CMR Engineering College

Affiliated to JNTU, Hyderabad and Approved by AICTE-New Delhi

Department of Mechanical Engineering

LABORATORY IMPROVEMENTFOR FUTURE TRENDS (LIFT)--I MANUAL

A Guide for execution of Lab Courses

VISION OF THE INSTITUTE:

To be recognized as a premier institution in offering value based and futuristic quality technical education to meet the technological needs of the society.

MISSION OF THE INSTITUTE:

- To impart value based quality technical education through innovative teaching and learning methods.
- To continuously produce employable technical graduates with advanced skills to meet the current and future technological needs of the society.
- To prepare the graduates for higher learning with emphasis on academic and industrial research.

DEPARTMENT OF MECHANICAL ENGINEERING

VISION

To be a center of excellence in offering value based and futuristic quality technical education in the field of mechanical engineering.

MISSION

- To impart quality technical education imbibed with values by providing state of the art laboratories and effective teaching and learning process.
- To produce industry ready mechanical engineering graduates with advanced technical and lifelong learning skills.
- To prepare graduates for higher learning and research in mechanical engineering and its allied areas.

PROGRAMME OUTCOMES

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.

Program Specific Outcomes:

1. Design a Thermal system for efficiency improvement as per industrial needs.
2. Design and manufacture mechanical components using advanced manufacturing technology as per the industrial needs.

PROGRAMMES EDUCATIONAL OBJECTIVES

- PEO 1: The students will exhibit strong knowledge in mathematics, sciences and engineering for successful employment or higher education in mechanical engineering.
- PEO 2: The students will design and implement complex modeling systems conduct research and work with multi disciplinary teams.
- PEO 3: The students will be capable of communicating effectively with lifelong learning attitude and function as responsible member of global society.

LAB IMPROVEMENT FOR FUTURE TRENDS PROGRAMME (LIFT)

INDEX

GUIDELINES FOR LAB IMPROVEMENT FOR FUTURE TRENDS (LIFT)

I. **Aim of the Lift Programme:**

The main aim of the Lift programme in laboratory is to innovate, modify the existing facilities in labs, to create awareness among the students and develop Industry –Institution interactions and reach the standards in laboratories.

II. **Functions of the Lift Programme:**

(i) To create better understanding among all the staff and lab staff. /technicians about the concepts of Lift and other lab related activities.

(ii) To Prepare Gap Analysis: This involves collection of requirements from each lab of every Department, information about expansion of labs, repairs and maintenance of labs etc.

(iii) To arrange Industrial Visits: A lab and lift related industrial visit will be organized in a year for II or III year students and a report is to be submitted by all the students who visited that particular industry.

(iv) A report on Smart (Shadow) Engineering: This involves arrangement of Industrial practical learning's, submission of Industrial visit report, Technical Survey reports and Market Survey of a product for development in laboratories.

(v) Verification of all the laboratories in every department by Lift Team along with the Principal and Concerned HODs to check whether the activities are going according to Lift guidelines, record keeping, Lab Manuals and Viva sessions etc.

(vi) Check for LEAD Experiments and its follow up

(vii) Submission of proposals related to R&D, Project and Consultancy from lab staff to Principal Sir for further approvals.

LAB IMPROVEMENT FOR FUTURE TRENDS PROGRAMME (LIFT CONCEPT)

1. OBJECTIVES AND RELEVANCE:

The main objective of the Lift concept in lab course is to provide practical hands on experience for each student by making them with good exposure to different experiments and uplift the knowledge levels of student in various fields with different applications.

2. SCOPE:

The main scope of the Lift lab course is to cover all the experiments as per the schedule given in the prescribed week wise periods. With this, a student can better understand the concepts and operating systems so that he could be able to get better knowledge about each lab.

3. PREREQUISITES:

The basic level idea related to each experiment should be provided to the students before conducting main lab course Following details are to be explained related to experiment:

a. Introduction to experiment – 30 min
b. Operating of the equipment/instrument/software
c. Record of Experimental results.
d. Sample Calculations / Executable Programmes

4. SYLLABUS AS PER JNTUH:

The lab course should be planned as per the JNTUH syllabus. In this, LEAD experiments should also be included in cycle of experiments.

5. GUIDELINES FOR LEAD EXPERIMENT:

a. A Lead Experiment is selected apart from all the other experiments that in JNTU Syllabus
b. This experiment is exclusively new idea with the background from the rest of the experiments that continuously running in each laboratory.
c. Lead experiment should utilize the existing resources within the laboratory itself.
d. Every student should aware of Lead Experiment and himself involved in doing and knowing about the experimental technique.
e. A separate page is provided to record lead experiment in record book stating all details like Aim, Procedure and Record of Results.
f. A Lead experiment should be a unique one from all the other experiments.
g. Each Lab Staff/Technicians must clearly explain all the students about the concept of Lead Experiment and make them understand before going to that Experiment.

6. SUGGESTED BOOKS:

The suggested books should be recommended to the students as per the JNTUH syllabus Prescribed.

7. WEBSITES (USEFUL LINKS):

The useful links should be provided to the students, where they can get easily accessing the knowledge of the experiment.

8. EXPERT DETAILS:

The expert details should be provided based on the experimental importance.

9. VIVA SCHEDULES:

An exclusive viva will be conducted for all the students to test their knowledge, ability to pick up from the experimental techniques, skill development in laboratories. This viva will be organized depending upon sessions schedule in each lab.

10. MAPPING OF LAB WITH PROJECT/CONSULTANCY/R & D:

The lab course should be designed in such a way that it should meet the requirements of research and development as well as consultancy projects. Also the Proposals of Project/R&D/Consultancy are as follows:

Proposal 1: Project Design & Execution.
Proposal 2: R& D Level Project Design & Execution.
Proposal 3: Consultancy Task / Project Design & Development.

a. PROPOSAL FOR R & D ACTIVITY:

1. An exact paper from a National/International journal in this entitled area/subject/area (IEEE Format) AND/OR
2. An article/white paper from a magazine /journal/weekly/any periodical in the entitled Subject AND/OR
3. An Advanced technology development/ proposal/article publication from any source of information.

b. PROPOSAL FOR PROJECT ACTIVITY:

A Proposal of a hobby/mini/proto/general/model/proto type project with extended abstract, Block Diagram/Circuit/Flow diagram and clear references may be presented and executed.

GUIDELINES FOR HOBBY/INCUBATION ACTIVITY:

A. A Hobby project/activity is necessary for staff as well as the students to improve ones individual skills in laboratory work.
B. This Project consists of selecting the suitable innovation in existing theory or practicals with each lab and suggest for proposals within the scope of the organization.
C. After proposals are subjected to preliminary acceptance, then final proposals and budgeting will be started out.

D. In view of this hobby project, a proposal is made jointly either from students or both students and staff and submit abstract along with block or flow diagram stating the applications and suitability in lab. This project will be sent for further approvals.

c. PROPOSAL FOR CONSULTANCY:

A programme/machine/product of utility may be proposed to develop for in house usage/ industrial requirements may be useful for any outside agency that can be marketable in order to generate revenue through consultancy.

d. PROPOSALS (WEEK WISE INDUSTRIAL VISITS)(IN HOUSE OR OUTSIDE VISIT)/TRAINING PROGRAMMES:

TABLE 1: INDUSTRIAL VISITS

S.no	Type of Industry	Nature of industry	Date of visit	No. of students participated	Year/branch	remarks

TABLE 2: INDUSTRIAL TRAINING (Smart Engg)
(Career Visit Approval)

S.no	Name of the Course	Nature Of Industry	Duration of Training	Authority	Date of Training/Certificate No.	remarks

GUIDELINES FOR SHADOW ENGINEERING(VIP)
INDUSTRIAL VISITS (IIP – INNOVATIVE INDUSTRIAL LEARNING PROGRAM):

OBJECTIVES OF SHADOW ENGINEERING:

1. The program which uplifts the knowledge of the students related to laboratories.
2. To improve the industry-college interactions.
3. To create industry like environment for all the students in order to make future Assignment.
4. This program leads to matrixing with the students.

e. CALIBRATION/INSTALLATION AND TESTING:

Calibration: Aim of this concept is to check:

i. Whether all the equipment is functioning correctly as per the standards.
ii. To bring correctness in the errors of instrument or equipment.
iii. To rectify the errors if any.

Installation: Aim of this concept is to make and maintain installation procedure for a new equipment or already existing equipment

Testing : Aim of this concept is to test the equipment after installation whether it Meets the existing standards.

After calibration the details of equipment should be submitted in following format:

S.no	Type of equipment	Certificate No	Certificate issued by	Date of calibration	Date of calibration due	Remarks

TROUBLE SHOOTING SCHEDULES:

A proposal is to be made from each lab branch wise. The proposal should carry following details related to specific equipment in lab.

S.no., Equipment Name , Type of Problem (Too much Noise, Abnormal Sound, Corrupt Software, Anti Virus Problem, Missing of Display, CRT not working, Motor is not giving signal, Digital display is not working, Break of tools, Mis alignment of machine elements, PLC is not properly working), Expected Reasons (Bearing failure, Improper alignment of machine centers, Missing of vibration pads etc)

Trouble shooting exercises should be properly recorded in a separate format as mentioned below:

S.no.	Date of recording Activity	Equipment Name	Type of Trouble	Remedial Activity	Remarks

Laboratory Additional Activity Coverage

A. **Learn Emerging Advancements in the Domain (LEAD) Experiments:**

Sl.No.	Activity	Date of Coverage	Sign. Of Faculty	Remarks

B. Trouble shooting Activity :

Sl.No.	Activity	Date of Coverage	Sign. Of Faculty	Remarks

C. Calibration / Testing / Installation Activity :

Sl.No.	Activity	Date of Coverage	Sign. Of Faculty	Remarks

D. Project / Consultancy /R&D Activity (if any):

Sl.No.	Activity	Date of Coverage	Sign. Of Faculty	Remarks

NAME OF THE LABORATORIES

S.No.	YEAR-SEM	NAME OF THE LAB
1.	II B.TECH-ISEM	Mechanics of solids
2	II B.TECH-ISEM	Metallurgy Lab
3.	III B.TECH-ISEM	Machine Tools
4.	III B.TECH-ISEM	Metrology
5.	III B.TECH-ISEM	Thermal Engineering
6.	IV B.TECH-ISEM	Instrumentation & Control Systems
7.	IV B.TECH-ISEM	CAD/CAM

SUBJECTWISE LAB PLANNER

Name of the Subject: METALLURGY & MECHANICS OF SOLIDS LAB

1. **Objectives and Relevance**
2. **Scope**
3. **Prerequisites**
4. **Syllabus**
5. **Lab Schedule**
6. **Suggested Books**
7. **Websites**
8. **Experts' Details**
9. **Mapping of Lab with Projects/Consultancy/R&Ds**
10. **Industrial Visits**
11. **Shadow Engineering**
12. **Calibration, Testing and Inspection**
13. **Preventive Maintenance Schedules**
14. **Troubleshooting**

1. OBJECTIVES AND RELEVANCE:

The main objective of the lab course is to gain practical hands on experience by exposing the students to experiments various tests like Tensile test, Deflection test, Compression test, Impact test, Torsion test and Hardness test

2. SCOPE:

Understanding of the various material testing methods and their applications

3. PREREQUISITES:

Theoretical knowledge on the subject Mechanics of Solids, which deals with the behavior and mechanics of solid materials.

PART - A

PREAMBLE

This lab covers the experiments in Mechanics of Solids subject. Out of the 14 experiments in the syllabus prescribed by JNTU, 10 are compulsory and any 2 experiments can be done from the remaining 4

4. MECHANICS OF SOLIDS EXPERIMENTS

EXPERIMENT NO. 1
Direct Tension Test

OBJECTIVE:

Determination of Young's modulus, yield and breaking stresses, Percentage of elongation, Percentage of reduction in cross sectional area in a circular rod subjected to direct tensile load

PREREQUISITES:

Knowledge about concepts like stress, strain and elastic modulus

DESCRIPTION:

a. Introduction to experiment -20 min

b. Preparing the equipment and specimen

c. Experimental determination of loads at different points

d. Graphical determination of various parameters

APPLICATIONS:

Tensile strength of rods of various materials

EXPERIMENT NO. 2 (LEAD EXPERIMENT)
Bending test on (a) simply supported beam (b) cantilever

OBJECTIVE:
To find the Young's modulus of the material of the given beam (Mild Steel or Wood)

PREREQUISITES:
Knowledge about various formulas regarding the deflections of beams

DESCRIPTION:

a. Introduction to experiment – 20 min

b. Preparation of deflection test set up

c. Experimental determination of Young's modulus of mild steel (or) wood

APPLICATIONS:
Design of beams

EXPERIMENT NO. 3
Torsion Test

OBJECTIVE:
To find the rigidity modulus of the material of the given square rod (Mild Steel)

PREREQUISITES:
Knowledge about Elastic constants

DESCRIPTION:

a. Introduction to experiment – 20 min

b. Setting up the torsion testing machine

c. Experimental determination of rigidity modulus of MS square rod

APPLICATIONS:
Design of members subjected to torsion

EXPERIMENT NO. 4
Hardness test – Brinell hardness Test, Rockwell hardness Test

OBJECTIVE:
To find the hardness number of the material of a given specimen (Aluminium, Copper, Brass, Mild steel)

PREREQUISITES:
Basic knowledge of mechanical properties

DESCRIPTION:

a. Introduction to experiment – 20 min

b. Preparation of the specimen and setting up the hardness testing machine

c. Experimental determination of hardness number

APPLICATIONS:

Quality testing (strength) of materials

EXPERIMENT NO. 5

Test on spring – Tension test and Compression test

OBJECTIVE:

To find the rigidity modulus of the material of a spring subjected to tension and compression

PREREQUISITES:

Basic knowledge about types of loads and elastic constants

DESCRIPTION:

a. Introduction to experiment – 20 min

b. Setting of Spring testing machine

c. Experimental determination of rigidity modulus of the material of a spring subjected to

i) Tension

ii) Compression

APPLICATIONS:

Design of springs

EXPERIMENT NO. 6

Impact test - Izod impact test and Charpy impact test

OBJECTIVE:

Experimental determination of the impact strength of the material of given mild steel specimen

PREREQUISITES:

Knowledge about impact loads

DESCRIPTION:

a. Introduction to experiment – 20 min

b. Preparation of the impact testing machine for Izod test or charpy test

c. Experimental determination of the impact strength of the mild steel specimen

APPLICATIONS:

Design of members subjected to impact loads

METALLURGY EXPERIMENTS

EXPERIMENT NO. 1

Preparation and study of micro structure of pure metals like iron, copper and aluminum

OBJECTIVE:

To prepare a specimen and study the micro structure of pure metals like iron, copper and aluminum

PREREQUISITES:

Basic knowledge about pure metals and their characteristics

DESCRIPTION:

a. Introduction to experiment – 20 min
b. Preparation of specimen
c. Study of the micro structure of the specimen under a microscope
d. Drawing the micro structure of the specimen

APPLICATIONS:

Study of characteristics of materials

EXPERIMENT NO. 2

Preparation and study of micro structure of mild steel

OBJECTIVE:

To prepare a specimen and study the micro structure of mild steel

PREREQUISITES:

Basic knowledge about pure metals and their characteristics

DESCRIPTION:

a. Introduction to experiment – 20 min
b. Preparation of specimen
c. Study of the micro structure of the specimen under a microscope
d. Drawing the micro structure of the specimen

APPLICATIONS:

Study of characteristics of materials

EXPERIMENT NO. 3

Study of micro structure of cast iron

OBJECTIVE:

To study the micro structure of cast iron

PREREQUISITES:

Basic knowledge about pure metals and their characteristics

DESCRIPTION:

a. Introduction to experiment – 20 min
b. Preparation of specimen
c. Study of the micro structure of the specimen under a microscope
d. Drawing the micro structure of the specimen

APPLICATIONS:

Study of characteristics of materials

EXPERIMENT NO. 4

Hardenability of steels by Jominey end quench test Study of hardness of materials before and after heat treatment (Lead Experiment)

OBJECTIVE:

To find the Hardenability of steels by Jominey end quench test

PREREQUISITES:

Basic knowledge about pure metals and their characteristics

DESCRIPTION:

a. Introduction to experiment – 20 min
b. Heat treating the specimen
c. Finding the Hardenability of the specimen

APPLICATIONS:

Study of characteristics of materials

5. LAB SCHEDULE:

CYCLE 1

Batches	week-1	week-2	week-3	week-4	week-5	week-6	week-7
B1	Demo	Exp.1	Exp.2	Exp.3	Exp.4	Exp.5	test
B2	Demo	Exp.2	Exp.3	Exp.4	Exp.5	Exp.1	test
B3	Demo	Exp.3	Exp.4	Exp.5	Exp.1	Exp.2	test
B4	Demo	Exp.4	Exp.5	Exp.1	Exp.2	Exp.3	test
B5	Demo	Exp.5	Exp.1	Exp.2	Exp.3	Exp.4	test
B6	Demo	Exp.1	Exp.2	Exp.3	Exp.4	Exp.5	test
B7	Demo	Exp.2	Exp.3	Exp.4	Exp.5	Exp.1	test
B8	Demo	Exp.3	Exp.4	Exp.5	Exp.1	Exp.2	test
B9	Demo	Exp.4	Exp.5	Exp.1	Exp.2	Exp.3	test
B10	Demo	Exp.5	Exp.1	Exp.2	Exp.3	Exp.4	test

CYCLE 2

Batches	week-1	week-2	week-3	week-4	week-5	week-6	week-7
B1	Exp.6	Exp.7	Exp.8	Exp.9	Exp.10	Lead	test
B2	Exp.7	Exp.8	Exp.9	Exp.10	Exp.6	Lead	test
B3	Exp8	Exp.9	Exp.10	Exp.6	Exp.7	Lead	test
B4	Exp.9	Exp.10	Exp.6	Exp.7	Exp.8	Lead	test
B5	Exp.10	Exp.6	Exp.7	Exp.8	Exp.9	Lead	test
B6	Exp.6	Exp.7	Exp.8	Exp.9	Exp.10	Lead	test
B7	Exp.7	Exp.8	Exp.9	Exp.10	Exp.6	Lead	test
B8	Exp8	Exp.9	Exp.10	Exp.6	Exp.7	Lead	test
B9	Exp.9	Exp.10	Exp.6	Exp.7	Exp.8	Lead	test
B10	Exp.10	Exp.6	Exp.7	Exp.8	Exp.9	Lead	test

(B) VIVA SCHEDULE:

ROUND - 1

Batches	week-1	week-2	week-3	week-4	week-5	week-6	week-7
B1,B2,B3	viva					viva	
B1,B2,B3		viva					viva
B1,B2,B3			viva				
B1,B2,B3				viva			
B1,B2,B3					viva		

ROUND – 2

Batches	week-1	week-2	week-3	week-4	week-5	week-6	week-7
SG1	viva					viva	
SG2		viva					viva
SG3			viva				
SG4				viva			
SG5					viva		

*SG: Selected Group with a maximum of 6 or 12 students

SCHEME OF EVALUATION OF LAB

LAB EXTERNALS

S.NO	Write up	Results(by skill assistant)	Final Evaluation	Viva
1	1.Aim 2.Apparatus&chemicals etc 3.Principle etc 4 Procedure etc 5.Tabler form etc 6.Model Graph etc 7. Result etc	Based on observation, How the student is arranging the apparatus or system or circuit and typical readings	Based on correctness of the graph to the expected graph and Results	Based on understanding of Experiment and theoretical questions in the related subjects

LAB INTERNALS

Day to Day Evalution-15					Internal Exam-10		
Uniform	Observation &Record	Performance of the Experiment	Result	Viva	Write up	Arrangement or connections etc & Results	Viva
Marks-3	Marks-3	Marks-3	Marks-3	Marks-3	Marks-3	Marks-3	Marks-4
Total marks-25							

6. **SUGGESTED BOOKS**

1 Strength of materials by R.S.Khurmi & Gupta
2 Solid Mechanics by Popov
3Strength of materials by Ryder G.H, Macmillan (Long man Publication)
4Strength of materials by W.A.Nash, (TMH)
5Strength of materials by Ramamrutham (Dhanpath rai Publications)
6Strength of materials by Bhavikatti (Vikas Publications).

7. WEB SITES

1. http://nptel.iitm.ac.in/video.php?subjectId=112107147
2. http://link.springer.com/journal/11223
3. http://www.slideshare.net/Gowthambe/strength-of-materials-11754748
4. www.solidmechanics.org
5. www.accessengineeringlibrary.com
6. www.phindia.com
7. www.engineersedge.com
8. www.iitk.ac.in
9. www.iitd.ernet.in
10. www.iitb.ac.in
11. www.iitm.ac.in
12. www.iitr.ac.in
13. www.iitg.ernet.in

8. **EXPERTS DETAILS**

The expert details which have been mentioned below are only a few of the eminent ones known Internationally, Nationally and Locally.

INTERNATIONAL

1. Prof. Ossama Abduelkhalik, Department of Mechanical Engineering, University O f Michigan Email: ooabdelk@mtu.edu

NATIONAL

1. Prof. Kalyanmoy Deb Department of Mechanical Engineering IIT Kanpur E mail: deb@iitk.ac.in
2. Professor M.S. Siva Kumar Department of Mechanical Engineering IIT Madras E mail: mssiva@iitm.ac.in
3. Dr, Satish Sharma & Dr. S.P. Harsha Department of Mechanical Engineering IIT Roorkee E mail: Sshmefme@Iitr.Ernet.In

REGIONAL

1. Dr. Chennakeshava Reddy, Dept of Mechanical Engg, JNTU CE, Hyd. Email: dr_acreddy@yahoo.com
2. Prof. L.V.A. Sesha Sayi, Rtd Professor &Head, Osmania University, Hyderabad

9. MAPPING OF LAB WITH PROJECT/CONSULTANCY/R & D:

The lab course should be designed in such a way that it should meet the requirements of research and development as well as consultancy projects. Also the Proposals of Project/R&D/Consultancy are as follows:

Proposal 1: Project Design & Execution
Proposal 2: R& D Level Project Design & Execution
Proposal 3: Consultancy Task / Project Design & Development

<u>PROPOSAL FOR R & D ACTIVITY</u>

1. An exact paper from a National/International journal in this entitled area/subject/area(IEEE Format)

AND/OR

2. An article/white paper from a magazine /journal/weekly/any periodical in the entitled Subject

AND/OR

3. An Advanced technology development/ proposal/article publication from any source of Information

Sample for Serial No:1

EXACT PAPER FROM A NATIONAL/INTERNATIONAL JOURNAL:

Chiang Mai J. Sci. 2009; 36(3): 276-286
www.science.cmu.ac.th/journal-science/josci.html
Contributed Paper

Effect of Hardness Test on Precipitation Hardening Aluminium Alloy 6061-T6 Chee Fai Tan*, and Mohamad R. Said

Faculty of Mechanical Engineering, Universiti Teknikal Malaysia Melaka, Locked bag 1752, 76109 Durian Tunggal, Melaka, Malaysia.

