diameters by Vernier calipers and micrometers.	CO1
MET2	Measurement of bores by dial bore indicators.	CO1
MET3	Taper measurement by using balls and rollers.	CO1
MET4	Use of gear teeth Vernier calipers and checking the chordal addendum and chordal height of spur gear.	CO2
MET5	Machine tool alignment of test on the lathe or milling machine	CO2
INT6	Calibration of Pressure Gauges	CO4
INT7	Study and calibration of LVDT transducer for displacement measurement.	CO3
INT8	Calibration of strain gauge for load measurement.	CO3
INT9	Study and calibration of photo and magnetic speed pickups for the measurement of speed.	CO3
INT10	Calibration of capacitive transducer for linear displacement.	CO3

PROGRAMME EDUCATIONAL OBJECTIVES:

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

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

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

PROGRAM OUTCOMES (POs)

Engineering Graduates will be able to:

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

PROGRAMME SPECIFIC OUTCOMES (PSOs):

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

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

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

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