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ABSTRACT

The paper presents an experimental study on precipitation of aluminum alloy 6061-T6 to determine the effect of artificial ageing on the hardness of aluminum alloy 6061-T6. The precipitation hardening is a thermal treatment, which consists of a heat treatment, quenching and artificial ageing process. The experimental study is focused on artificial ageing upon which the temperature is varying between 175^{O}C to 420 ^{O}C at different period of time. The Vickers hardness test is to evaluate the hardness of aluminum alloy 6061-T6 before and after ageing process. The optimum ageing time and temperature is determined at the end of this experiment to obtain reduction in energy and total cost. The study leads to the conclusion that the optimum aged was achieved between 175^{O}C to 195^{O}C with 2 to 6 hours of ageing time. The contribution of short time ageing is comparable to that of longer ageing time from previous studies.

Keywords: aluminum alloy 6061-T6, precipitation, hardness test, ageing

PROPOSAL FOR PROJECT ACTIVITY

A Proposal of a hobby/mini/proto/general/model/proto type project with extended abstract, Block Diagram/Circuit/Flow diagram and clear references may be presented and executed.

ABSTRACT ON HOBBY PROJECT

STUDY OF MICRO STRUCTURE AND MECHANICAL PROPERTIES OF HEAT TREATED ALLOYS

Heat treatment is the process of increasing the mechanical properties of metals. This is done by heating the metal in a furnace at the appropriate temperature and then cooling them to room temperature by sudden or gradual quenching in water. The cooling can be done even by keeping the metal in free air. The various heat treatment processes are annealing, normalizing, hardening, tempering, quenching, case hardening, carburizing, nitriding etc. The micro structure of the alloys can be studied by using a metallurgical microscope. The mechanical properties of the metals such as impact strength and hardness number, before and after heat treatment, can be calculated by suitable tests. A study can be made on the comparison of different methods for the same material or even for different metals. The values obtained before and after heat treatment can be tabulated and presented.

10. PROPOSALS (WEEK WISE INDUSTRIAL VISITS) (IN HOUSE OR OUTSIDE VISIT) / TRAINING PROGRAMMES:

TABLE 1 : INDUSTRIAL VISITS

S.no	Type of industry	Nature of industry	Date of visit	No. of students participated	Year/branch	remarks
1	AGARWAL RUBBER PVT LTD	RUBBER		60	II/1V I SEM	
2	ENGINE VALVES,MEDCHAL	VALVES		60	II/IV I SEM	

11. GUIDELINES FOR SHADOW ENGINEERING (VIP)

INDUSTRIAL VISITS (IIP – INNOVATIVE INDUSTRIAL LEARNING PROGRAM):

<u>OHJECTIVES OF SHADOW ENGINEERING</u>

1. The program which uplifts the knowledge of the students related to laboratories.
2. To improve the industry-college interactions.
3. To create industry like environment for all the students in order to make future assignment.
4. This program leads to matrixing with the students.

TABLE 2: INDUSTRIAL TRAINING (Shadow Engg)
(Career Visit Approval)

S.no	Name of the Course	Nature of industry	Duration of Training	Authority	Date of Training/Certificate No.	remarks
1	MECHTRIX	Machine manufacturers	1 WEEK	General Manager		

12. CTIVITIES IN LIFT PROGRAMME:

CALIBRATION/INSTALLATION AND TESTING:

Calibration: Aim of this concept is to check :

i. whether all the equipment is functioning correctly as per the standards
ii. To bring correctness in the errors of instrument or equipment.
iii. To rectify the errors if any

Installation: Aim of this concept is to make and maintain installation procedure for a New equipment or already existing equipment

Testing : Aim of this concept is to test the equipment after installation whether it Meets the existing standards.

The list of equipments (hardware/software) :

Necessity of tools for development and testing
Equipment to be calibrated
Installation of supporting equipment if any.

PROCEDURE FOR CALIBRATION:

Any Equipment or Instrument or Gauge or Machine can be calibrated as the standard guidelines mentioned under:

1. Identify the Equipment/Instrument/Gauge/Machine which is under defective or to be calibrated or correction for error
2. Identify the type of error and estimate its frequency of variation.
3. Check with Master Standards or equipment/instrument/machine which is working correctly and meeting our requirements.
4. Estimate the frequency of deviations from normal mode.
5. If the equipment is under warranty, then inform to concerned supplier or agency who will carry out calibration.
6. If the equipment is out of warranty then we can compare the deviations and set the error rectification.
7. Generally as per the procedure, the equipment or instruments can be calibrated by the agencies and issue calibration certificate which consists of date of calibration, calibration next due date and remarks as mentioned in the following format.
8. Record and keep all the calibration certificates in safe custody.

After calibration the details of equipment should be submitted in following format.

s.no	Type of equipment	Certificate No	Certificate issued by	Date of calibration	Date of calibration due	Remarks
1						
2						
3						

Calibration,Testing and Installation details equipment wise are mentioned as follows:

Case 1: Calibration of Equipment -------------------------------------- if any

Case 2: Installation of Equipment -------------------------------------- if any

Case 3: Testing of Equipment -- if any

Presently there is no new equipment is present for either testing or installations.

13. MAINTAINANCE AND TROUBLESHOOTING:

Maintenance:

Maintenance and trouble shooting of each equipment in a laboratory must follow the following guidelines:

Maintenance Schedules:

(1) Preventive Maintenance Schedules of lab will be decided by lab in charge along with concerned HOD. The details of schedule should be recorded in the following template of format.

S.No.	Name of the Equipment	Date of Maintenance	Type of Activity	Remarks
1				
2				
3				
4				

(2) Maintenance Reports duly signed by in charges as well as HODs and duly approved by Principal periodically.

14. TROUBLE SHOOTING SCHEDULES:

A proposal is to be made from each lab branchwise. The proposal should carry following details related to specific equipment in lab.

S.No., Equipment Name , Type of Problem (Too much Noise, Abnormal Sound, Corrupt Software, Anti Virus Problem, Missing of Display, CRT not working, Motor is not giving signal, Digital display is not working, Break of tools, Mis alignment of machine elements, PLC is not properly working), Expected Reasons (Bearing failure, Improper alignment of machine centres, Missing of vibration pads etc)

Trouble shooting exercises should be properly recorded in a separate format as mentioned below:

S.No.	Date of recording activity	Equipment Name	Type of Trouble	Remedial Activity	Remarks

ASSESSMENT AND ACCREDITATION PROCESDURE

Accreditation is the formal recognition, authorization and registration of a laboratory that has demonstrated its capability, competence and credibility to carry out the tasks. It provides the feedback to laboratories as to whether they are performing according to technical competence as per guidelines of NABL (National Accreditation Board for Testing and Calibration Laboratories)

The laboratory should carry out the following important tasks towards getting ready for accreditation from NABL.

1. Preparation of methodology in each experiment
2. Preparation of Standard Operating procedure for each equipment
3. Preparation of Laboratory Manual as per the guidelines specified by Combined Lab Team(CLT) headed by Principal/HOD/Dean/incharge
4. Ensure Effective environmental conditions(temperature, humidity,storage and placement) in the laboratories by implementing proper housekeeping and cleaning of the equipments from dust, dirt etc.
5. Ensure Calibration of instruments/equipment(Only NABL accredited authorized laboratories provide calibration.
6. All the details of Calibration should be included in the format specified exclusively for calibration procedure.
7. Ensure proper implementation of all the documents, formats to be included in the lab manual.
8. Impart training for all the technicians working in labs about the importance of documentation, log sheets, operating procedure of the lab.
9. Incorporate Internal Lab audits for effective functioning of the laboratories. Audits may be once in a month or 3 months or at the end of the semester. The audit schedule will be decided by the Chairman and Principal of the CLT team.
10. Auditors should submit the detailed report of each lab duly signed to the Principal.
11. Each lab should maintain all the bills/invoices of each instrument or equipment in a separate file.
12. All the stock registers either consumable or non consumable should be updated whenever any purchases of consumables or equipment takes place.
13. All the safety precautions are properly displayed in front of each lab.
14. All the Lead experiments should be maintained separately in a record /record in a separate folder.
15. Based on Pre Assessment report submitted by auditor, corrective actions should be carried out by each lab in charge and that must be forwarded to concerned HOD and Principal.

MACHINE TOOLS AND METROLOGY LAB

1. **Objectives and Relevance**
2. **Scope**
3. **Prerequisites**
4. **Syllabus**
5. **Lab Schedule**
6. **Suggested Books**
7. **Website**
8. **Experts' Details**
9. **Mapping of Lab with Projects/Consultancy/R&Ds**
10. **Industrial Visits**
11. **Shadow Engineering**
12. **Calibration, Testing and Inspection**
13. **Preventive Maintenance Schedules**
14. **Troubleshooting**

1. OBJECTIVES AND RELEVANCE:

The main objective of the lab course is to gain practical hands on experience by exposing the students to general purpose machines like lathe, drilling and milling machine,shaper and planners.

2. SCOPE:

The scope of this lab is to make understand students for machining of various components on different Machines by application of various mechanisms.

3. PREREQUISITES:

Theoretical knowledge on subject Machine tools deals with the basic mechanism related to chip formation Geometrical modelling of various cutting operations and basics of lubrication, different types of chips and different cutting operations.

PART - A

PREAMBLE

This lab covers the experiments in Machine tools subject. The JNTU has given 10 experiments in the syllabus out of which eight experiments are compulsory and from the remaining 2 experiments any two shall be conducted.

4. SYLLABUS-JNTU:

MAIN LINKAGE OF MACHINE TOOLS THEORY WITH LAB EXPERIMENTS:

UNIT-I

No experiments suggested as per the JNTU syllabus. Only tool materials and work piece materials as well as basic concepts of machinability is suggested.

UNIT –II

EXPERIMENT NO.1

Introduction of general purpose machines – Lathe, Drilling machine, Milling machine and shaper.

OBJECTIVE:

The main objective is to understand clearly about all the general purpose machines, its functions and Mechanisms involved in it.

PRE REQUISITES:

Basic mechanisms of Lathe Machines, Drilling machines, Milling machines, Speed, Feed and Depth of Cut In Shaping machines.

DESCRIPTION:

1. Introduction to Experiment – 30 Min
2. Introduction to general purpose machines
3. Introduction to basic level of mechanisms involved in lathe, drilling ,milling, shaper machines
4. Study of mechanisms of lathe,drilling and milling machines
5. Study of gear drive and belt drive lathe machines and types of machine elements as well as accessories.

APPLICATIONS:
1. This mechanism can be practically applied in all the manufacturing sectors of different products.
2. Operations can be useful for the components made as per the drawings given in a production unit.

EXPERIMENT NO: 3 & 4:
3. Step turning and taper turning on lathe machine
4. Thread Cutting and knurling on lathe machine
5. Eccentric Turning on a Lathe (Lead Experiment)

OBJECTIVE:

To make different jobs with different cross sections on a 3 jaw chuck and 4 jaw chuck lathe machines.

PRE REQUISITES:

Basic mechanism of Step turning operations. Mechanisms involved in taper turning operations.

DESCRIPTION:

Introduction to Experiment – 30 Min
Introduction to general purpose machines
Introduction to basic level of mechanisms involved in lathe, drilling,milling, shaper machines
Study of mechanisms of lathe,drilling and milling machines
Study of gear drive and belt drive lathe machines and types of machine elements as well as accessories.

APPLICATIONS:

1. This mechanisms can be practically applied in all the manufacturing sectors of different products.
2. Operations can be useful for the components made as per the drawings given in a production unit.

UNIT III:

EXPERIMENT NO:5(A)

Planning machine, slotting machine, cylindrical grinder, surface grinder and tool and cutter grinder.

OBJECTIVE:

Determination of mechanisms involved in planning machines, slotting machines, mechanisms involved in Cylindrical grinders, Surface grinders etc.

PREREQUISITIES:

It requires basic level of mechanisms involved in planning, slotting, Cylindrical grinding machines. Also a basic concept related to speed, feed and depth of cut belonging to different machine elements is needed.

DESCRIPTION:

1. A Basic level of mechanism is studied related to planning, slotting and cylindrical grinding machines
2. Calculation of speed, feed and depth of cut can be done for all the machines.

3. Comparative study of shaping and slotting machines is tobe required in order to make the machining of different components.

APPLICATIONS: 1. planning of components is applied for smooth surface finish.
2.Shaping and slotting is required in order to make splines, keyways and key machining.

EXPERIMENT NO: 5(B)
Shaping and Planing

OBJECTIVE:

Making of a component subjected to shaping and planing operations. To shape the component both on Keyway side as well as splines. Planing is required to make the surface smooth and accurate finish.

PREREQUISITES:
To make these operations a student has to know about the basics of shaping and planning operations.

DESCRIPTION:
1. To check for shaping machine and planing machine
2. To make alignment of machines with the help of dial indicators and spirit level
3. To fix the workpieces and do the necessary operations.

UNIT IV:
EXPERIMENT NO: 6
Drilling and Tapping

OBJECTIVE:
Determination of hole diameters and tap size by using drilling and tapping

PREREQUISITES:

It requires thorough knowledge of basic dimension on elements of drilling and types of tap sets.

DESCRIPTION:
1. Introduction to Experiment – 30 Min
2. Check the operation chart given along with the machine
3. To make a drill on work piece as per the given size on component.
4. To make a tap on already drilled hole.
5. Check the sizes on pierced hole and tapped hole with the given sketch and drawings.

APPLICATIONS:
This operation is very much performed and required in all the drilling operations which are generally used in all the manufacturing sectors. It helps the students toacquire the knowledge about the basic level of drilling and tapping on all the workpieces subjected to different product designs.

EXPERIMENT NO:7
Slotting

OBJECTIVE:
To make the slot on a given workpiece.

PREREQUISITES:
It requires basic knowledge of slotting and shaping operations and its mechanisms.

DESCRIPTION:
1. Introduction to Experiment – 30 Min
2. Fixing of work piece on fixtures.
3. Cehck the alignment on slotting machine
4. Apply the mechanism
5. Finish the operation and check for dimensions.

APPLICATIONS:
1.It makes student to know thoroughly about the slotting of work pieces and make slots on different work pieces.

UNIT-V

EXPERIMENT NO: 8
Milling

OBJECTIVE:
To make milling operation on a given work piece and manufacture of gears.

PREREQUISITES:
Basic knowledge of Milling operations, types of milling and machining parameters related to machine.

DESCRIPTION:
1. Introduction to Experiment – 45 min
2. Check the alignment for machine by using dial indicators.
3. Check for work piece and arbors
4. Check for number of teeth on arbor
5. Prepare the machine ready for operation
6. Select the suitable milling operation
7. Make the finish operation on a given work piece.

APPLICATION:
1.It gives the correct idea to a student for making milling on work pieces.
2. It gives the student about the manufacture of gears by using milling concept.

UNIT-VI:

EXPERIMENT NO: 9
Cylindrical Surface Grinding

OBJECTIVE:
To make a grinding operation on a given component.

PREREQUISITES:

1.It requires knowledge about the grinding technique
2. It requires basics about different types of grinding wheels.
3. It requires knowledge about the different geometrical parameters related to grinding operations.

DESCRIPTION:

1.Introduction to Experiment – 30 Min
2.Check for grinding machine alignment
3. Align the wheels properly for making grinding machine ready
4. Check for abrasive wheels
5. Fix the work piece on fixtures
6. Check for work piece alignment with grinding machine.

UNIT- VII AND VIII:

EXPERIMENT NO. 10
Grinding of Tool angles

OBJECTIVE:

To determine cutting tool angles on a workpiece

PREREQUISITES:

It requires basic knowledge about the surface roughness and surface waviness

DESCRIPTION:

1. Introduction to Experiment – 40 Min
2. Check for grinding machine
3. Align the workpiece
4. Cehck for angles.

APPLICATION:

It can be useful for measuring the various angles on a given workpiece.

5.LAB SCHEDULE:

(A) LAB SCHEDULE: The lab schedule should be planned once in a week. The week wise scheduled experiment should be completed.

CYCLE 1

Batches	**week-1**	**week-2**	**week-3**	**week-4**	**week-5**	**week-6**	week-7
B1(301-12),B2(313-24),B3(325-336)	Demo	Exp.1	Exp.2	Exp.3	Exp.9	Exp.8	test
B4(337-348),B5(349-360),B6	Demo	Exp.2	Exp.10	Exp.9	Exp.8	Exp.1	test
B3	Demo	Exp.10	Exp.9	Exp.8	Exp.1	Exp.2	test
B4	Demo	Exp.9	Exp.8	Exp.1	Exp.2	Exp.10	test

B5	Demo	Exp.8	Exp.1	Exp.2	Exp.10	Exp.9	test

CYCLE 2

Batches	week-1	week-2	week-3	week-4	week-5	week-6	week-7
B1	Exp.3	Exp.4	Exp.6	Exp.11	Exp.12	Exp.5	test
B2	Exp.7	Exp.6	Exp.11	Exp.12	Exp.5	Exp.4	test
B3	Exp.3	Exp.11	Exp.12	Exp.5	Exp.4	Exp.6	test
B4	Exp.10	Exp.12	Exp.5	Exp.4	Exp.6	Exp.11	test
B5	Exp.9	Exp.5	Exp.4	Exp.6	Exp.11	Exp.12	test

(B) VIVA SCHEDULE: The viva schedule should be planned prior starting to the lab experiment.

ROUND - 1

Batches	week-1	week-2	week-3	week-4	week-5
B1,B2,B3	viva				
B1,B2,B3		viva			
B1,B2,B3			viva		
B1,B2,B3				viva	
B1,B2,B3					viva

ROUND - 2

Batches	week-1	week-2	week-3	week-4	week-5
SG1	viva				
SG2		viva			
SG3			viva		
SG4				viva	
SG5					viva

*SG: Selected Group with a maximum of 6 or 12 students

SCHEME OF EVALUATION OF

LAB INTERNALS

Day to Day Evalution-15					Internal Exam-10		
Uniform	Observation &Record	Performance of the Experiment	Result	Viva	Write up	Arrangement or connections etc & Results	Viva
Marks-3	Marks-3	Marks-3	Marks-3	Marks-3	Marks-3	Marks-3	Marks-4

Total marks-25

LAB EXTERNALS

S.NO	Write up	Results(by skill assistant)	Final Evaluation	Viva
1	1.Aim 2.Apparatus&chemicals etc 3.Principle etc 4 Procedure etc 5.Tabler form etc 6.Model Graph etc 7. Result etc	Based on observation, How the student is arranging the apparatus or system or circuit and typical readings	Based on correctness of the graph to the expected graph and Results	Based on understanding of Experiment and theoretical questions in the related subjects

6. **SUGGESTED BOOKS:**
   1. A TEXT BOOK OF MACHINE TOOLS BY R.K.JAIN
   2. A TEXT BOOK OF MACHINE TOOLS BY N.K.ADITAN

7. **WEB SITES(USEFUL LINKS):**

1. http://www.facweb.iitkgp.ernet.in/~skpal/expt_2.pdf
2. http://www.facweb.iitkgp.ernet.in/~skpal/expt_1b.pdf .
3. http://www.scribd.com/doc/48023416/MET -lab-manual
4. http://www.scribd.com/doc/64024338/Metrology -Lab-Manual-2
5. http://fetweb.ju.edu.jo/ME/courses/labs/measurements/labsheet/Experiment%20No %203%20Surface%20Roughness.pdf
6. http://www.nitt.edu/home/academics/departments/mech/facilitiesandservices/ metrology lab optical projector/
7.. http://www.scribd.com/doc/65216885/34/ALIGNMENT -TESTS-ON-MILLING-MACHINE
8. http://www.scribd.com/doc/41082878/Alignment -tests-on-pillar-type-drilling-machine

8. **EXPERTS' DETAILS**

The expert details which have been mentioned below are only a few of the eminent ones known Internationally, Nationally and Locally.

REGIONAL EXPERTS:

1. Mr. Gupta,. Head of the Department, Arora's Scientifica Technological Institute,Bhuvanagiri
2. Mr. D.Kondaiah, Professor , Srinidhi Institute of Science and Technology ,Hyderabad.

METROLOGY LAB LIFT PLANNER:

1. OBJECTIVES AND RELEVANCE:

The main objective of the lab course is to gain practical hands on experience by exposing the students to experiments like linear measurement, angular measurement, taper measurement, screw thread measurement, gear measurement and tool maker's microscope.

2. SCOPE:

The scope of this lab is to make understand students for measuring various dimensional accuracies on Machine elements which internally help all the students to perform better in any manufacturing concern While doing quality control techniques.

3. PREREQUISITES:

Theoretical knowledge on subject Metrology which deals with the basic mechanism related to precision and tolerances and measurement by using various instruments,devices and quality control instrumentation.

In order to carry out the laboratory instrumentation and handle various instruments, a student must have ability to go through the basic fundamental concepts related to limits, fits and tolerances.

PART - A

PREAMBLE

This lab covers the experiments in Metrology subject. The JNTU has given 11 experiments in the syllabus out of which eight experiments are compulsory and from the remaining 3 experiments any two twshall be conducted.

4 . SYLLABUS-JNTU

UNIT-I

No experiments in this unit as per syllabus

UNIT –II

EXPERIMENT NO.1

Measurement of lengths, heights and diameters by vernier calipers, micrometers etc.(JNTU Sl.No.1/Section A)

OBJECTIVE:

Determination of lengths, diameters and heights of at different cross-sections of various work pieces by Using Vernier Calipers and micrometer apparatus.

PRE REQUISITES:

Basic mechanism of vernier calipers, different types of micrometers and its classifications, basic least Counts of Vernier Calipers and micrometers, reading of instruments

DESCRIPTION:

Introduction to Experiment – 30 Min
Introduction ot instrument
Calculation of least counts
Reading the instrument
Error Calculation and adjustment

APPLICATIONS:

1. Checking of external and internal dimensions in any transmission mechanisms 2. To check the dimensional variations after machining of jobs.

.

EXPERIMENT NO:2
Measurement of Bores by Internal Micrometers and Dial bore indicators etc.

OBJECTIVE:

Determination of internal dimensions on circular workpieces with bores by using internal micrometers and Dial indicators.

PREREQUISITIES:

It requires basic level of metrological concepts during measurement process. Also, to determine internal Parameters, student requires knowledge related to reading as well as least count of the instruments.

DESCRIPTION:

Introduction to Experiment – 30 Min
Calculation of least counts
Reading the instrument
Calculation of dimensions

APPLICATIONS:

1. To check the alignments in various transmission mechanism
2. To help the student in determining the most precision and accurate measurement of dimensions.

EXPERIMENT NO:4 & 5:
(a)Machine Tool Alignment test on Lathe
(b) Machine Tool Alignment test on Milling Machine

OBJECTIVE:

Determination of alignment and check the alignment of lathe and milling machine with reference to datum surface and zero level basis.

PREREQUISITES:

It requires thorough knowledge of alignment and use of dial indicators to verify the centre distance and swing over lathe bed as well as milling machine alignment with respect to arbor and datum.

DESCRIPTION:

1. Introduction to Experiment – 30 Min
2. Check the operation chart given along with the machine
3. To check and verify the dimensions measure with dial indicators
4. To compare the discrepancies between actual and measured dimensions on machines

APPLICATIONS:

1.It makes the student to develop a sort of knowledge in aligning the machine elements on machine during commissioning as well as installation of any machines in manufacturing industry.

EXPERIMENT NO:7

Angle and Taper measurement by using Bevel Protractors, Sine bars etc.

OBJECTIVE:

Determination of angle as well as taper angles in a workpieces by using sine bar and protractors.

PREREQUISITES:

Determination of angles and taper requires more knowledge on use of protractors , theory on angles, as well as calculation of readings over protractors.

DESCRIPTION:

1. Introduction to Experiment – 30 Min
2. Calculation of least counts
3. Check the reading on instrument
4. Correction for errors if any in instrument
5. Practice for use of instrument
6. Measurement of dimensions

APPLICATIONS:

1. It makes student to know thoroughly about the angular measurement in all the systems of angles
2. It makes student to measure different angles on various tapered surfaces of work

UNIT-III

EXPERIMENT NO:6

Toolmakers Microscope and its application

Use of Toolmakers Microscope to find Thread Measurement(Lead Experiment)

OBJECTIVE:

Determination of linear , angular , pitch, diameters of all the workpieces by using microscope

PREREQUISITES:

Basic knowledge of optics, optical measurement, Microscopes and its applications, classification of Microscopes.

DESCRIPTION:

Introduction to Experiment – 45 min
Check the Microscope for measurement
Adjustment of all the eyepieces
Adjustment of grid for crossmesh alignment with given workpiece images
Note down the readings from micrometers attached to microscope

APPLICATION:

1.It gives the correct idea and measure the different dimensions on various workpieces
2. It makes student to check both linear, angular, taper , screw , gear as well as any type Measurements.

EXPERIMENT NO: 8

Use of Spirit Level in finding flatness of surface plate

OBJECTIVE:

Determination of flatness of a given surface plate by using calibrated spirit level

PREREQUISITES:

1. It requires knowledge about the classification of different surface plates
2. It requires basics about different types of spirit levels
3. It requires knowledge about the different geometrical parameters such as straightness, Flatness etc.

DESCRIPTION:

1.Introduction to Experiment – 30 Min

2.Check for least count on spirit level

3. Check for surface plate

4. Calculation of different characteristic elements of spirit level

5. Check for dimensions in both directions positive and negative etc.

6.Calculate flatness by using readings obtained from calibrated spirit level

UNIT-IV

EXPERIMENT NO. 10

Surface Roughness Measurement by using Talysurf (JNTU/Serl No.10)

OBJECTIVE:

To determine surface roughness on a given work surface by using Taylor Hobson Talysurf

PREREQUISITES:

1. It requires basic knowledge about the surface roughness and surface waviness
2. A basic level of measurement related to estimation surface roughness methods is required
3. Understanding of the behavior of electronic comparator like Talysurf is very much needed

DESCRIPTION:

1. Introduction to Experiment – 40 Min

2. Check for probe or stylus
3. Check for workpiece surface
4. Switchon the instrument to make the probe in contact with surface
5. Check for measured dimension or output
6. Estimate the roughness on the profile obtained on profilogram

APPLICATION:

1.It can be useful in measuring the roughness characteristic of any work surface

2. It makes student to understand better about the surface inequality and finish obtained On the surface by using roughness methods.

UNIT V:

No experiment is suggested under JNTU

UNIT –VI

EXPERIMENT NO. 9

Thread measurement by Two Wire/Three Wire method by using ToolMakers microscope

OBJECTIVE:

To determine screw thread elements like pitch, flank angle and effective diameter by using Screw thread micrometer or toolmakers microscope

PREREQUISITES:

1. It requires basic knowledge about the fundamental nomenclature of screw threads
2. It requires basics of micrometers , methods of finding out effective diameter

DESCRIPTION:

1. Introduction to Experiment – 45 Min
2. Check for readings on micrometer
3. Allow for calculation for effective diameters on given workpieces

APPLICATION:

1. It gives idea about the performance and accuracy of threads generated On workpieces
2. It makes student to know the characteristic elements of a screw thread
3. It makes student to check the accuracy of screw threads since they plays lot of role In transmission

UNIT VII:

No Experiments were suggested as per JNTU

UNIT VIII:

EXPERIMENT NO: 11

Surface Wear resistances test using Electro Spark Coating Device.

OBJECTIVE:

To test wear resistance on a given surface by using Spark Coating device

PREREQUISITES:

1. It requires fundamental knowledge about the surface integrity, surface corrosion, Wear of surface
2. It requires knowledge about surface coatings
3. It requires basic knowledge related to electro spark coating machines

DESCRIPTION:

1. Introduction to Experiment – 30 Min
2. Check for wear on surface by using instrument
3. Check for alignment on instrument and proper functioning of device
4. To check and measure the wear by using instrument

APPLICATIONS:

1. This instrument can be used for any type of wear resistance on a given work surface or job surface that plays role in finished products.
2. This test is compulsory for any type of surface after processing or machining.

SUGGESTED BOOKS:

1. A TEXT BOOK OF ENGINEERING METROLOGY – MAHAJAN
2. A TEXT BOOK OF METROLOGY – R.K. JAIN
3. A TEXT BOOK OF ENGINEERING METROLOGY AND MEASUREMENTS BY N.K.ADITAN

6. WEB SITES

1.http://www.facweb.iitkgp.ernet.in/~skpal/expt_2.pdf
2.http://www.facweb.iitkgp.ernet.in/~skpal/expt_1b.pdf .
3. http://www.scribd.com/doc/48023416/MET -lab-manual
4. http: //www.scribd.com/doc/64024338/Metrology -Lab-Manual-2

URL:

1. http://fetweb.ju.edu.jo/ME/courses/labs/measurements/labsheet/Experiment%20No %203%20Surface%20Roughness.pdf
2. http://www.nitt.edu/home/academics/departments/mech/facilitiesandservices/ metrologylab/opticalprojector/
3. http://www.scribd.com/doc/65216885/34/ALIGNMENT -TESTS-ON-MILLING- MACHINE
4. http://www.scribd .com/doc/41082878/Alignment -tests-on-pillar-type-drilling-machine

9. **MAPPING OF LAB WITH PROJECT/CONSULTANCY/R & D:**

The Machine tools lab course should be designed in such a way that it should meet the requirements of research and development as well as consultancy projects. Also the Proposals of Project/R&D/Consultancy are as follows:

Proposal 1: Project Design & Execution
Proposal 2: R& D Level Project Design & Execution
Proposal 3: Consultancy Task / Project Design & Development

PROPOSAL FOR R & D ACTIVITY:

PROPOSAL FOR R & D ACTIVITY:

1.An exact paper from a National/International journal in this entitled area/subject/ area (IEEE Format)

AND/OR

2.An article/white paper from a magazine /journal/weekly/any periodical in the entitled Subject

AND/OR

3.An Advanced technology development/ proposal/article publication from any source of Information

Sample for Serial No:1

EXACT PAPER FROM A NATIONAL/INTERNATIONAL JOURNAL:

Optimization of Surface Finish in Turning Operation by Considering the Machine Tool Vibration using Taguchi Method

MUHAMMAD MUNAWAR*, NADEEM A. MUFTI*, AND HASSAN IQBAL*

ABSTRACT

Optimization of surface roughness has been one of the primary objectives in most of the machining operations. Poor control on the desired surface roughness generates non conforming parts and results into increase in cost and loss of productivity due to rework or scrap. Surface roughness value is a result of several process variables among which machine tool condition is one of the significant variables. In this study, experimentation was carried out to investigate the effect of machine tool condition on surface roughness. Variable used to represent machine tool's condition was vibration amplitude. Input parameters used, besides vibration amplitude, were feed rate and insert nose radius. Cutting speed and depth of cut were kept constant. Based on Taguchi orthogonal array, a series of experimentation was designed and performed on AISI 1040 carbon steel bar at default and induced machine tool's vibration amplitudes. ANOVA (Analysis of Variance), revealed that vibration amplitude and feed rate had moderate effect on the surface roughness and insert nose radius had the highest significant effect on the surface roughness. It was also found that a machine tool with low vibration amplitude produced better surface roughness. Insert with larger nose radius produced better surface roughness at low feed rate.

Key Words: Taguchi Method, Surface Roughness, Vibration Amplitude, ANOVA, Optimization.

An article/white paper from a magazine /journal/weekly/any periodical in the entitled Subject

A PERIODICAL ON MACHINE TOOLS BY ENCYCLOPAEDIA BRITANNICA

Written by The Editors of Encyclopædia Britannica

Lathe, machine tool that performs turning operations in which unwanted material is removed from a work piece rotated against a cutting tool.

The lathe is one of the oldest and most important machine tools. Wood lathes were in use in France as early as 1569. During the Industrial Revolution in England the machine was adapted for metal cutting. The rotating horizontal spindle to which the work holding device is attached is usually power driven at speeds that can be varied. On a speed lathe the cutting tool is supported on a tool rest and manipulated by hand. On an engine lathe the tool is clamped onto a cross slide that is power driven on straight paths parallel or perpendicular to the work axis. On a screw cutting lathe the motion of the cutting tool is accurately related to the rotation of the spindle by means of a lead screw that drives the carriage on which the cutting tool is mounted.

Internal turning is known as boring and results in the enlargement of an already existing hole. For internal turning on solid work pieces, holes are drilled first; engine lathes are equipped for drilling coaxial holes.

Drilling machinery, equipment used to drill holes in the ground for such activities as prospecting, well sinking (petroleum, natural gas, water, and salt), and scientific explorations. Drilling holes in rock to receive blasting charges is an operation in tunneling, mining, and other excavating.

Most modern drilling machines are either percussive (chipping rock or ground intermittently by impact) or rotary (involving a cutting or grinding action). A combined rotary-percussive drill uses both types of action when the hardness of the stratum warrants it.

The simplest rotary drill is the earth auger, which is hand-operated and resembles the wood auger used in carpentry. The earth auger, used principally for drilling holes in relatively soft earth, is armed with either a spiral drill or a pod-type drill and is attached to a shaft by a socket joint. Successive sections are added to the shaft as the hole deepens.

Rotary drilling may be adapted for use at any angle and is suitable for underground mining. In most rotary drilling, hollow rods of steel provide circulation of cooling water or other fluid.

There are three kinds of rotary drill bits: (1) drag bits, which cut the rock with two, three, or four wings, sometimes tipped with tungsten carbide, and are used mostly in soft rock; (2) roller bits, which operate with a crushing action by means of wedge-shaped teeth and are used for harder rock; (3) diamond bits, which grind away the rock. The coring-type diamond bit makes an annular hole, the core of which provides a sample cross section of the strata penetrated, and is used for prospecting.

Percussive drilling is slower than rotary drilling but has a number of special applications, such as for shallow holes. In percussive drilling, blows are applied successively to a tool attached to rods or a cable, and the tool is rotated so that a new portion of the face is attacked at each blow.

Another simple percussive drill consists of one or more lengths of wrought-iron pipe open at both ends, driven by a heavy hammer or, for larger holes, a light pile driver. A second cylinder is sunk inside the first, and water is pumped down the inner pipe to loosen soil and raise debris. For deep boring, rotary drilling has replaced these methods.

Long after the rock drill was invented, manual drilling by two men was still usual in mining operations. One man turned the drill, while the second swung the hammer. Most advances in drilling machinery have been developed by tunnelers. The driving of two particular tunnels, the Mont Cenis (Fréjus) tunnel, between France and Italy, and the Hoosac tunnel, in Massachusetts, U.S.—both driven during the 1850s and '60s—produced a great number of innovations in rock-drilling equipment, most notably the compressed-air drill.

The first patented rock drill was invented in 1849 by J.J. Couch of Philadelphia. Its drill rod passed through a hollow piston and was thrown like a lance against the rock; caught on the rebound by a gripper, it was again hurled forward by the stroke of the piston. A notable development was a hammering-type rock drill for overhead drilling devised by C.H. Shaw, a Denver machinist, before 1890. Cuttings dropped out by gravity. This machine was called a stoper when it was used in Colorado and California mines. A pneumatic feed held the machine in place and fed the steel into the rock. These two developments, hammering action and air-leg feed, became important in modern machines. The problem of removing the cuttings from horizontal drill holes was eventually solved by the invention of the hollow drill with an air channel for blowing compressed air into the bottom of the hole.

Modern rock drills are commonly mounted on large rigs to bore many holes at one time; the Mont Blanc Tunnel between France and Italy (1960s) was the first tunnel the entire diameter of which was drilled and blasted in a single operation. At the opposite end of the scale, lightweight pneumatic rock drills have also found wide favour in mining and certain tunneling operations. The chief prototype is that designed by Eric Ryd of Sweden, employing a tungsten carbide bit.

SAMPLE FOR SERIAL NO: 3:

An Advanced technology development/ proposal/article publication from any source of Information New Technology in CNC Automatic Lathes Drives Higher Productivity A fully programmable B axis is the latest advanced technology for Swiss machines

By Jim Lorincz Senior Editor

URL LINK:

http://www.sme.org/MEMagazine/Article.aspx?id=80720#sthash.FQjUWWti.dpuf

A Swiss-style CNC automatic lathes are used to productively manufacture machine precision parts for medical devices. Parts are typically 12–20" (305–508-mm) long, with length-to-diameter ratios of 12–15×, and machined from bar from 10 to 32-mm diameter. Outlier sizes down to 3 mm and up to 38 mm and even larger are available for specialized applications. Swiss-machined parts of these types require support with a guide bushing along their entire machining length to allow removal of a large amount of material in a single pass.

But there are some new innovations in the marketplace that are worth a fresh look, such as advanced Swiss machine technology with a fully programmable B axis, which provides the user with capability to machine complex shapes and drill angles and mill profiles. New developments in CNC automatic lathes aren't limited to the Swiss-type, however. CNC automatic lathes that are convertible from Swiss to fixed headstock machines (often with changeover time as fast as 15 minutes) have been introduced by leading machine builders. These machines allow machining short parts close to the headstock and save material cost by reducing the remnant of expensive ground bar that is left by Swiss machines.

PROPOSAL FOR PROJECT ACTIVITY :

A Proposal of a hobby/mini/proto/general/model/proto type project with estended abstract, Block Diagram/Circuit/Flow diagram and clear references may be presented and executed.

Aim of the Project: **Calculation of Speed, Feed , Depth of Cut and Machining time for different materials using Gear Driven Lathe machine.**

ABSTRACT

Two materials were selected based upon their chemical composition and melting points. Preferably One is Mild Steel and other is High Speed Steel specimen. These two materials will be fixed on lathe chuck and start the operation include both facing and complete machining processes. Estimation of time is made by using stop watch. Other parameters also calculated based upon numerical assessment only.

PROPOSAL FOR CONSULTANCY:

OBJECTIVE: A programme/machine/product of utility may be proposed to develop for in house usage/ Industrial requirements may be useful for any outside agency that can be marketable in order to generate revenue through consultancy

Proposal to manufacture 14 teeth gears suitable to two stroke scooter engines:

A proposal is made possible to manufacture the gears with the facilities available in machine tools laboratory

Proposed Equipment for usuage: Lathe Machine, Milling Machine, Grinding Machine and Slotting Machines

INTRODUCTION TO CONCEPT OR PRODUCT OF UTILITY

Gear manufacturing refers to the making of gears. Gears can be manufactured by most of manufacturing processes such as casting, forging, extrusion, powder metallurgy, blanking . But as a rule, machining is applied to achieve the final dimensions, shape and surface finish in the gear. The initial operations that produce a semi finishing part ready for gear machining as referred to as blanking operations, the starting product in gear machining is called a gear blank

Selection of materials: Cast Steel, Forged Steel and EN8 Steel

The gear material should have the following properties:

- High tensile strength to prevent failure against static loads
- High endurance strength to withstand dynamic loads
- Low coefficient of friction

- Good manufacturability

Gear manufacturing processes

There are multiple ways in which gear blanks can be shaped through the cutting and finishing processes.

Gear forming

In gear form cutting, the cutting edge of the cutting tool has a shape identical with the shape of the space between the gear teeth. Two machining operations, milling and broaching can be employed to form cut gear teeth.

Form milling

In form milling, the cutter called a form cutter travels axially along the length of the gear tooth at the appropriate depth to produce the gear tooth. After each tooth is cut, the cutter is withdrawn, the gear blank is rotated, and the cutter proceeds to cut another tooth. The process continues until all teeth are cut.

Broaching

Broaching can also be used to produce gear teeth and is particularly applicable to internal teeth. The process is rapid and produces fine surface finish with high dimensional accuracy. However, because broaches are expensive-and a separate broach is required for each size of gear-this method is suitable mainly for high-quantity production.

Gear generation

In gear generating, the tooth flanks are obtained as an outline of the subsequent positions of the cutter, which resembles in shape the mating gear in the gear pair. There are two machining

processes are employed, shaping and milling. There are several modifications of these processes for different cutting tool used.

Gear hobbing

Gear hobbing is a machining process in which gear teeth are progressively generated by a series of cuts with a helical cutting tool. All motions in hobbing are rotary, and the hob and gear blank rotate continuously as in two gears meshing until all teeth are cut.

Finishing operations

As produced by any of the process described, the surface finish and dimensional accuracy may not be accurate enough for certain applications. Several finishing operations are available, including the conventional process of shaving, and a number of abrasive operations, including grinding, honing, and lapping.

Testing of Gears

All the gears manufactured in in house should be tested only with laboratories which are having NABL accredited certificate.

FUNDED/UNFUNDED PROPOSALS (if any):

OBJECTIVE:

The proposals for AICTE grants like (SDPs, RPS and MODROBES etc) UGC grants, DST CPRI and other funding agencies by giving Title and abstract/objective OR Self Funded programee proposals may be submitted for Management approvals.

PROPOSAL FOR SDP:

TITLE: OPTIMIZATION TECHNIQUES IN MATERIAL REMOVAL RATES FOR CONVENTIONAL MACHINING PROCESSES.

OBJECTIVE: This SDP programme is intended to bring down the awareness among all Staff in order to study the various possible mechanisms involved in Conventional machining processes to improve the material removal rates.

10. PROPOSALS (WEEK WISE INDUSTRIAL VISITS)(IN HOUSE OR OUTSIDE VISIT)/TRAINING PROGRAMMES:

TABLE 1 : INDUSTRIAL VISITS

S.no	Type of industry	Nature of industry	Date of visit	No. of students participated	Year/branch	remarks
1	LINDE INDIA LTD	Industrial Chemicals	17/08/14	60	III/1V I SEM	
2	ENGINE VALVES,MEDCHAL	VALVES	24/8/14	60	III/IV I SEM	

11. **GUIDELINES FOR SHADOW ENGINEERING (VIP)**

INDUSTRIAL VISITS (IIP – INNOVATIVE INDUSTRIAL LEARNING PROGRAM):

OBJECTIVES OF SHADOW ENGINEERING:

1. The program which uplifts the knowledge of the students related to laboratories.
2. To improve the industry-college interactions.
3. To create industry like environment for all the students in order to make future Assignment.
4. This program leads to matrixing with the students.

TABLE 2: INDUSTRIAL TRAINING (Shadow Engg)
(Career Visit Approval)

S.nO	Name of the Course	Nature of industry	Duration of Training	Authority	Date of Training/Certificate No.	remarks

1	MECHATRONICS	ADVANCED MACHINING	1 WEEK	DyDirector		

ACTIVITIES IN LIFT PROGRAMME:

12. **CALIBRATION/INSTALLATIONAND TESTING:**

Calibration: Aim of this concept is to check :

i. whether all the equipment is functioning correctly as per the standards
ii. To bring correctness in the errors of instrument or equipment.
iii. To rectify the errors if any

Installation: Aim of this concept is to make and maintain installation procedure for a New equipment or already existing equipment

Testing : Aim of this concept is to test the equipment after installation whether it Meets the existing standards.

The list of equipments (hardware/software) :

Necessity of tools for development and testing
Equipment to be calibrated
Installation of supporting equipment if any.

PROCEDURE FOR CALIBRATION:

Any Equipment or Instrument or Gauge or Machine can be calibrated as the standard guidelines mentioned under:

1. Identify the Equipment/Instrument/Gauge/Machine which is under defective or to be calibrated or correction for error
2. Identify the type of error and estimate its frequency of variation.
3. Check with Master Standards or equipment/instrument/machine which is working correctly and meeting our requirements.
4. Estimate the frequency of deviations from normal mode.
5. If the equipment is under warranty, then inform to concerned supplier or agency who will carry out calibration.
6. If the equipment is out of warranty then we can compare the deviations and set the error rectification.
7. Generally as per the procedure, the equipment or instruments can be calibrated by the agencies and issue calibration certificate which consists of date of calibration, calibration next due date and remarks as mentioned in the following format.
8. Record and keep all the calibration certificates in safe custody.

After calibration the details of equipment should be submitted in following format.

S.no	**Type of**	**Certificate**	**Certificate**	**Date of**	**Date of**	**Remarks**

	equipment	no	issued by	calibration	calibration due	
1	**Vernier Calipers**		**SS Instruments, Kukatpally**			
2	**Micrometer**		**SS Instruments, Kukatpally**			
3	**Slip Gauges**		**-do-**			

iv.Calibration,Testing and Installation details equipment wise are mentioned as follows:

Case 1: Calibration of Equipment -------------------------------------- if any

Case 2: Installation of Equipment -------------------------------------- if any

Case 3: Testing of Equipment -- if any

Presently there is no new equipment is present for either testing or installations.

13. MAINTAINANCE AND TROUBLESHOOTING:

Maintenance:

Maintenance and trouble shooting of each equipment in a laboratory must follow the following guidelines:

Maintenance Schedules:

Preventive Maintenance Schedules of lab will be decided by lab in charge along with concerned HOD. The details of schedule should be recorded in the following template of format.

S.No.	Name of the Equipment	Date of Maintenance	Type of Activity	Remarks
1	Lathe machine		Cleaning and Lubrication	Working well
2	Milling Machine		Alignment	Working OK
3	Slip Gauges		Lubrication	Working OK
4	Micrometers		Error Correction	Working OK

(2) Maintenance Reports duly signed by in charges as well as HODs and duly approved by Principal periodically.

14.TROUBLE SHOOTING SCHEDULES:

A proposal is to be made from each lab branchwise. The proposal should carry following details related to specific equipment in lab.

S.No., Equipment Name , Type of Problem (Too much Noise, Abnormal Sound, Corrupt Software, Anti Virus Problem, Missing of Display, CRT not working, Motor is not giving signal, Digital display is not working, Break of tools, Mis alignment of machine elements, PLC is not properly working), Expected Reasons (Bearing failure, Improper alignment of machine centres, Missing of vibration pads etc)

Trouble shooting exercises should be properly recorded in a separate format as mentioned below:

S.No.	**Date of recording activity**	**Equipment Name**	**Type of Trouble**	**Remedial Activity**	**Remarks**

ASSESSMENT AND ACCREDITATION PROCESDURE AS PER NABL

Accreditation is the formal recognition, authorization and registration of a laboratory that has demonstrated its capability, competence and credibility to carry out the tasks. It provides the feedback to laboratories as to whether they are performing according to technical competence as per guidelines of NABL (National Accreditation Board for Testing and Calibration Laboratories)

The laboratory should carry out the following important tasks towards getting ready for accreditation from NABL.

a. Preparation of methodology in each experiment
b. Preparation of Standard Operating procedure for each equipment
c. Preparation of Laboratory Manual as per the guidelines specified by Combined Lab Team(CLT) headed by Principal/HOD/Dean/incharge
d. Ensure Effective environmental conditions(temperature, humidity,storage and placement) in the laboratories by implementing proper housekeeping and cleaning of the equipments from dust, dirt etc.
e. Ensure Calibration of instruments/equipment(Only NABL accredited authorized laboratories provide calibration.
f. All the details of Calibration should be included in the format specified exclusively for calibration procedure.
g. Ensure proper implementation of all the documents, formats to be included in the lab manual.
h. Impart training for all the technicians working in labs about the importance of documentation, log sheets, operating procedure of the lab.
i. Incorporate Internal Lab audits for effective functioning of the laboratories. Audits may be once in a month or 3 months or at the end of the semester. The audit schedule will be decided by the Chairman and Principal of the CLT team.
j. Auditors should submit the detailed report of each lab duly signed to the Principal.
k. Each lab should maintain all the bills/invoices of each instrument or equipment in a separate file.

l. All the stock registers either consumable or non consumable should be updated whenever any purchases of consumables or equipment takes place.
m. All the safety precautions are properly displayed in front of each lab.
n. All the Lead experiments should be maintained separately in a record /record in a separate folder.
o. Based on Pre Assessment report submitted by auditor, corrective actions should be carried out by each lab in charge and that must be forwarded to concerned HOD and Principal.

THERMAL ENGINEERING LAB

1. **Objectives and Relevance**
2. **Scope**
3. **Prerequisites**
4. **Syllabus**
5. **Lab Schedule**
6. **Suggested Books**
7. **Websites**
8. **Experts' Details**
9. **Mapping of Lab with Projects/Consultancy/R&Ds**
10. **Industrial Visits**
11. **Shadow Engineering**
12. **Calibration,Testing and Inspection**
13. **Preventive Maintenance Schedules**
14. **Troubleshooting**

1 OBJECTIVES AND RELEVANCE:

The main objective of the lab course is to gain practical hands on experience by exposing the students to experiments like various testing on single cylinder petrol & diesel engines, compressors, boilers and the to study the components of an engine.

2 SCOPE:

Understanding of Thermal Engineering Lab has the scope to make the learner comfortable to work in any industry where there involves applications and working of automobiles.

3 PREREQUISITES:

Theoretical knowledge on subject Applied Thermodynamics-I which deals the overall working and performance of engines and compressors in-depth is required. Also student should have basic knowledge of engines and compressors.

PART - A

PREAMBLE

This lab covers the experiments in thermal engineering subject. The JNTU has given 10 experiments in the syllabus out of which eight experiments are compulsory and from the remaining 2 experiments any two shall be conducted.

4 SYLLABUS-JNTU:

UNIT-I

Volumetric efficiency, Air/Fuel ratio

EXPERIMENT NO. 1

I.C.Engines Air/Fuel Ratio and Volumetric Efficiency

OBJECTIVE:

Determination of volumetric efficiency of single/multicylinder engine.

PREREQUISITES:

Basic concepts of air standard cycles are required to understand the volumetric efficiency of any engine.(JNTU Sl.no.6)

DESCRIPTION:

a. Introduction to experiment -30 min

b. Run the engine with applying different loads.

c. Experimental determination of fuel consumption and time.

d. Graphical determination of load, speed and efficiency.

APPLICATIONS:

1. Design of single/multicylinder engines

2. To reduce the consumption of fuel

3. To increase the performance of engines

UNIT –II

Valve and Port Timing Diagrams

EXPERIMENT NO. 2

I.C. Engines Valve / Port Timing Diagrams (JNTU SL.No.1)

OBJECTIVE:

To draw valve and port timing diagrams.

PREREQUISITES:

Basic concepts of air standard cycles are required to understand the valve and port timing diagrams.

DESCRIPTION:

a. Introduction to experiment -30 min

b. Draw the valve and port diagrams at different instances

c. Graphical determination of port/valve opening/closing.

APPLICATIONS:

1. Design of single/multicylinder engines

2. To increase the performance of engines

3. Design of valves in engines

EXPERIMENT NO. 3
Study of Boilers (JNTU SL.No.9)

OBJECTIVE:

To study the classification and working of boilers.

PREREQUISITES:

Basic concepts of heat generation principles are required.

DESCRIPTION:

a. Introduction to experiment -30 min

b. Draw the diagrams for boilers.

APPLICATIONS:

1. Design of boilers

2. To increase the performance of power plants

3. Design of thermal power stations.

EXPERIMENT NO. 4
Dis-assembly / Assembly of Engines (JNTU SL.No.10)
Study of Assemblies and investigate the problems and its identification (Lead Experiment)

OBJECTIVE:

To assemble and dis-assemble the engine.

PREREQUISITES:

Basic concepts of the components of engine are required.

DESCRIPTION:

a. Introduction to experiment -30 min

b. Explaining each and every component.

APPLICATIONS:

1. Design of single/multicylinder engines

2. To increase the performance of engines

3. Design of components.

UNIT –V

Performance Test on engines, Heat balance sheet

EXPERIMENT NO. 5

I.C. Engines Performance Test on 2-Stroke Petrol (JNTU SL.No.3)

OBJECTIVE:

Determination of volumetric efficiency, thermal efficiency of an engine.

PREREQUISITES:

Basic concepts of air standard cycles are required to understand the volumetric efficiency and thermal efficiency of any engine.

DESCRIPTION:

a. Introduction to experiment -30 min

b. Run the engine with applying different loads.

c. Experimental determination of fuel consumption and time.

d. Graphical determination of load, speed and efficiency.

APPLICATIONS:

1. Design of single/multicylinder engines

2. To reduce the consumption of fuel

3. To increase the performance of engines

EXPERIMENT NO. 6

I.C. Engines Performance Test on 4-Stroke Petrol (JNTU SL.No.2)

OBJECTIVE:

Determination of volumetric efficiency, thermal efficiency of an engine.

PREREQUISITES:

Basic concepts of air standard cycles are required to understand the volumetric efficiency and thermal efficiency of any engine.

DESCRIPTION:

a. Introduction to experiment -30 min

b. Run the engine with applying different loads.

c. Experimental determination of fuel consumption and time.

d. Graphical determination of load, speed and efficiency.

APPLICATIONS:

1. Design of single/multicylinder engines

2. To reduce the consumption of fuel

3. To increase the performance of engines

EXPERIMENT NO. 7
Performance Test on Variable Compression Ratio Engines (JNTU SL.No.7)

OBJECTIVE:

Determination of volumetric efficiency, thermal efficiency of an engine by varying the compression ratio.

PREREQUISITES:

Basic concepts of air standard cycles are required to understand the volumetric efficiency and thermal efficiency, compression ratio of any engine.

DESCRIPTION:

a. Introduction to experiment -30 min

b. Run the engine with applying different loads.

c. Experimental determination of fuel consumption and time.

d. Graphical determination of load, speed, compression ratio and efficiency.

APPLICATIONS:

1. Design of single/multicylinder engines

2. To reduce the consumption of fuel

3. To increase the performance of engines

EXPERIMENT NO. 8
Evaluation of Engine friction by conducting Morse test on 4-Stroke Multi cylinder Petrol Engine and retardation and motoring test on 4- stroke diesel engine (JNTU SL.No.4)

OBJECTIVE:

Determination of frictional power and efficiency of an engine.

PREREQUISITES:

Basic concepts of air standard cycles are required to understand the concepts of indicated, brake and frictional power.

DESCRIPTION:

a. Introduction to experiment -30 min

b. Run the engine with applying different loads.

c. Experimental determination of fuel consumption and time.

d. Graphical determination of load, speed, frictional power and efficiency.

APPLICATIONS:

1. Design of single/multicylinder engines

2. To reduce the consumption of fuel

3. To increase the performance of engines

EXPERIMENT NO. 9

I.C. Engines Heat Balance (JNTU SL.No.5)

OBJECTIVE:

Determination of the amount heat supplied and rejected in an engine.

PREREQUISITES:

Basic concepts of air standard cycles are required to understand the concepts of indicated, brake and frictional power, heat supplied and heat rejected.

DESCRIPTION:

a. Introduction to experiment -30 min

b. Run the engine with applying different loads.

c. Experimental determination of fuel consumption and time.

d. Graphical determination of load, speed, frictional power and efficiency.

e. Draw the heat balance sheet.

APPLICATIONS:

1. Design of single/multicylinder engines

2. To reduce the consumption of fuel

3. To increase the performance of engines

EXPERIMENT NO. 10

Performance Test on Reciprocating Air – Compressor Unit (JNTU SL.No.8)

OBJECTIVE:

Determination of volumetric efficiency, isothermal efficiency of a compressor.

PREREQUISITES:

Basic concepts of air standard cycles are required to understand the volumetric efficiency and thermal efficiency of any engine and the concepts of compressors.

DESCRIPTION:

a. Introduction to experiment -30 min

b. Run the compressor with applying different loads.

c. Graphical determination of load, speed and efficiency.

APPLICATIONS:

1. Design of Multistage compressors

2. To use the compressed air for required purpose

3. To increase the performance of compressor

5. LAB SCHEDULE:

(A) LAB SCHEDULE: The lab schedule should be planned once in a week. The week wise scheduled experiment should be completed.

CYCLE 1

Batches	**week-1**	**week-2**	**week-3**	**week-4**	**week-5**	**week-6**	week-7
B1	Demo	Exp.1	Exp.2	Exp.3	Exp.4	Exp.5	test
B2	Demo	Exp.2	Exp.3	Exp.4	Exp.5	Exp.1	test
B3	Demo	Exp.3	Exp.4	Exp.5	Exp.1	Exp.2	test
B4	D emo	Exp.4	Exp.5	Exp.1	Exp.2	Exp.3	test
B5	Demo	Exp.5	Exp.1	Exp.2	Exp.3	Exp.4	test

CYCLE 2

Batches	**week-1**	**week-2**	**week-3**	**week-4**	**week-5**	**week-6**	week-7
B1	Exp.6	Exp.7	Exp.8	Exp.9	Exp.10	Exp.11	test
B2	Exp.7	Exp.8	Exp.9	Exp.10	Exp.11	Exp.12	test
B3	Exp.8	Exp.9	Exp.10	Exp.11	Exp.12	Exp.6	test
B4	Exp.9	Exp.10	Exp.11	Exp.12	Exp.6	Exp.7	test
B5	Exp.10	Exp.11	Exp.12	Exp.6	Exp.7	Exp.8	test

(B) VIVA SCHEDULE: The viva schedule should be planned prior starting to the lab experiment.

ROUND - 1

Batches	**week-1**	**week-2**	**week-3**	**week-4**	**week-5**
B1,B2,B3	viva				

B1,B2,B3		viva			
B1,B2,B3			viva		
B1,B2,B3				viva	
B1,B2,B3					viva

ROUND - 2

Batches	**week-1**	**week-2**	**week-3**	**week-4**	**week-5**
SG1	viva				
SG2		viva			
SG3			viva		
SG4				viva	
SG5					viva

*SG: Selected Group with a maximum of 6 or 12 students

6. SUGGESTED BOOKS:

. 1 I.C. Engines / V. GANESAN- TMH
2. Thermal Engineering / Rajput / Lakshmi Publications.
3. IC Engines – Mathur & Sharma – Dhanpath Rai & Sons.
4. Engineering fundamentals of IC Engines – Pulkrabek / Pearson /PHI
5. Thermal Engineering / Rudramoorthy - TMH
6. Thermodynamics & Heat Engines / B. Yadav/ Central Book Depot., Allahabad
7. I.C. Engines / Heywood /McGrawHIll.
8. Thermal Engineering – R.S. Khurmi & J.K.Gupta – S.Chand
9. IC Engines/ Ramalingam/ Scietech publishers
10. Thermal engineering data book-B.Srinivasulu Reddy/JK International Pub.

7. WEB SITES(USEFUL LINKS):

1. www.howstuffworks.com/engine1.htm
2. www.thermallab .com/
3. books.google.com/books/about/ Ic_Engines.html?id=WLdcxNvWB2wC
4. ocw.mit.edu
5. www.unep.org/transport/gfei/autotool/approaches/.../ ic_engines.asp
6. courses.washington.edu/me341/oct22v2.htm
7. web.iitd.ac.in/~ravimr/courses/mel345/classification.pdf
8. www.wku.edu/icset/abt_ta_ lab.php

8.EXPERTS' DETAILS

The expert details which have been mentioned below are only a few of the eminent ones known Internationally, Nationally and Locally.

INTERNATIONAL

1. Prof. John H Johnson,Dept. Of Mechanical Engineering, Michigan Tech University, United States.

2. Mahdi Shahbhakti, Dept. Of Mechanical Engineering, Michigan Tech University, United States.

NATIONAL

1. Prof. V. Ganesan,Dept. Of Mechanical Engineering, IIT MADRAS.
2. Prof. B.P Pundhir, Dept. Of Mechanical Engineering, IIT Kanpur.

REGIONAL

1. Dr. Ashok Kumar, Dept. Of Mechanical Engineering, JNTU Hyderabad.
2. Mr. V. UmaMaheshwar Dept. Of Mechanical Engineering, Osmania University Hyderabad.

9.MAPPING OF LAB WITH PROJECT/CONSULTANCY/R & D:

The thermal engineering lab course should be designed in such a way that it should meet the requirements of research and development as well as consultancy projects. Also the Proposals of Project/R&D/Consultancy are as follows:

Proposal 1: Project Design & Execution

Proposal 2: R& D Level Project Design & Execution

Proposal 3: Consultancy Task / Project Design & Development

PROPOSAL FOR R & D ACTIVITY:

PROPOSAL FOR R & D ACTIVITY:

1.An exact paper from a National/International journal in this entitled area/subject/ area(IEEE Format)

AND/OR

2.An article/white paper from a magazine /journal/weekly/any periodical in the entitled Subject

AND/OR

3.An Advanced technology development/ proposal/article publication from any source of Information

Sample for Serial No:1

EXACT PAPER FROM A NATIONAL/INTERNATIONAL JOURNAL:

Performance of HCCI Diesel Engine under the Influence of Various Working and Geometrical Parameters

T. Karthikeya Sharma, G. Amba Prasada Rao &
K.Madhu Murthy *Department of Mechanical Engineering, NIT*

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ABSTRACT: Homogenous-charge-compression-ignition (HCCI) engines have the benefit of high efficiency with low emissions of NO and particulates. These benefits are due to the autoignition process of the dilute mixture of fuel and air during compression. Homogenous Compression ignition (HCCI) is a combustion concept, which is a hybrid between Otto engine and Diesel engine.

The other emissions like HC and CO are high but can be after treated by a catalyst. This paper reviews the Characteristics of HCCI combustion in direct injection diesel

engines under various governing factors in HCCI operations such as injection timing, injection pressure, piston bowl geometry, compression ratio, intake charge temperature, exhaust gas recirculation (EGR) and supercharging or turbo charging are discussed in this review. The effects of design and operating parameters on HCCI diesel combustion, emissions particularly NOx and soot are reviewed

INTRODUCTION

International regulations ratified in recent years have imposed more stringent limits on pollutant emissions and fuel consumption in internal combustion engines. To comply with these regulations and reduce diesel NOx and soot emissions, several new combustion concepts have been developed. In the quest for ever improving fuel efficiency and emissions reduction, an old and very promising idea has found new life. HCCI technology has been around for a long time, but has recently received renewed attention and enthusiasm. While the early years saw many insurmountable (at the time) obstacles whose answers would only come as sophisticated computer controlled electronics were developed and matured into reliable technologies, progress stalled. Time has, as it always does, worked its magic and nearly every problem has been solved. HCCI is a hybrid of the traditional spark ignition (SI) and the compression ignition processes (such as Diesel engine).Schematic diagram of HCCI combustion is shown in Fig.1. HCCI combustion process can provide fuel conversion efficiencies as high as compression-ignition, direct-injection (CIDI) engines while, unlike CIDI engines, producing ultra-low oxides of nitrogen (NOx) and particulate matter (PM) emissions. HCCI engines operate on the principle of having a dilute, premixed charge that reacts and burns volumetrically throughout the cylinder as it is compressed by the piston. In some regards, HCCI incorporates the best features of both spark ignition (SI) and compression ignition (CI) Engines. As in an SI engine, the charge is well mixed, which minimizes particulate emissions, and as in a CIDI engine, the charge is compression ignited and has no throttling losses, which leads to high efficiency. However, unlike either of these conventional engines, the combustion occurs simultaneously throughout the volume rather than in a flame front. This important attribute of HCCI allows combustion to occur at much lower temperatures, dramatically reducing engine-out emissions of NOx. Most engines employing HCCI to date have dual mode combustion systems in which traditional SI or CI combustion is used for operating conditions where HCCI operation is more difficult. Typically, the engine is cold-started as a SI or CIDI engine, then switched to HCCI mode for idle and low- to mid-load operation to obtain the benefits of HCCI in this regime, which comprises a large portion of typical automotive driving cycles. For high-load operation, the engine would again be switched to SI or CIDI operation.

II. WORKING OF HCCI ENGINE

In an HCCI engine (which is based on the four-stroke Otto cycle), fuel delivery control is of paramount importance in controlling the combustion process. On the intake stroke, fuel is injected into each cylinder's combustion chamber via fuel injectors mounted directly in the cylinder head. This is achieved independently from air induction which takes place through the intake plenum. By the end of the intake stroke, fuel and air have been fully introduced and mixed in the cylinder's combustion chamber. As the piston begins to move back up during the compression stroke, heat begins to build in the combustion chamber. When the piston reaches the end of this stroke, sufficient heat has accumulated to cause the fuel/air mixture to spontaneously combust (no spark is necessary) and force the piston down for the power stroke. Unlike conventional spark engines (and even diesels), the combustion process is a lean, low temperature and flameless release of energy across the entire combustion chamber. The entire fuel and air mixture is burned simultaneously producing equivalent power, but using much less fuel and releasing far fewer emissions in the process.

At the end of the power stroke, the piston reverses direction again and initiates the exhaust stroke, but before all of the exhaust gases can be evacuated, the exhaust valves close early, trapping some of the latent combustion heat. This heat is preserved, and a small quantity of fuel is injected into the combustion chamber for a pre-charge (to help control combustion temperatures and emissions) before the next intake stroke begins.

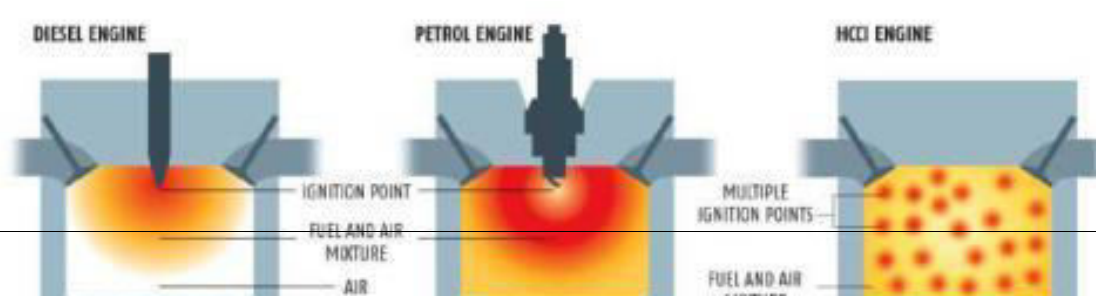
Few of the characteristic differences between conventional SI Engine and HCCI Engine and conventional Diesel Engine and HCCI Engine are shown in Table.1. and Table.2. respectively.

Table 1 : Comparison between Conventional SI Engine and HCCI Engine

Basis of comparison	SI Engine	HCCI Engine
Efficiency	Less	More
Throttle losses	More	No
Compression Ratios	Low	High
Combustion Duration	More	Less
NOx Emissions	Comparatively more	Less

Table 2 : Comparison between Conventional Diesel Engine and HCCI Engine.

Basis of comparison	Diesel Engine	HCCI Engine
Efficiency	High	Equally high
Combustion Temperatures	1900-2100K	800-1100K
Cost	Comparatively High	Less
Combustion Duration	More	Less
PM and NOx Emissions	More	Less



III. CHALLENGES

HCCI combustion is achieved by controlling the temperature, pressure and composition of the air/fuel mixture so that it auto ignites near top dead center (TDC) as it is compressed by the piston. This mode of ignition is fundamentally more challenging than using a direct control mechanism such as a spark plug or fuel injector to dictate ignition timing as in SI and CIDI engines, respectively. While HCCI has been known for some twenty years, it is only with the recent advent of electronic engine controls that HCCI combustion can be considered for application to commercial engines.[1].

Even so, several technical barriers should be overcome before HCCI engines will be viable for high-volume production and application to a wide range of vehicles. The following describes the more significant challenges for developing practical HCCI engines for transportation. Greater detail regarding these technical barriers, potential solutions, and the R&D needed to overcome them are provided in Section V. Some of these issues could be mitigated or eliminated if the HCCI engine was used in a series hybrid-electric application. Some of the challenges that are encountered to develop the HCCI engine to meet commercial needs are discussed below.

A. *Controlling Ignition Timing over a Range of Speeds and Loads*

Expanding the controlled operation of an HCCI engine over a wide range of speeds and loads is probably the most difficult hurdle facing HCCI engines. HCCI ignition is determined by the charge mixture composition and its temperature history (and to a lesser extent, its pressure history). Changing the power output of an HCCI engine requires a change in the fueling rate and, hence, the charge mixture. As a result, the temperature history must beadjusted to maintain proper combustion timing. Similarly, changing the engine speed changes the amount of time for the auto ignition chemistry to occur relative to the piston motion. Again, the temperature history of the mixture must be adjusted to compensate. These control issues become particularly challenging during rapid transients. Several potential control methods have been proposed to provide the compensation required for changes in speed and load. Some of the most promising include varying the amount of hot EGR introduced into the incoming charge, using a VCR mechanism to alter TDC temperatures, and using VVT to change the effective compression ratio and/or the amount of hot residual retained in the cylinder. VCR and VVT are particularly attractive because their time response could be made sufficiently fast to handle rapid transients. Although these techniques have shown strong potential, they are not yet fully proven, and cost and reliability issues must be addressed.

B. Extending the Operating Range to High Loads

Although HCCI engines have been demonstrated to operate well at low-to-medium loads, difficulties have been encountered at high-loads. Combustion can become very rapid and intense, causing unacceptable noise, potential engine damage, and eventually unacceptable levels of NOx emissions. Preliminary research indicates that the operating range can be extended significantly by partially stratifying the charge (temperature and mixture stratification) at high loads to stretch out the heat-release event. Several potential

mechanisms exist for achieving partial charge stratification, including varying in-cylinder fuel injection, injecting water, varying the intake and in-cylinder mixing processes to obtain non-uniform fuel/air/residual mixtures, and altering cylinder flows to vary heat transfer. The extent to which these techniques can extend the operating range is currently unknown, and extensive R&D is needed. Because of the difficulty of high-load operation, most initial concepts involve switching to traditional SI or CI combustion for operating conditions where HCCI operation is more difficult. This dual mode operation provides the benefits of HCCI over a significant portion of the driving cycle but adds to the complexity by switching the engine between operating modes.

C. Cold-Start Capability

At cold start, the compressed-gas temperature in an HCCI engine will be reduced because the charge receives no preheating from the intake manifold and the compressed charge is rapidly cooled by heat transferred to the cold combustion chamber walls. Without some compensating mechanism, the low compressed-charge temperatures could prevent an HCCI engine from firing. Various mechanisms for cold-starting in HCCI mode have been proposed, such as using glow plugs, using a different fuel or fuel additive, and increasing the compression ratio using VCR or VVT. Perhaps the most practical approach would be to start the engine in spark-ignition mode and transition to HCCI mode after warm-up. For engines equipped with VVT, it may be possible to make this warm-up period as short as a few fired cycles, since high levels of hot residual gases could be retained from previous spark-ignited cycles to induce HCCI combustion. Although solutions appear feasible, significant R&D will be required to advance these concepts and prepare them for production engines.

D. HC and CO Emissions

HCCI engines have inherently low emissions of NOx and PM, but relatively high emissions of hydrocarbons (HC) and carbon monoxide (CO). Some potential exists to mitigate these emissions at light load by using direct in-cylinder fuel injection to achieve appropriate partial-charge stratification. However, in most cases, controlling HC and CO emissions from HCCI engines will require exhaust emission control devices. Catalyst technology for HC and CO removal is well understood and has been standard equipment on automobiles for many years. However, the cooler exhaust temperatures of HCCI engines may increase catalyst light-off time and decrease average effectiveness. As a result, meeting future emission standards for HC and CO will likely require further development of oxidation catalysts for low-temperature exhaust streams. However, HC and CO emission control devices are simpler, more durable, and less dependent on scarce, expensive precious metals than are NOx and PM emission control devices. Thus, simultaneous chemical oxidation of HC and CO (in an HCCI engine) is much easier than simultaneous chemical reduction of NOx and oxidation of PM (in a CIDI engine).

IV. EFFECT OF DESIGN AND OPERATING PARAMETERS ON HCCI DIESEL EMISSIONS

A. Injection timing

Port fuel injection would be the obvious way to generate a homogeneous mixture by allowing sufficient mixing time, as charge homogeneity is necessary for HCCI combustion. It is not feasible to deliver diesel fuel via port injection due to the high boiling point range of diesel fuel which leads to poor vaporization at typical diesel intake manifold temperatures [2]. Smoke and HC emissions increase as the non-evaporated liquid fuel adheres to the walls of the intake system and combustion chamber [3]. Although increasing the intake gas temperature can alleviate to a certain extent the problem of poor vaporization, engine efficiency is lowered [4]. To achieve the required degree of air fuel mixture homogeneity necessary for HCCI combustion, injection timing is of paramount importance since the length of mixing time of air and fuel is dependent on when the fuel is injected into the combustion chamber. Here, HCCI operations can be broadly classified into three categories: early injection, multiple injections and late injection.

i. Early injection

Unlike conventional HCCI combustion, where fuel is injected early in the compression stroke, consisting sufficient time for the formation of a homogeneous mixture to form,Takeda et al. [5] described an Early Injection strategy in the Premixed lean Diesel Combustion (PREDIC) mode operated on a DI four-cycle naturally aspirated single-cylinder engine. Using two side injectors and one centre injector, different injector configurations were tested in combination with varying injection timings and excess air ratios, λ. For fixed excess air ratios, the ranges of operational injection timings were limited to misfiring (too early) and knocking (too late). For instance, at $\lambda = 2.7$, injection timing had to be between approximately 800 Before Top Dead Centre (BTDC) to 600BTDC. NOx emissions were significantly lower under PREDIC operation compared to conventional diesel combustion, with values reaching as low as 1/10 of the minimum concentrations emitted by standard diesel operation. However, this was accompanied by increased HC and CO concentrations due to over-leaning of the air fuel mixture. The shortcomings of the PREDIC combustion system included limited partial load operation and lack of ignition timing control [6].

ii. Multiple injections

Multiple injections strategies have been developed subsequently to single early injection strategy for diesel combustion in HCCI mode. The systems featuring multiple injections include the Multiple stage Diesel Combustion (MULDIC) [7] and Homogeneous charge intelligent Multiple Injection Combustion System (HiMICS) [8, 9]. In the former, following an early injection at 1500 BTDC, a second injection occurs within the range of 20BTDC to 300 After Top Dead Centre (ATDC) as can be seen in Fig.2.

The first stage of combustion is premixed lean combustion which lowers NOx emissions, while the second stage is diffusion combustion which occurs under high temperature and low air conditions.

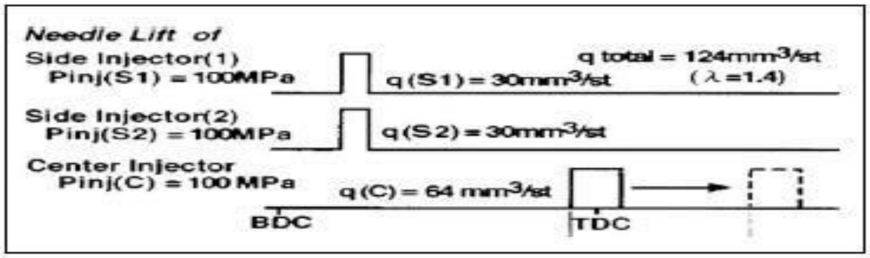


Fig. 2: Injection pattern of MULDIC [7].

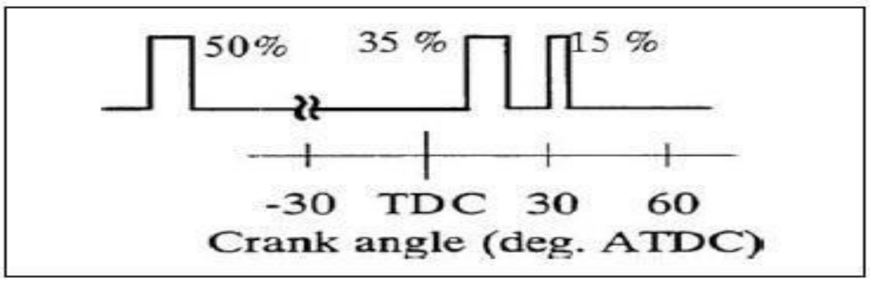


Fig. 3: Injection pattern of HiMICS [8].

This enabled the MULDIC operating range to be extended to higher load conditions, with substantial reduction in NOx emission at higher load conditions, compared to the PREDIC system. Fig. 3 shows the injection pattern of the HiMICS. In the HiMICS, a combination of a very advanced preliminary injection followed by a main injection around Top Dead Centre (TDC) and a late stage injection at approximately 300ATDC to reduce smoke is carried out. Compared to standard injection and pilot injection cases, trade-off relations worsen between NOx and fuel consumption as well as NOx and smoke in the region of ordinary injection timing. In the region of excessively retarded timing, these trade-off relations can be improved for HiMICS due to the ultra low NOx emission. Nevertheless, drawbacks of this combustion system included high levels of HC and CO emissions, premature ignition and inadequate homogenization of the pre-mixture.

iii. Late injection

With late injection timing starting just before TDC till later crank angles, gas temperature and density decrease because of piston expansion which leads to longer ignition delay (ID) and an improved mixture formation. The in-cylinder conditions become favorable for HCCI combustion. The Homogeneous Charge Late Injection (HCLI) and the Highly Premixed Late Injection (HPLI) are the latest HCCI diesel combustion concepts featuring late injection timing [10]. In HCLI, the injection is carried out at approximately 400BTDC and a rapid homogenization occurs. For HPLI, SOI is after TDC to ensure that the ID is sufficient for mixture formation and homogenization before combustion. Fig. 4 shows that the operational regions of HCLI and HPLI are restricted to low load and medium load conditions respectively. Conventional DI diesel combustion is used for high load conditions.

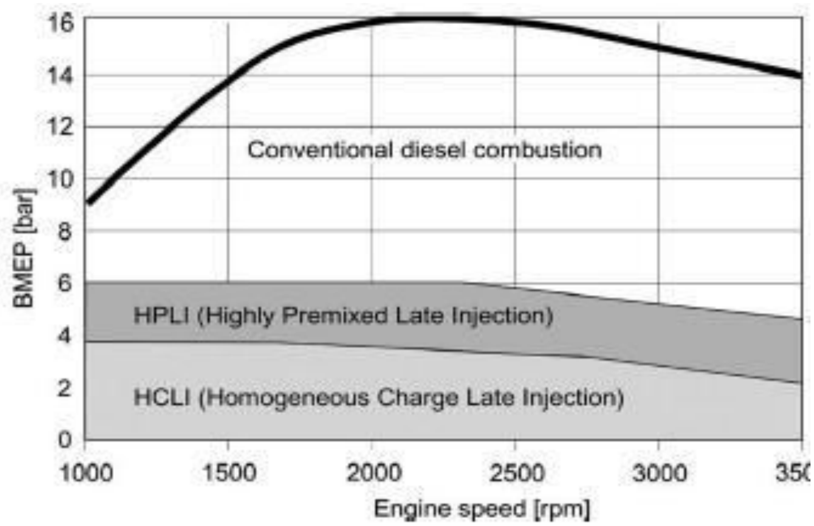


Fig. 4 : HCLI and HPLI combustion concepts according to load range [10].

B. *Injection pressure*

Better mixing of the in-cylinder charge especially when used in combination with smaller nozzle orifice can be promoted with increased injection pressures[11]. Increased injection speed at high fuel injection pressure leading to a high rate of air entrainment and mixing which results in favorable spray structure and better combustion [9]. Furthermore, investigations on a pressurized vessel with optical access and common rail (CR) fuel injection system indicated that leaner sprays which are important for PCI combustion are produced when fuel injection pressure is increased [2].

C. *Piston bowl geometry*

The combustion in the bowl case was more stratified probably in temperature with less ignition kernels compared to the disc case. One possible explanation for this could be that the hot residuals are trapped in the bottom of the bowl introducing temperature gradients throughout the charge. Hot zones are more prone to ignite resulting in combustion that starts in the bowl and propagates throughout the colder charge. It was also seen that the combustion in the squish was much later compared to the bowl which might not be so strange if the temperature is lower in this region, since the heat losses are higher due to the narrow squish distance.[17].

D. *Compression Ratio*

The increase in compression ratio increases the peak pressure and advances the position of peak pressure. Figure 5 displays the calculated and measured variations of cylinder pressure at three compression ratios. It shows that the calculated and measured data agree well for three compression ratios. The fact that the threepressure curves in Fig. 5 start to deviate at earlier compression stage (starting from about -50 CA) [18]

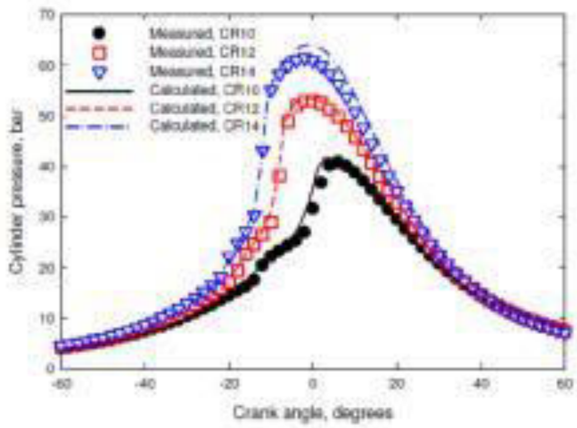


Fig. 5 : Effect of compression ratio. AFR = 50, Tintake = 40 C, Pintake = 95 kPa, Pexthaust = 104 kPa, n = 900 RPM.[18]

Figure 6 displays the variation of NOx emissions when compression ratio changes. It is noted that there is some difference between experimental and simulation results. The experimental result shows that NOx emissions first decrease then quickly increases and finally decreases again with decreasing compression ratio. In contrast, simulation shows a monotonic decrease in NOx emissions with decreasing compression ratio. As has been indicated above, decreasing compression ratio reduces the combustion inside cylinder. Therefore, both simulation and experimental results show a decrease in NOx emissions when compression ratio decreases from 16 to 11.

However, it is not clear why NOx emissions increased in experiment when the compression ratio decreased from 11 to lower values, since combustion intensity inside cylinder became weaker for lower compression ratio cases, as shown in Fig. 5. This inconsistency between experimental and numerical data is similar to that observed above for higher air/fuel ratio cases, suggesting that further study is needed for the cases at extreme conditions when combustion intensity is relatively weak or near misfire.

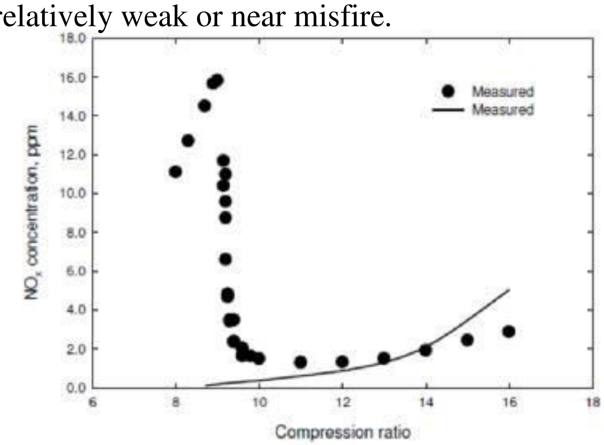


Fig. 6 : Effect of compression ratio on NOX emission. AFR = 50, Tintake = 40 C, Pintake = 95 kPa, Pexthaust = 104 kPa, n = 900 RPM.1[18]

E. Engine Speed

Figure 7 shows the measured and calculated variation of cylinder pressure when engine Speed is increased from 600 to 1400 rpm. It is found that the calculated and measured data agree well until an engine speed of 1200 rpm is reached. At an engine speed of 1400 rpm, simulation over predicted the cylinder peak pressure. It is noted from experiment that at the engine speed of 1400 rpm and other parameters investigated, engine is near a condition at which ignition and combustion fail. Therefore, the over prediction of peak pressure at the engine speed of 1400 rpm suggests that multizone model over predicts the combustion intensity at some extreme conditions. This is similar to the failure of the model at extremely high air/fuel ratio conditions.[18]

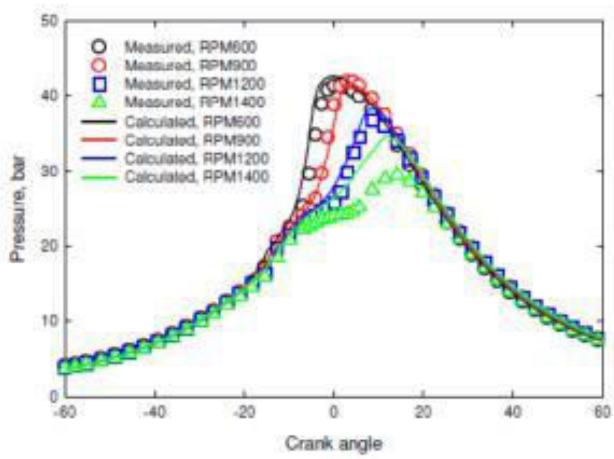


Fig. 7 : Effect of engine speed. AFR = 50, Tintake = 40 C, Pintake = 95 kPa, Pexthaust = 104 kPa, CR = 10[18].

Both experiments and the numerical simulation show that increasing engine speed causes the decrease in peak pressure and the delay in the position of peak pressure. Relatively, the effect of engine speed on low temperature heat release stage is weak. The effect of engine speed on the combustion of a HCCI engine could be caused by two possible factors. Firstly, the increase in engine speed intensifies the heat transfer to cylinder wall and thus increases heat loss. In addition, the increase in engine speed also results in the decrease in residence time of mixture inside cylinder, which may also lead to the delay of ignition and weaken the combustion process.

F.Air/Fuel Ratio

Similar to spark ignition and diesel engines, air/fuel ratio (AFR) is an important parameter to control the combustion of a HCCI engine. The effect of air/fuel ratio on the combustion of the HCCI engine was investigated first. Figure 8 shows the variation of pressure calculated by this paper and measured previously [12,13] at air/fuel ratios (mass based) of 45, 50 and 55, when other parameters are constant. It is observed that simulation successfully captured the experimental phenomena for all three air/fuel ratios. The start of combustion, the peak pressures and the positions of peak pressure were reasonably calculated. These imply that the multi-zone model developed in this paper is able to predict the primary phenomena of HCCI combustion [18].

The experiment and simulation also show that decreasing air/fuel ratio advances the position of peak pressure and increases the peak pressure. This is because the air/fuel mixture approaches stoichiometric conditions when the air/fuel ratio is decreased. Moreover, it is noted that the variation of air/fuel ratio causes more significant changes in peak pressure and its position, while has relatively less effect on low temperature heat release stage.

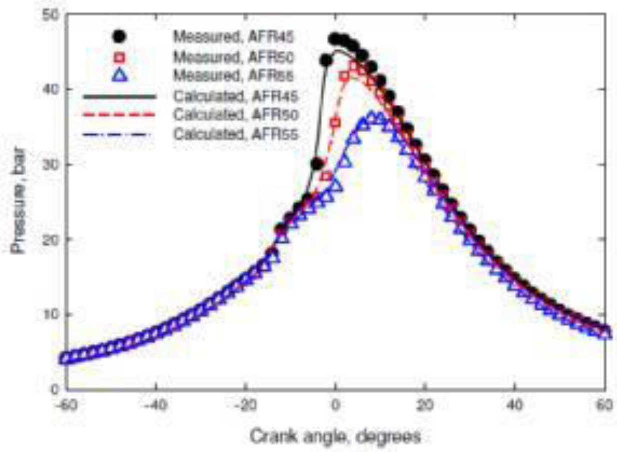


Fig. 8 : Effect of air/fuel ratio on HCCI combustion. Compression ratio (CR) = 10, intake temperature (Tintake) = 40 C, intake pressure (Pintake) = 95 kPa, exhaust tank pressure (Pexthaust) = 104 kPa, engine speed (n) = 900 RPM.

H. Intake Temperature

As HCCI combustion mode is controlled by chemical kinetic reactions, the engine inlet charge temperature is an important parameter which can modify the ignition timing. In this part, the effect of the intake charge temperature on the combustion ignition delays was evaluated, for the three fuels without EGR and at the equivalence ratio of 0.3. Figure 9 shows the Heat Release Rate (HRR) of 80%n-heptane-20%toluene mixture combustion as example, with an inlet temperature range from 53 to 118°C. First, as expected, cool and main flames appear earlier in the cycle when the temperature increases. Secondly, the HRR gradient becomes more and more important.[18]

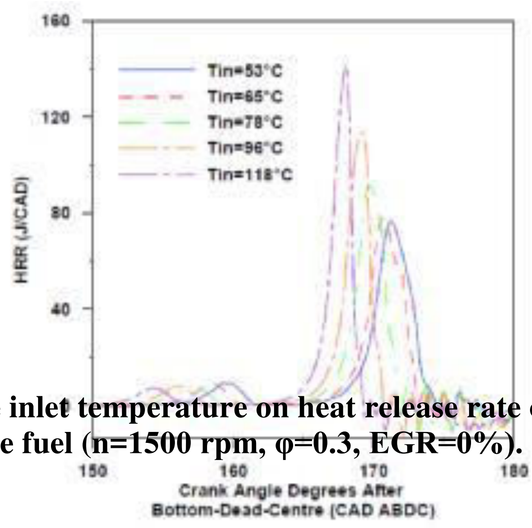


Fig. 9 : Effect of the inlet temperature on heat release rate of combustion of 80%n-heptane-20%toluene fuel (n=1500 rpm, φ=0.3, EGR=0%).

Figure 10 presents the effect of the intake temperature on cool and main flames ignition delays (τLTHR and τHTHR respectively). Their evolution seems to be linear with the inlet temperature increase. Moreover, the octane number effect on ignition delays can be noticed.

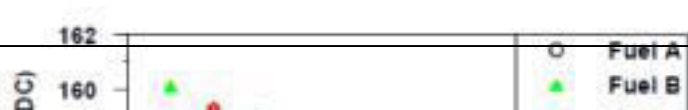


Fig. 10 : Effect of the intake charge temperature on ignition delays τLTHR (a) and τHTHR (b) for the three fuels.

I. EGR

In order to decrease NOx emissions, the recirculation of the exhaust gases (EGR) is strongly used in engines [14]. Moreover, in the case of HCCI mode, it could also be a solution to control combustion ignition timings. For that, the ignition timings for the three studied fuels was evaluated at a constant intake temperature (Tin=80 °C), at fixed equivalence ratio (φ=0.3) with an EGR rate from 0 to 50% (volume percentage of air replaced by CO2, O2 and N2). Figure 11 presents only the case of n heptane combustion (the other fuels cases present similar evolution). The combustion is globally retarded due to the higher mixture heat capacity (of air, fuel, CO2 and N2) which increases with the EGR rate and generates a lower in-cylinder temperature. The maximum of the heat release rate is also lower as it is shown in the Figure 11, involving the decrease of the in cylinder pressure peak (67 bars to 60 bars respectively without and with 50% of EGR, constant standard deviation equal to 0.2 bar)[19]. With the increase of EGR rate, the HCCI combustion can be closed to the incomplete combustion limit: as the CO is an indicator of incomplete combustion, its concentration in the exhaust gases was measured and found to be 0.28% (without EGR) and 0.4% (with 50%EGR). In the Figure 11, the heat release rates of 40 and 50% of EGR begin to present some bumps, representative of the difficulty in converting carbon monoxide (CO) in carbon dioxide (CO2) because of a lack of high temperature in these operating tests.

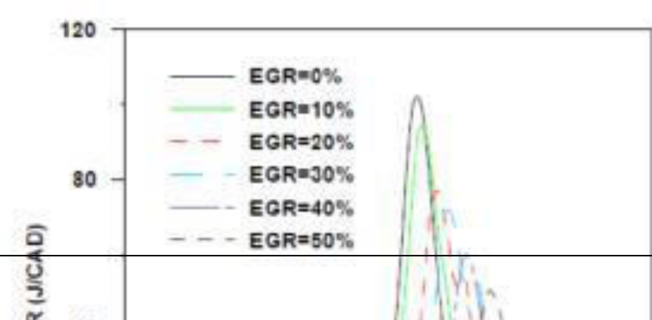


Fig. 11 : Effect of the EGR rate on heat release rate of combustion (n=1500 rpm, τ=0.3 Tin=80°C)[19]

J. Supercharging and Turbo charging

The HCCI operating range can be increased with both mechanical supercharging and turbo charging. The maximum load and brake efficiency are higher with turbo charging than with mechanical supercharging, due to the high parasitic losses with supercharging. The total turbocharger efficiency is assumed to be 42% in the turbocharged test. The maximum load achieved with the turbocharged HCCI is 10bar BMEP. The brake efficiency is higher for the turbocharged HCCI than with the natural aspirated CI in the entire operating range for HCCI. The difference in brake efficiency decreases with load and is almost negligible at the maximum turbocharged HCCI load.

K. Swirl Ratio

The effects of swirl ratio on emissions from premixed low temperature diesel combustion have been studied on a HSDI diesel engine at fixed operating conditions of 1500 rpm and 3 bar IMEP for an injection timing range of 34–2_BTDC [15]. As swirl ratio was increased from 1.0 to 4.0, significant reduction in soot emissions was achieved especially for advanced injection timing. This indicated that increasing swirl ratio favors the reduction of local rich regions within the in-cylinder charge. It was also shown that swirl ratio had negligible influence on both NOx and CO emissions. Similarly, Choi et al. [20] observed that increasing swirl ratio from 1.44 to 7.12 monotonically decreased peak soot luminosity at a low load of 3 bar IMEP. At higher load of 6 bar IMEP, intermediate swirl ratios of 3.77 and 4.94 produced the highest levels of soot luminosity but the decay was very rapid compared to the relatively slow decay at low and high swirl ratios. It was suggested that an optimum swirl ratio exists at 6 bar load whereby the soot oxidation rate was maximized.

V. CONCLUSIONS

HCCI diesel engines have strong potential to improve fuel efficiency than petrol engine, reduce NOx, and soot emission than diesel engine. HCCI engine implementation requires

three main hurdles; combustion phasing control, HC and CO emission, and operating range, which needs to be overcome for successful HCCI operation[21]. HCCI can be applied to a variety of fuel types and the choice of fuel will have a significant impact on both engine design and control strategies. Single zone model and all parameters that used to study HCCI combustion behavior, emission, and performance have discussed. Five main control strategies also highlighted, which could be used to maintain, stabilize HCCI operation. Finally, the control of ignition timing, which determines the main combustion phasing and thus has a strong influence on efficiency and operating range of HCCI engine, because early and late combustion can result in heavy knock-like combustion that damages the engine. Therefore, a need of good combustion phasing control is essential to achieve successful HCCI operation.

Although much advancement has been achieved in this research field over the last decade, large scale adoption of HCCI diesel engines in commercial vehicles is currently not possible. The main challenges facing HCCI diesel engines are its limited operational range, lack of direct control of combustion phasing and increased HC and CO emissions as reported in some applications. The feasibility of a full HCCI diesel engine was demonstrated in a single-cylinder heavy duty Caterpillar engine which attained 20 bar BMEP but the extension of full load HCCI application to light duty engines remains unclear. Hence, for future long term development of HCCI diesel combustion systems, the key issues will be more flexible injection strategies and EGR control for better mixture formation and control as well as high boost to extend the upper load limits. With projected increasing flexibility in both engine hardware and control system in the long term, the development of a full HCCI diesel engine is possible. [22]

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Sample for Serial No: 2:

PROPOSAL FOR PROJECT ACTIVITY :

1.**A Proposal of a hobby/mini/proto/general/model/proto type project with estended abstract, Block Diagram/Circuit/Flow diagram and clear references may be presented and executed**.

Optimizing the Compression Ratio of Compression Ignition Engine Fuelled With Esters of Crude Rice Bran Oil

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ABSTRACT

Experiments were carried out on a single cylinder four stroke variable compression ratio compression ignition engine with an attempt to figure out the optimum compression ratio fuelled with blend of methyl ester of crude rice bran oil with diesel. A 2-step transesterification reaction was carried out for the preparation of the methyl ester of crude rice bran oil. Experiments were carried out at different compression ratios ranging from 12 to 18. A B20 blend was used as fuel for conducting the experiments. At a compression ratio of 14 results showed significant improvement in the performance characteristics. Highest brake thermal efficiency along with lowest specific fuel consumption was observed at a compression ratio of 14. Compression ratio above and below 14 showed drop in the brake thermal efficiency and increase in specific fuel consumption. Keywords – crude rice bran oil, trans-esterification, compression ratio, performance

I. INTRODUCTION Worldwide energy demands are increasing day-by-day. Major part of it is contributed by fossil fuels. Petroleum diesel being cheaper in cost has attracted the minds of people to use it as fuel in diesel engine which has increased the number of diesel fuelled vehicles. This rapidly increasing demand of petroleum diesel has promoted research on its alternative fuel and diesel fuelled engine. Improved engine design can lead to lesser fuel consumption along with better engine performance [1]-[4]. For satisfying their energy demands most of the fossil fuels are being imported by the developing countries. For a petroleum importing country like India it is a major concern. So an alternative fuel within the country has to

be found. Biodiesel is the most appropriate fuel for replacement of petroleum diesel. Biodiesel is generally produced by trans-esterification of vegetable oil, animal fats and waste cooking oiil [5]-[8]. Trans-esterification is the conversion of one ester into other. Trans-esterification process is generally called alcoholysis as the original ester is reacted with alcohol. Glycerol is the byproduct of the reaction. Fig.1 shows the basic trans-esterification reaction. The most commonly used alcohol is methanol. The reaction is completed in the presence of catalyst. The catalyst used can be acidic or basic. Catalysts used are generally sodium hydroxide (NaOH), potassium hydroxide (KOH) as base catalyst and hydrochloric acid (HCl), sulphuric acid (H_2SO_4) as acid catalyst. The main purpose of trans-esterification is to reduce the viscosity. Lower viscosity solves the problem of engine choking. There are various feedstock available for production of biodiesel. Crude rice bran oil is a potential resource for production of biodiesel [9] [10]. Rice bran oil is extracted from the germ and inner husk generally known as bran which is a byproduct of rice processing industry.

15-20% of oil content is present in rice bran oil. India is the second largest producer of rice, next to China. Recent survey has shown India as the largest producer of rice bran oil in the world

The biodiesel extracted has to be blended in a particular proportion with petroleum diesel. The blended fuel should possess an improved or an equivalent performance characteristic as that of diesel. So an appropriate blend has to be optimized. Various researchers have recommended B20 (20% biodiesel, 80% diesel) as the most appropriate blend to be used as fuel in diesel engine without any modification to the engine [1

The current research work is associated with finding the optimum compression ratio of a compression ignition engine fuelled with B20 blend of methyl ester of crude rice bran oil at different load conditions

II. MATERIAL AND METHODS

A. Equipment

Table I show the detailed specification of the engine. Compression ratio (C.R.) of the engine was varied with the use of a tilting cylinder block arrangement without altering the combustion chamber geometry. For combustion pressure and crank angle measurement set-up has provision of the required instruments. Engine indicator, process indicator and transmitters for fuel and air flow measurement were present in the panel box of the set-up. Fig.2 shows the pictorial view of the set-up. Cooling water flow at 300 litres per hour was kept throughout the entire experimentation.

Table I: Engine Specification:

Make Type	Kirloskar
Engine Type	Single Cylinder 4-Stroke, Water Cooled
Compression ratio	Variable ranging from 12 to 18
Rated power	3.75 kW@1500 R.P.M
Stroke	110 mm
Bore	87.5 mm
Loading device	Eddy current dynamometer

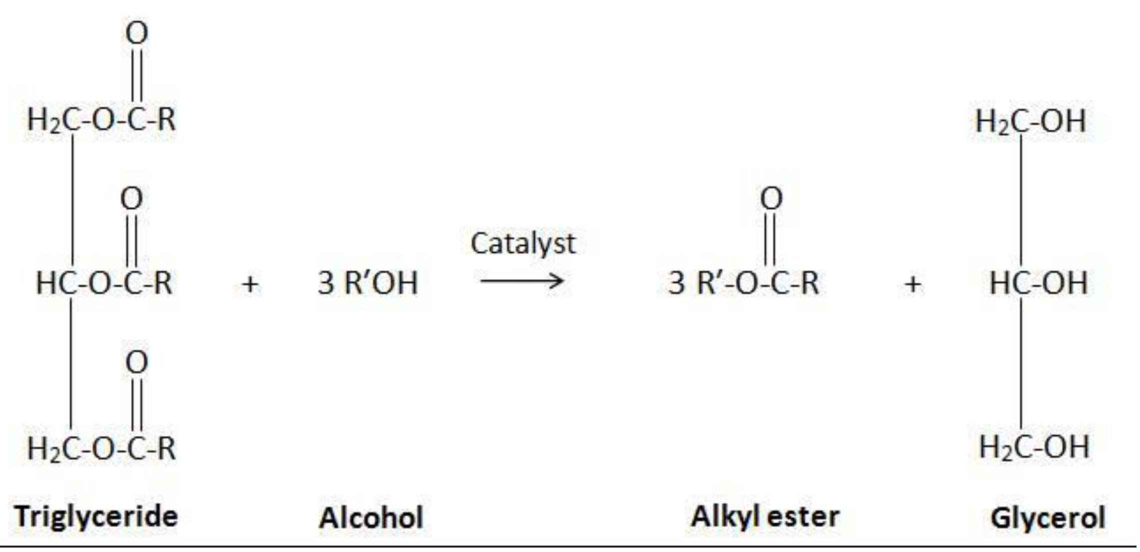


Fig.1 : Trans-esterification reaction

Fig. 2 : Pictorial view of the set-up

B. Materials

Crude oil was procured from A. P. Refinery Pvt. Ltd. near Ludhiana (India). The trans-esterification process was carried at biofuel laboratories, Mechanical Engineering Research and Development Organization (MERADO). Methanol, potassium hydroxide (KOH) and sulphuric acid (H2SO4) were used for carrying out trans-esterification in water bath shaker.

C. Trans-esterification

A 2-step trans-esterification involving an acid catalyzed trans-esterification followed by an alkali catalyzed trans-esterification was carried out for crude rice bran oil. In the first step, an acid catalyzed trans-esterification was carried out with sulphuric acid (H2SO4) as acid catalyst and methanol as alcohol with constant stirring for 1 hour in a water bath shaker at 60°C. In the second step, the pretreated oil was further subjected to an alkali catalyzed trans-esterification with methanol as alcohol and KOH as catalyst with constant stirring for 1 hour in water bath shaker at 60°C. The un-reacted catalyst along with methanol and the residual glycerol were removed by the water washing method (3-5 times) using hot distilled water until the water became clear. After washing, the crude rice bran biodiesel was heated on a oil hot plate for 15-20 minutes for removal of water and methanol content present in it. After washing and drying,

various properties were investigated. Table II lists the fatty acid profile of crude rice bran oil and Table III shows the properties of crude rice bran biodiesel.

Table II Fatty acid composition of crude rice bran

Fatty acid profile	**(%)**
Myristic Acid (C14)	0.34
Palmitic Acid (C16)	19.5
Stearic Acid (C18)	2.3
Oleic Acid (C18: 1)	43.0
Linolic Acid (C18: 2)	32.0
Linolenic Acid (C18: 3)	1.6
Arechidic Acid (C20)	0.7
Higher Fatty Acids(C22)	0.6

Table III Crude rice bran biodiesel properties

Property parameters	Crude rice bran biodiesel
Density, kg/m3	877
Viscosity at 40 ºC, mm²/sec	3.57
Carbon Residue, % w/w	0.244
Flash point, ºC	210

RESULTS AND DISCUSSION:

Results obtained at each compression ratio for different load conditions pertaining performance of the engine are demonstrated with the help of graphs. Increase in brake power is directly proportional to the increase in load.

Fig.3 shows the brake thermal efficiency (BTE) variation with brake power. For all compression ratios, brake thermal efficiency shows an almost identical type of variation with the increase in engine load. At C.R.14, the highest value of thermal efficiency is obtained. While the lowest obtained is at C.R.18. An increasing trend is observed in brake thermal efficiency till C.R 14, but the trend reverses with further increase in the compression ratio.

IV. CONCLUSIONS:

Conclusions summarized from the experimental investigation are as follows:

1) Maximum value of brake thermal efficiency is obtained at C.R. 14.
2) Lowest brake specific fuel consumption is obtained at C.R. 14.
3) With the increase in engine load the maximum increase in cylinder pressure along with decrease in ignition delay is attained at C.R. 14.
4) Moderate exhaust gas temperature is observed at C.R. 14.
5) B20 blend of rice bran methyl ester can be used as a fuel in diesel engine without any modification in it.

A practical conclusion is that, 14 is the most optimum compression ratio based upon the performance characteristics of a compression ignition engine fuelled with B20 blend of crude rice bran methyl ester.

PROPOSAL FOR CONSULTANCY:

OBJECTIVE: A programme/machine/product of utility may be proposed to develop for in house usage/ Industrial requirements may be useful for any outside agency that can be marketable in order to generate revenue through consultancy

FUNDED/UNFUNDED PROPOSALS (if any):

PROPOSAL FOR SDP:

OBJECTIVE: This SDP programme is intended to bring down the awareness among all Staff in order to study the various possible mechanisms involved in Conventional machining processes to improve the material removal rates.

13. **PROPOSALS (WEEK WISE INDUSTRIAL VISITS)(IN HOUSE OR OUTSIDE VISIT)/TRAINING PROGRAMMES:**

TABLE 1 : INDUSTRIAL VISITS

S.no	Type of Industry	Nature of industry	Date of visit	No. of students participated	Year/branch	remarks
1	MAHINDRA &MAHINDRA COMPANY	MANUFACTURING	16.O8.14	60	III/1V I SEM	

11.GUIDELINES FOR SHADOW ENGINEERING(VIP)
INDUSTRIAL VISITS (IIP – INNOVATIVE INDUSTRIAL LEARNING PROGRAM):
OBJECTIVES OF SHADOW ENGINEERING:

1. The program which uplifts the knowledge of the students related to laboratories.
2. To improve the industry-college interactions.
3. To create industry like environment for all the students in order to make future Assignment.
4. This program leads to matrixing with the students.

TABLE 2: INDUSTRIAL TRAINING (Shadow Engg)

(Career Visit Approval)

S.no	Name of the Course	Nature of industry	Duration of Training	Authority	Date of Training/Certificate No.	remarks
1	RANE ENGINE VALVES-MEDCHAL	BRAKELINER AND ENGINE VALVES	1 WEEK	DyDirector		

ACTIVITIES IN LIFT PROGRAMME:

12.CALIBRATION/INSTALLATION AND TESTING:

Calibration: Aim of this concept is to check :

i.whether all the equipment is functioning correctly as per the standards

ii. To bring correctness in the errors of instrument or equipment.

iii. To rectify the errors if any

Installation: Aim of this concept is to make and maintain installation procedure for a New equipment or already existing equipment

Testing : Aim of this concept is to test the equipment after installation whether it Meets the existing standards.

The list of equipments (hardware/software) :

Necessity of tools for development and testing

Equipment to be calibrated

Installation of supporting equipment if any.

PROCEDURE FOR CALIBRATION:

Any Equipment or Instrument or Gauge or Machine can be calibrated as the standard guidelines mentioned under:

1.Identify the Equipment/Instrument/Gauge/Machine which is under defective or to be calibrated or correction for error

2.Identify the type of error and estimate its frequency of variation.

3. Check with Master Standards or equipment/instrument/machine which is working correctly and meeting our requirements.

4. Estimate the frequency of deviations from normal mode.

5. If the equipment is under warranty, then inform to concerned supplier or agency who will carry out calibration.

6. If the equipment is out of warranty then we can compare the deviations and set the error rectification.

7. Generally as per the procedure, the equipment or instruments can be calibrated by the agencies and issue calibration certificate which consists of date of calibration, calibration next due date and remarks as mentioned in the following format.

8. Record and keep all the calibration certificates in safe custody.

After calibration the details of equipment should be submitted in following format

S.no	Type of equipment	Certificate no	Certificate issued by	Date of calibration	Date of calibration due	Remarks
1	PETROL ENGINE		MATRIX COMPANY,BANGALORE			
2	DIESEL ENGINE		MATRIX COMPAN			

			Y,BANGA LORE			
3	COMPRE SSOR		MATRIX COMPAN Y,BANGA LORE			

iv. Calibration,Testing and Installation details equipment wise are mentioned as follows:

Case 1: Calibration of Equipment -------------------------------------- if any

Case 2: Installation of Equipment -------------------------------------- if any

Case 3: Testing of Equipment -- if any

Presently there is no new equipment is present for either testing or installations.

13. MAINTENANCE AND TROUBLESHOOTING :

Maintenance:

Maintenance and trouble shooting of each equipment in a laboratory must follow the following guidelines:

Maintenance Schedules:

(1) Preventive Maintenance Schedules of lab will be decided by lab in charge along with concerned HOD. The details of schedule should be recorded in the following template of format.

S.No.	Name of the Equipment	Date of Maintenance	Type of Activity	Remarks
1	DIESEL ENGINE		TESTING OF FUEL CONSUMPSION,WEIGHTING M/C READING,MANOMETER READING	
2	PETROL ENGINE		TESTING OF FUEL CONSUMPSION,WEIGHTING M/C READING,MANOMATER READING,PRESURE GUAGE	

(2) Maintenance Reports duly signed by in charges as well as HODs and duly approved by Principal periodically.

14. TROUBLE SHOOTING SCHEDULES:

A proposal is to be made from each lab branchwise. The proposal should carry following details related to specific equipment in lab.

S.No., Equipment Name , Type of Problem (Too much Noise, Abnormal Sound, Corrupt Software, Anti Virus Problem, Missing of Display, CRT not working, Motor is not giving signal, Digital display is not working, Break of tools, Mis alignment of machine elements, PLC is not properly working), Expected Reasons (Bearing failure, Improper alignment of machine centres, Missing of vibration pads etc)

Trouble shooting exercises should be properly recorded in a separate format as mentioned below:

S.No.	**Date of recording activity**	**Equipment Name**	**Type of Trouble**	**Remedial Activity**	**Remarks**
1	**10.05. 2014**	**DIESEL ENGINE**	**TRACK S IN THE SILENSER**	**RECTIFIED WITH METAL JOINING PROCESS**	

ASSESSMENT AND ACCREDITATION PROCESDURE AS PER NABL

Accreditation is the formal recognition, authorization and registration of a laboratory that has demonstrated its capability, competence and credibility to carry out the tasks. It provides the feedback to laboratories as to whether they are performing according to technical competence as per guidelines of NABL (National Accreditation Board for Testing and Calibration Laboratories)

The laboratory should carry out the following important tasks towards getting ready for accreditation from NABL.

1. Preparation of methodology in each experiment
2. Preparation of Standard Operating procedure for each equipment
3. Preparation of Laboratory Manual as per the guidelines specified by Combined Lab Team(CLT) headed by Principal/HOD/Dean/incharge
4. Ensure Effective environmental conditions(temperature, humidity,storage and placement) in the laboratories by implementing proper housekeeping and cleaning of the equipments from dust, dirt etc.
5. Ensure Calibration of instruments/equipment(Only NABL accredited authorized laboratories provide calibration.
6. All the details of Calibration should be included in the format specified exclusively for calibration procedure.
7. Ensure proper implementation of all the documents, formats to be included in the lab manual.

8. Impart training for all the technicians working in labs about the importance of documentation, log sheets, operating procedure of the lab.
9. Incorporate Internal Lab audits for effective functioning of the laboratories. Audits may be once in a month or 3 months or at the end of the semester. The audit schedule will be decided by the Chairman and Principal of the CLT team.
10. Auditors should submit the detailed report of each lab duly signed to the Principal.
11. Each lab should maintain all the bills/invoices of each instrument or equipment in a separate file.
12. All the stock registers either consumable or non consumable should be updated whenever any purchases of consumables or equipment takes place.
13. All the safety precautions are properly displayed in front of each lab.
14. All the Lead experiments should be maintained separately in a record /record in a separate folder.
15. Based on Pre Assessment report submitted by auditor, corrective actions should be carried out by each lab in charge and that must be forwarded to concerned HOD and Principal.

INSTRUMENTATION AND CONTROL SYSTEM LAB

1. **Objectives and Relevance**
2. **Scope**
3. **Prerequisites**
4. **Syllabus**
5. **Lab Schedule**
6. **Suggested Books**
7. **Websites**

8. **Experts' Details**
9. **Mapping of Lab with Projects/Consultancy/R&Ds**
10. **Visits**
11. **Shadow Engineering**
12. **Calibration, Testing and Inspection**
13. **Preventive Maintenance Schedules**
14. **Troubleshooting**

1. **OBJECTIVES AND RELEVANCE:**

The main objective of the lab course is to gain practical hands on experience by exposing the students to experiments like various testing on speed, displacement, force, pressure, strain.

2. **SCOPE:**

Understanding of Mechanical Machines has the scope to make the learner comfortable to work in any industry where there involves applications of instruments.

3. **PREREQUISITES:**

Theoretical knowledge on subject Instrumentation and control system. Which deals the overall working and performance of instrumentation and control system is required. Also student should have basic knowledge of, basic physics, matameticals, and electrical laws.

4. SYLLABUS-JNTU

EXPERIMENT NO. 1
Calibration of Thermocouple

OBJECTIVE:

To calibrate the given thermocouple using thermometer

DESCRIPTION:

a. Introduction to experiment – 30 min
b. Connection of experiment and its verification. c.
Check the room temperature initially.

APPLICATIONS:

- In studying the temperature of molten metal in foundries
- In studying the temperature of winding of electrical machines

EXPERIMENT NO. 2
Calibration of RTD
Calibration of RTD and Thermistor (Lead Experiment)

OBJECTIVE:

To calibrate and measure the temperature using Resistance Temperature detector.

DESCRIPTION:

a. Introduction to experiment – 30 min
b. Connection of experiment and its verification. c.
Check the room temperature initially.

APPLICATIONS:

- It is usually used when temperature measurement is to be done from a distance. this is possible since the sensing element.

EXPERIMENT NO. 3
Angular displacement using capacitive transducer

OBJECTIVE:

Measurement of angular displacement using capacitive transducer

DESCRIPTION:

a. Introduction to experiment -30 min

b. Connection of experiment and its verifications

c. Experimental determination of magnetization characteristics.

APPLICATIONS:

- Aircrafts, automobiles etc.

EXPERIMENT NO. 3
Calibration of LVDT

OBJECTIVE:

To determine the displacement of an object by using linear variable differential transformer transducer, to Compare it with a micrometer displacement and to establish accuracy of the instrument.

DESCRIPTION:

a. Introduction to experiment – 30 min

b. Connection of experiment and its verification.

APPLICATIONS:

- LVDT is generally used to measure displacement.
- LVDT can be used to measure vibrations, pressure, force and weight

EXPERIMENT NO. 4

Measurement of strain gauge

OBJECTIVE:

To determine the elastic constant of cantilever beam subjected to concentrated end load by using strain gauge

DESCRIPTION:

a. Introduction to experiment – 30 min

b. Connection of experiment and its verification.

c. Switch on the instrument and leave 5 minutes to warm up

APPLICATIONS:

- Strain gauge are used in the measurement of vibrations, acceleration
- Strain gauge are used in force measuring device (such as strain gauge load cell

EXPERIMENT NO. 5
Calibration of vibration setup

OBJECTIVE:

To measure the linear and angular displacement, velocity and acceleration

DESCRIPTION:

a. Introduction to experiment – 30 min

b. Connection of experiment and its verification.

APPLICATIONS:

- Rotating and reciprocating machine vibrate. The vibration of this machines are measured, which intern gives information about probable problems that may occur.
- Vibration monitoring is done on turbines of PowerStation to detect early problem.

EXPERIMENT NO. 6
Rota meter set up

OBJECTIVE:

Calibration of rotameter at different flow rates

DESCRIPTION:

a. Introduction to experiment – 30 min
b. Connection of experiment and its verification.
c. Fill in the sump tank with clean water, keep the delivery valve closed.

APPLICATIONS:

- Can be used to measure the flow rates of corrosive fluids
- Particularly useful to measure low flow rates.

EXPERIMENT NO. 7
Pressure cell

OBJECTIVE:

To Calibration the given pressure cell (hydraulic dead weight)

DESCRIPTION:

a. Introduction to experiment – 30 min

b. Connection of experiment and its verification. c.Adjust

the zero pot of the indicator to indicate zero.

APPLICATIONS:

- The flatted tube pressure cell is used for low pressure measurement

- The cylindrical type pressure cell is used for medium and high pressure measurement

EXPERIMENT NO. 8
Calibration of Mc Leod gauge

OBJECTIVE:

To Calibration the given vaccum cell (Low pressure cell)

DESCRIPTION:

a. Introduction to experiment – 30 min
b. Connection of experiment and its verification.
c. Adjust the zero pot of the indicator to indicate zero

APPLICATIONS:

Used to measure vacuum pressure

EXPERIMENT NO. 9
Magnetic and photo pickups.

OBJECTIVE:

To study and calibrate the speed by using magnetic and photo pickups.

DESCRIPTION:

a. Introduction to experiment – 30 min
b. Connection of experiment and its verification.

APPLICATIONS:

It is used to measure the speed (automobile etc.)

5. LAB SCHEDULE:

(A) LAB SCHEDULE: The lab schedule should be planned once in a week. The week wise scheduled experiment should be completed.

CYCLE 1

Batches	**week-1**	**week-2**	**week-3**	**week-4**	**week-5**	**week-6**	week-7
B1	Demo	Exp.1	Exp.2	Exp.3	Exp.4	Exp.5	test
B2	Demo	Exp.2	Exp.3	Exp.4	Exp.5	Exp.1	test
B3	Demo	Exp.3	Exp.4	Exp.5	Exp.1	Exp.2	test
B4	Demo	Exp.4	Exp.5	Exp.1	Exp.2	Exp.3	test
B5	Demo	Exp.5	Exp.1	Exp.2	Exp.3	Exp.4	test
B6	Demo	Exp.1	Exp.2	Exp.3	Exp.4	Exp.5	test
B7	Demo	Exp.2	Exp.3	Exp.4	Exp.5	Exp.1	test
B8	Demo	Exp.3	Exp.4	Exp.5	Exp.1	Exp.2	test
B9	Demo	Exp.4	Exp.5	Exp.1	Exp.2	Exp.3	test
B10	Demo	Exp.5	Exp.1	Exp.2	Exp.3	Exp.4	test

CYCLE 2

Batches	week-1	week-2	week-3	week-4	week-5	week-6	week-7
B1	Exp.6	Exp.7	Exp.8	Exp.9	Exp.10	Lead	test
B2	Exp.7	Exp.8	Exp.9	Exp.10	Exp.6	Lead	test
B3	Exp8	Exp.9	Exp.10	Exp.6	Exp.7	Lead	test
B4	Exp.9	Exp.10	Exp.6	Exp.7	Exp.8	Lead	test
B5	Exp.10	Exp.6	Exp.7	Exp.8	Exp.9	Lead	test
B6	Exp.6	Exp.7	Exp.8	Exp.9	Exp.10	Lead	test
B7	Exp.7	Exp.8	Exp.9	Exp.10	Exp.6	Lead	test
B8	Exp8	Exp.9	Exp.10	Exp.6	Exp.7	Lead	test
B9	Exp.9	Exp.10	Exp.6	Exp.7	Exp.8	Lead	test
B10	Exp.10	Exp.6	Exp.7	Exp.8	Exp.9	Lead	test

B) VIVA SCHEDULE: The viva schedule should be planned prior starting to the lab Experiment.

ROUND - 1

Batches	week-1	week-2	week-3	week-4	week-5	week-6	week-7
B1,B2,B3	viva					viva	
B1,B2,B3		viva					viva
B1,B2,B3			viva				
B1,B2,B3				viva			
B1,B2,B3					viva		

ROUND - 2

Batches	week-1	week-2	week-3	week-4	week-5	week-6	week-7
SG1	viva					viva	
SG2		viva					viva
SG3			viva				
SG4				viva			
SG5					viva		

*SG: Selected Group with a maximum of 6 or 12 students

SCHEME OF EVALUATION OF LABS

LAB EXTERNALS

S.NO	Write up	Results(by skill assistant)	Final Evaluation	Viva
1	1.Aim 2.Apparatus&chemicals etc 3.Principle etc 4 Procedure etc 5.Tabler form etc 6.Model Graph etc 7. Result etc	Based on observation, How the student is arranging the apparatus or system or circuit and typical readings	Based on correctness of the graph to the expected graph and Results	Based on understanding of Experiment and theoretical questions in the related subjects

LAB INTERNALS

Day to Day Evalution-15					Internal Exam-10		
Uniform	Observation &Record	Performance of the Experiment	Result	Viva	Write up	Arrangement or connections etc & Results	Viva
Marks-3	Marks-3	Marks-3	Marks-3	Marks-3	Marks-3	Marks-3	Marks-4
Total marks-25							

6. SUGGESTED BOOKS

1. Measurement systems: applications design by D.S.kumar
2. Instrumentation, measurement & analysis by B.C.Nakra
3. Instrumentation and control system/S.Bhaskar.
4. Experimental methods for engineers /Holman.
5. Ernest O. Doeblin “Measurement Systems–Application & Design” McGraw-Hill Publishing company, 1990.
6. Woolvert, G.A., “Transducer in Digital Systems” Peter Peregrinus Ltd., England,

7.WEB SITES

1. www.mit.edu
2. www.amazon.com/...Instrumentation...Experiments/dp/book
3. www.amazon.co.uk › ... › Instrument & Instrumentation Engineering
4. www.iitk.ac.in/mech/Presentation/Mechanical.pdf

8. EXPERTS’ DETAILS

INTERNATIONAL

1. John Keaton, M.S., Ph.D.,Professor of mechanical Engineering, DeptSchool of Engineering, Mercer University, Macon, Georgia - 31207,Ph.:(912) 301 -2213
2. Richardchristensen., prof of mechanical dept, Staf ond University.

NATIONAL

1. Dr. Vinayak Eswaran - Prof. & Head, Deptt. Of mechanical Engg**.,** IIT Hyderabad
2. Dr.venkat reddy –prof of mechanical department, IT Hyderabad

REGIONAL

1. Prof. Dr.Chalam, Dept. of mech, chalamrv@yahoo.com, ph: 9866212198 NIT, Warangal.
2. Prof.Dr.Krishnanandlanka, HoD, Dept. of mech, email: mech_hod@nitw.ac.in. NIT, Warangal.

9. Mapping of Lab with Projects/ Consultancy/ R & D :

EXACT PAPER FROM A NATIONAL/INTERNATIONAL JOURNAL:

TEMPERATURE CONTROL USING FUZZY LOGIC

P. Singhala1, D. N. Shah2, B. Patel 1, 2,3Department of instrumentation and control, Sarvajanik College of Engineering and Technology Surat, Gujarat, INDIA

ABSTRACT

The aim of the temperature control is to heat the system up to delimitated temperature, afterward hold it at that temperature in insured manner. Fuzzy Logic Controller (FLC) is best way in which this type of precision control can be accomplished by controller. During past twenty years significant amount of research using fuzzy logic has done in this field of control of non-linear dynamical system. Here we have developed temperature control system using fuzzy logic. Control theory techniques are the root from which convention controllers are deducted. The desired response of the output can be guaranteed by the feedback controller.

Keywords

Fuzzy logic, Fuzzy Logic Controller (FLC) and temperature control system.

PROPOSAL FOR PROJECT ACTIVITY:

1.**A Proposal of a hobby/mini/proto/general/model/proto type project with extended abstract, Block Diagram/Circuit/Flow diagram and clear references may be presented and executed**.

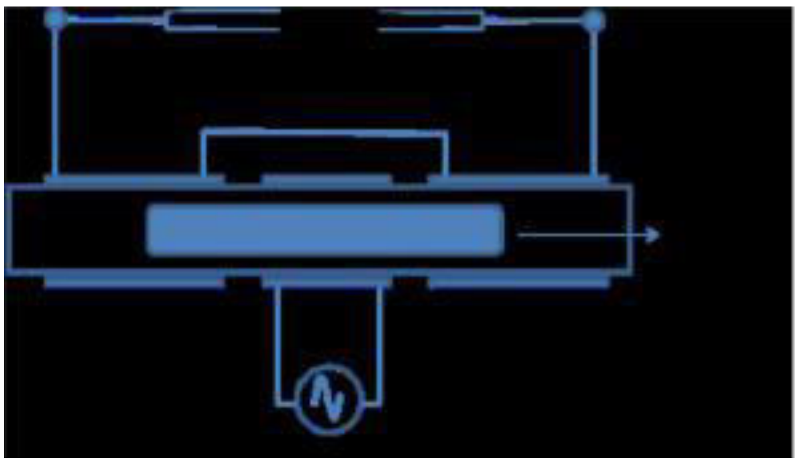
Abstract— Linear Variable Differential Transformer (LVDT) is a transducer which converts mechanical displacement into output electrical corresponding to the input displacement. Generally it is impossible to measure displacement and the direction of the movable iron in a conventional LVDT. The modified LVDT can measure exact position and displacement direction of movable iron. The magnetic field distributions of modified LVDT connections are analyzed using FEMM (Finite Element Method Magnetics) software.

A. Conventional and Modified LVDT connections

it consists one primary coil excited by AC supply, two secondary coils and movable iron core. By connecting AC voltmeter across the output terminal of the LVDT, an RMS voltage proportional to the displacement will be displayed (that do not have polarity), not direction.

Conventional LVDT with back to back connection of secondary windings

Both direction and displacement can be measured by using rectified output with the modified design



Modified LVDT with series connection of secondary windings.

10. PROPOSALS (WEEK WISE INDUSTRIAL VISITS)(IN HOUSE OR OUTSIDE VISIT)/TRAINING PROGRAMMES:

TABLE 1 : INDUSTRIAL VISITS

S.no	Type of industry	Nature of industry	Date of visit	No. of students participated	Year/branch	remarks
1	Advanced processing technology institute	Instrumentation and control system	17/08/14	60	III/1V I SEM	
2			24/8/14	60	III/IV I SEM	

11.GUIDELINES FOR SHADOW ENGINEERING (VIP)

INDUSTRIAL VISITS (IIP – INNOVATIVE INDUSTRIAL LEARNING PROGRAM):

OBJECTIVES OF SHADOW ENGINEERING:

1. The program which uplifts the knowledge of the students related to laboratories.
2. To improve the industry-college interactions.
3. To create industry like environment for all the students in order to make future Assignment.
4. This program leads to matrixing with the students.

TABLE 2: INDUSTRIAL TRAINING (Shadow Engg)
(Career Visit Approval)

S.no	Name of the Course	Nature of industry	Duration of Training	Authority	Date of Training/Certificate No.	RemarkS
1	Process instrumentation	Instrumentation	1 WEEK	DyDirector		

ACTIVITIES IN LIFT PROGRAMME:

12.CALIBRATION/INSTALLATION AND TESTING:

Calibration: Aim of this concept is to check:

i. whether all the equipment is functioning correctly as per the standards

ii. To bring correctness in the errors of instrument or equipment. iii. To rectify the errors if any

Installation: Aim of this concept is to make and maintain installation procedure for a New equipment or already existing equipment

Testing : Aim of this concept is to test the equipment after installation whether it Meets the existing standards.

The list of equipments (hardware/software) :

Necessity of tools for development and testing
Equipment to be calibrated
Installation of supporting equipment if any.

PROCEDURE FOR CALIBRATION:

Any Equipment or Instrument or Gauge or Machine can be calibrated as the standard guidelines mentioned under:

1. Identify the Equipment/Instrument/Gauge/Machine which is under defective or to be calibrated or correction for error
2. Identify the type of error and estimate its frequency of variation.
3. Check with Master Standards or equipment/instrument/machine which is working correctly and meeting our requirements.
4. Estimate the frequency of deviations from normal mode.
5. If the equipment is under warranty, then inform to concerned supplier or agency who will carry out calibration.

6. If the equipment is out of warranty then we can compare the deviations and set the error rectification.

7. Generally as per the procedure, the equipment or instruments can be calibrated by the agencies and issue calibration certificate which consists of date of calibration, calibration next due date and remarks as mentioned in the following format.

8. Record and keep all the calibration certificates in safe custody

After calibration the details of equipment should be submitted in following format.

S.no	Type of equipment	Certificate no	Certificate issued by	Date of calibration	Date of calibration due	Remarks
1	Strain gauge		SS Instruments, Kukatpally			
2	Thermocouple		SS Instruments, Kukatpally			
3	Forced transducer		-do-			

iv. Calibration, Testing and Installation details equipment wise are mentioned as follows:

Case 1: Calibration of Equipment -------------------------------------- if any

Case 2: Installation of Equipment -------------------------------------- if any

Case 3: Testing of Equipment -- if any

Presently there is no new equipment is present for either testing or installations.

13.MAINTENANCE AND TROUBLESHOOTING:

Maintenance:

Maintenance and trouble shooting of each equipment in a laboratory must follow the following guidelines:

Maintenance Schedules:

(1) Preventive Maintenance Schedules of lab will be decided by lab in charge along with concerned HOD. The details of schedule should be recorded in the following template of format.

S.No.	Name of the Equipment	Date of Maintenance	Type of Activity	Remarks

1	**Lvdt**		**Cleaning, connection problems**	**Working well**
2	**Pressure cell**		**Cleaning and Lubrication**	**Working well**

(2) Maintenance Reports duly signed by in charges as well as HODs and duly approved by Principal periodically.

14.TROUBLE SHOOTING SCHEDULES:

A proposal is to be made from each lab branch wise. The proposal should carry following details related to specific equipment in lab.

S.No., Equipment Name , Type of Problem (Too much Noise, Abnormal Sound, Corrupt Software, Anti Virus Problem, Missing of Display, CRT not working, Motor is not giving signal, Digital display is not working.

Trouble shooting exercises should be properly recorded in a separate format as mentioned below:

S.No.	Date of recording activity	Equipment Name	Type of Trouble	Remedial Activity	Remarks
1					

ASSESSMENT AND ACCREDITATION PROCESDUREAS PER NABL

Accreditation is the formal recognition, authorization and registration of a laboratory that has demonstrated its capability, competence and credibility to carry out the tasks. It provides the feedback to laboratories as to whether they are performing according to technical competence as per guidelines of NABL (National Accreditation Board for Testing and Calibration Laboratories)

The laboratory should carry out the following important tasks towards getting ready for accreditation from NABL.

1. Preparation of methodology in each experiment
2. Preparation of Standard Operating procedure for each equipment
3. . Preparation of Laboratory Manual as per the guidelines specified by Combined Lab Team(CLT) headed by Principal/HOD/Dean/incharge
4. Ensure Effective environmental conditions(temperature, humidity,storage and placement) in the laboratories by implementing proper housekeeping and cleaning of the equipments from dust, dirt etc.
5. Ensure Calibration of instruments/equipment(Only NABL accredited authorized laboratories provide calibration.

6. All the details of Calibration should be included in the format specified exclusively for calibration procedure.
7. Ensure proper implementation of all the documents, formats to be included in the lab manual.
8. Impart training for all the technicians working in labs about the importance of documentation, log sheets, operating procedure of the lab.
9. Incorporate Internal Lab audits for effective functioning of the laboratories. Audits may be once in a month or 3 months or at the end of the semester. The audit schedule will be decided by the Chairman and Principal of the CLT team.
10. Auditors should submit the detailed report of each lab duly signed to the Principal.
11. Each lab should maintain all the bills/invoices of each instrument or equipment in a separate file.
12. All the stock registers either consumable or non consumable should be updated whenever any purchases of consumables or equipment takes place.
13. All the safety precautions are properly displayed in front of each lab.
14. All the Lead experiments should be maintained separately in a record /record in a separate folder.
15. Based on Pre Assessment report submitted by auditor, corrective actions should be carried out by each lab in charge and that must be forwarded to concerned HOD and Principal.

CAD/CAM LAB

1. OBJECTIVES AND RELEVANCE

2. SCOPE

3. PREREQUISITES

4. SYLLABUS AS PER JNTUH

5. (A) LAB SCHEDULE

(B) VIVA SCHEDULE

6. SUGGESTED BOOKS

7. WEBSITES (USEFUL LINKS)

8. EXPERT DETAILS

9. MAPPING OF LAB WITH PROJECT/CONSULTANCY/R & D PROPOSALS

10. INDUSTRIAL VISITS (IIP – INNOVATIVE INDUSTRIAL LEARNING PROGRAM)

11. SHADOW ENGINEERING

12. CALIBRATION, TESTING AND INSPECTION

13. PREVENTIVE MAINTENANCE

14. TROUBLESHOOTING

1.OBJECTIVES AND RELEVANCE:

The main objective of the lab course is to gain practical hands on experience by Exposing the students to experiments like Drafting, Part modeling,Detemination And deflection of stresses in 2D and 3D trusses, Heat transfer Analysis, Development of process sheets, Development of manufacturing and tool Management and Development of CNC part programming for turning and milling Component.

2. SCOPE:

Understanding of CAD/CAM lab has the scope to make the learner comfortable to work in any industry where there involves applications of Design parameters strictly based on manufacturing by using CAD/CAM software.

3.PREREQUISITES:

Theoretical knowledge on all Mechanical subjects like Design Of Machine Members -1 &2, Strength of Materials, Applied Thermodynamics 1 &2, Metallurgy and Material science, Engineering Mechanics, Production Technology, Engineering Drawing ,Machine Drawing, Dynamics of Machinery, Machine Tools, Finite Element Methods, and CAD/CAM in-depth is required. Also student should have basic knowledge of remaining all Mechanical subjects' basic knowledge.

PART – A

PREAMBLE

This lab covers the experiments in electrical machines-I subject. The JNTU has given 11 experiments in the syllabus out of which eight experiments are compulsory and from the remaining 3 experiments any two shall be conducted.

4.SYLLABUS-JNTU:

UNIT-I

No experiments in this unit as per syllabus.

UNIT –II

No experiments in this unit as per syllabus.

UNIT-III

EXPERIMENT NO. 2

Part Modeling: Generation of various 3D Models through Protrusion, revolve, shell sweep, creation of various features. Study of parent and child relation. Feature based and Boolean based modeling, surface and assembly modeling. Study of various standard Translators. Design simple components**.**

OBJECTIVE:

To generate 3D models for the given 2D drawings through different features such as Protrusion, revolve, shell, sweep. Creation of various Study of parent and child relation. Feature based and Boolean based modeling, surface and assembly modeling. Study of various standard Translators. Design simple components**.**

UNIT-IV

EXPERIMENT NO. 1

Drafting: Development of Part drawings for various components in the form of orthographic and isometric. Representation of Dimensioning and tolerances scanning and plotting, Study of script DXE AND IGES FILES.

OBJECTIVE:

Creating 2D drawings for the given 3D solids by means of orthographic, isometric, sectional views etc.. Representation of dimensions, tolerances, scanning and plotting. The main objective is to learn study of drawings.

PREREQUISITES:

One of the CAD software referred by JNTUH

DESCRIPTION:

a. Introduction to experiment -30 min

b. Connection of experiment and its verifications

c. selecting angle of projection.

d. Graphical determination of critical curves and dimensioning

APPLICATIONS:

1. Design of components in 3D
2. Creation 2D drawings

Unit –V

No experiments in this unit as per syllabus.

Unit –VI

No experiments in this unit as per syllabus.

UNIT –VII

EXPERIMENT NO. 3

A) Determination of deflection and stresses in 2D and 3D trusses and beams
B) Determination of deflections component and principal and Von-mises stresses in plane stresses, plane strain and axisymmetric components.
C) Determination of stresses in 3D and shell structures(at least one example in each case)
D) Estimation of natural frequencies and mode shapes, Harmonic response of 2D beam.
E) Steady state heat transfer Analysis of plane and axisymmetric components.

OBJECTIVE:

Practical determination of stresses in 2D and 3D components both for physical; loading as well as temperature stresses.

PREREQUISITES:

Principle of operation of DC shunt motor , back emf . Basic knowledge about shunt motor 3-point starter, field and armature speed control of DC motor and its effects.

DESCRIPTION:

a. Introduction to experiment – 30 min

b. Connection of experiment and its verification.

c. Experimental determination of how a component reacts with varying load conditions

APPLICATIONS:

1. Design of new components
2. Easy of Analyzing.

UNIT-VIII

EXPERIMENT NO. 4

Study of CNC Turning Lathe and its Characteristics(Lead Experiment)

A) Development of process sheets for various components based on tooling Machines
B) Development of manufacturing and tooling management systems
C) Study of various post processers used in NC Machines.
D) Development of CNC part program for turning components and milling components.
E) Machining of simple components on NC lathe and Mill by transferring NC code/ from a CAM package.
F) Quality control and Inspection

OBJECTIVE:

Experimental determination of the stress and strain in 3D components by using ANSYS software.

PREREQUISITES:

Generation of 3D component and applying mesh.

DESCRIPTION:

a. Introduction to experiment – 30 min

b. Connection of experiment and its verification.

c. Experimental determination of the parameters (Stress , Strain , Deflection)

d. Determination of strength of component for temperature stresses.

APPLICATIONS:

1. Design of machine components
2. Improving the performance of machine components by changing material composition
3. Multi machine testing.
4. Simple prototyping.

5.LAB SCHEDULE:

(GROUP-I)

CYCLE 1:

BATCHES	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12
B1	Demo	E1	P	E5	P	E6	P	E10	P	E11	P	E12
B2	Demo	E2	P	E4	P	E7	P	E9	P	E12	P	E11
B3	Demo	E3	P	E3	P	E8	P	E8	P	E11	P	E12
B4	Demo	E4	P	E2	P	E9	P	E7	P	E12	P	E11
B5	Demo	E5	P	E1	P	E10	P	E6	P	E11	P	E12

E: EXPERIMENT; P: PRACTICE; W: WEEK;

CYCLE 2:

BATCHES	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12
B1	Demo	E1	P	E5	P	E6	P	E10	P	E11	P	E12
B2	Demo	E2	P	E4	P	E7	P	E9	P	E12	P	E11
B3	Demo	E3	P	E3	P	E8	P	E8	P	E11	P	E12
B4	Demo	E4	P	E2	P	E9	P	E7	P	E12	P	E11
B5	Demo	E5	P	E1	P	E10	P	E6	P	E11	P	E12

E: EXPERIMENT; P: PRACTICE; W: WEEK;

(GROUP-II)

CYCLE 1:

BATCHES	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12
B1	Demo	E1	P	E5	P	E6	P	E10	P	E11	P	E12
B2	Demo	E2	P	E4	P	E7	P	E9	P	E12	P	E11
B3	Demo	E3	P	E3	P	E8	P	E8	P	E11	P	E12

B4	Demo	E4	P	E2	P	E9	P	E7	P	E12	P	E11
B5	Demo	E5	P	E1	P	E10	P	E6	P	E11	P	E12

E: EXPERIMENT; P: PRACTICE; W: WEEK;

CYCLE 2:

BATCHES	W1	W2	W3	W4	W5	W6	W7	W8	W9	W10	W11	W12
B1	Demo	E1	P	E5	P	E6	P	E10	P	E11	P	E12
B2	Demo	E2	P	E4	P	E7	P	E9	P	E12	P	E11
B3	Demo	E3	P	E3	P	E8	P	E8	P	E11	P	E12
B4	Demo	E4	P	E2	P	E9	P	E7	P	E12	P	E11
B5	Demo	E5	P	E1	P	E10	P	E6	P	E11	P	E12

E: EXPERIMENT; P: PRACTICE; W: WEEK;

(B) VIVA SCHEDULE:

The viva schedule should be planned prior starting to the lab experiment.

ROUND - 1

Batches	week-1	week-2	week-3	week-4	week-5
B1,B2,B3	viva				
B1,B2,B3		viva			
B1,B2,B3			viva		
B1,B2,B3				viva	
B1,B2,B3					viva

ROUND - 2

Batches	week-1	week-2	week-3	week-4	week-5
SG1	viva				
SG2		viva			
SG3			viva		
SG4				viva	
SG5					viva

*SG: Selected Group with a maximum of 6 or 12 students

SCHEME OF EVALUATION:

The scheme of evaluation for internal and external exams as follows:

LAB INTERNAL							
Day to Day Evalution-15					**Internal Exam-10**		
Uniform	**Observation & Record**	**Performance Of the Experiment**	**Result**	**Viva**	**Write up**	**Execution & Results**	**Viva**
Marks-3	**Marks-3**	**Marks-3**	**Marks-3**	**Marks-3**	**Marks-4**	**Marks-3**	**Marks-3**
Total Marks-25							

LAB EXTERNAL			
S.NO	Write up	Final Evaluation	Viva
1	**1. Aim** **2. Procedure** **3. Program** **4. Expected output.**	**Based on correctness of the program and Results**	**Based on understanding of Experiment and theoretical questions in the related subjects**
Marks	**20**	**20**	**10**
Total Marks-50			

6. SUGGESTED BOOKS

TEXT BOOKS

1. CAD/CAM A Zimmers & P Groover/PE/PHI.
2. CAD/CAM Theory and Practice/ Ibrahim Zeid/TMH.

REFERENCE BOOKS

1. Automation, Production systems & Computer Integrated Manufacturing/Groover/P.E.
2. Computer Aided Design and Manufacturing … Lalit Narayan PHI.
3. CAD/CAM/CIM/ Radhakrishnan and Subramanian/New Age

7 . WEB SITES

1. www.mit.edu
2. www.soe.stanford.edu
3. www.grad.gatech.edu
4. www.gsas.harward.edu
5. www.eng.ufl.edu
6. www.iitk.ac.in
7. www.iitd.ernet.in
8. www.iitb.ac.in
9. www.iitm.ac.in

8. EXPERT DETAILS

The Expert Details which have been mentioned below are only a few of the eminent ones known Internationally, Nationally and Locally. There are a few others known as well.

INTERNATIONAL

1. Professor James Gao University of Greenwich
2. Dr Ertu Unver University of Huddersfield

NATIONAL

3. Anil D Sahasrabudhe, Ph.D, (IISc Bangalore)
4. Pramod Kumar Jain , Ph.D. (IIT Roorkee)

REGIONAL

1. Prof. N.S. Murthy, Dept. of ME, NIT, Warangal.

2. Mr. K.V.Prabhakara Rao, HoD, Dept. of ME, KPRIT Hyderabad.

JOURNALS

INTERNATIONAL

1. International Journal of Mechanical and Industrial Engineering (IJMIE)
2. International Journal of Mechanical Engineering & Technology (IJMET)
3. International Journal of Material Sciences and Manufacturing Engineering
4. International Journal of Computer Aided Engineering
5. International Journal of Industrial Engineering Research and Development (IJIERD)

NATIONAL

1. The Journal of Mechanical Engineering Research and Development (JMERD)
2. Advances in Mechanical Engineering
3. **Journal of Mechanical Design**

9. MAPPING OF LAB WITH PROJECT/CONSULTANCY/R & D:

The lab course should be designed in such a way that it should meet the requirements of research and development as well as consultancy projects. Also the Proposals of the project and/R&D/Consultancy are as follows:

Proposal 1: Project Design & Execution
Proposal 2: R& D Level Project Design & Execution
Proposal 3: Consultancy Task / Project Design & Development

Proposal 1: Project Design & Execution:

A Proposal of a hobby/mini/proto/general/model/proto type project with included with abstract, Block Diagram/Circuit/Flow diagram and clear references may be presented and executed.

Sample for Serial No:1

Integration of CAD/CAM/CAE in Product Development System Using STEP

ABSTRACT

Every day the companies make strategic business decisions to improve their position in the market. They examine the business value chain to improve the product innovation, customer intimacy, and operational efficiency. Product development is one of the key weapons in the war for a competitive advantage. Policy in product development is in the form of five 'rights', viz. the right information, in the right format, for the right people, in the right location, and at the right time.

The design and development of the product in small-scale and large-scale industries are managed with CAD/CAM/CAE systems. All the systems are heterogeneous. The Standard for the Exchange of Product (STEP) model data [1] is used as the standard format for models created in the CAD/CAM/CAE systems. In this research, an interface program to communicate the product data in the client/server environment has been developed. The interface program

converts the STEP file into an XML file. The XML format is the lightweight web-based communication format. With a properly secured web page communication for different users in the enterprise, the authors achieve the concurrent engineering environment throughout the product life cycle

5 Ways To Make CAD-CAM Implementation Easy

Getting started with a CAD-CAM product can sometimes be challenging when going about it on your own. Because CAD-CAM is such an important aspect of any shops CNC machining productivity, profitability and success we wanted to provide some assistance to help you get started. While these 5 elements are not everything, they are important and if followed, your shop will be well on its way to achieving improved productivity in CNC programming with less down time due to implementation challenges.

High Speed CAD-CAM Technology Helps Manufacturer Increase Production, Quality & Profitability

KPI Machining in Illinois Uses High Speed CAD-CAM Technology To Increase Production, Quality & Profitability

It is no mystery to Eric Pine, Production Manager of **KPI Machining** in Sheridan Illinois that to stay lean, productive and profitable in their CNC machining while turning out quality parts, they turn to cutting edge CAD/CAM technology to give them an edge. *"KPI Machining, Inc. is more than just another machine shop. We take pride in our work. Utilizing a planned, organized approach to every job, we assure high quality, reduced lead-times and offer reasonable costs"*, comments the company. KPI Machining is a job shop that produces CNC milled and CNC turned components with an emphasis on producing low quantity orders (1-500 parts). KPI offers a variety of services and capabilities in precision machining and much of their focus is on general milling and 3D machining towards their Haas VF3.

Proposal 2: R& D Level Project Design & Execution:

1. An exact paper from a National/International journal in this entitled area / subject / area (IEEE Format)

AND/OR

2. An article/white paper from a magazine /journal/weekly/any periodical in the entitled Subject

AND/OR

3. An Advanced technology development/ proposal/article publication from any source of information.

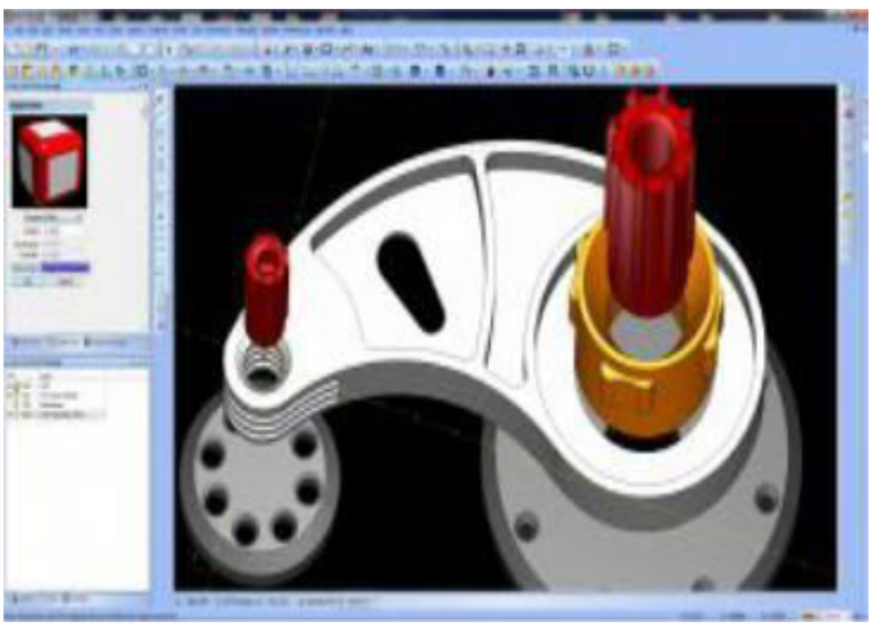
A periodical in the entitled subject on CAD-CAM Software:

What is CAD-CAM Software ?

CAD-CAM stands for Computer Aided Design & Computer Aided Manufacturing.

This software is widely used for drawing 2D & 3D shapes, things that will later be translated into a machine language (CAM) such as “G-Code. This numeric code is then sent to the machine tool such as a milling machine or a lathe typically via an RS 232 Communications cable. CAD

software in todays market is much more capable than even 10 years ago. Originally, drafting software was primarily 2 dimensional until the 1980′s when solid modeling technology was made available for personal desktop computers



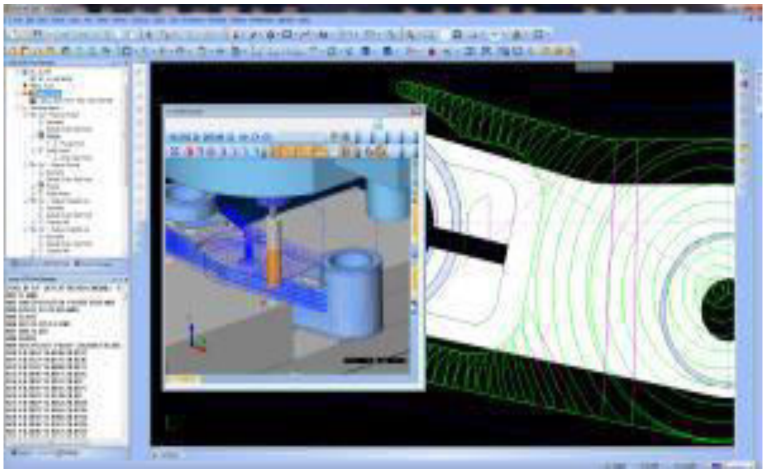
Complete assembly models can be constructed piece by piece as 3D models and assembled in a Parametric Design tree within the software interface. If one aspect of the model is changed, associated component models can be updated to properly reflect change. Building and editing solids and surfaces is much easier with a modern Parametric modeling solution.

CAD-CAM Software – High Speed CNC Machining

When it comes to CNC machining time is money. This is where High Speed Machining really delivers. That’s why professionals like Ken Herring, legendary race car design engineer trust

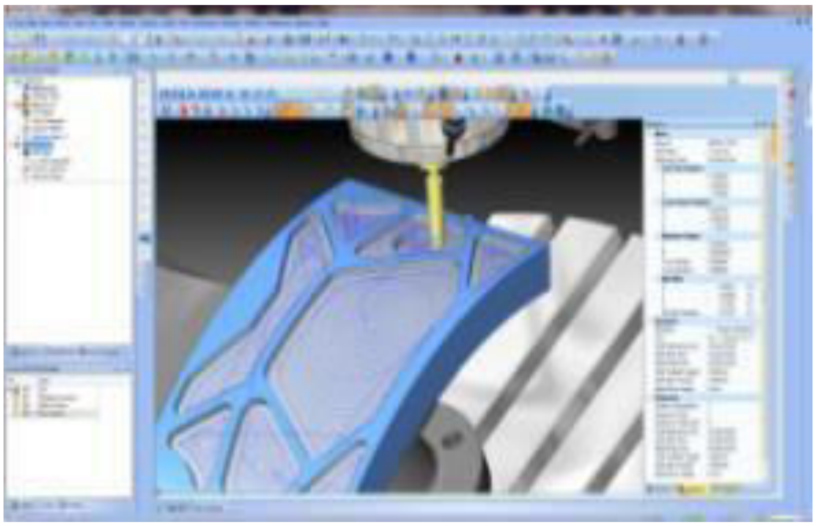
BobCAD-CAM to fill the need for speed by reducing cycle times and cut any part faster than ever before.

Increase Shop's Efficiency And Raise Bottom Line:



The latest versions of Bob CAD-CAM CNC software provide CAM users with an all new High Speed Adaptive machining tool path that empowers shops to light up their machines with cutting speeds that are significantly higher than ancient offset cutting strategies that have been used before. Most production job shop programs involve basic 2 – 2.5 Axis milling. The more complex the programs get, the longer these CNC machining cycle times become. With the new HS Adaptive machining operations in Bob CAD-CAM, you can select a CAD model feature and apply the high speed operations through Dynamic Machining Strategy™ wizards that provide advanced simulation and automatic g-code programming in a matter of minutes.

Top 10 Advantages in 2014 to Using CAD-CAM in the CNC Manufacturing Process



CAD-CAM software is used by thousands of CNC Machine shops around the world for its advantages in CNC manufacturing. CAD-CAM software is found in shops both small and large througout America and in other countries because in order to stay competitive and productive you have to have and use it. From Design to machining strategies and g-code programming, CAD-CAM has many advantages. Here are 10 of the top advantages in 2014 to adding CAD-CAM software to your CNC toolkit.

High Speed Machining Vs. Traditional Offset Machining

By adding High Speed machining operations into your part-making process you can achieve excellent results faster than by using traditional offset toolpaths. It isn't only just for 2 Axis CAD-CAM programming anymore. The latest CNC machining technologies in CAD-CAM software include High Speed Machining operations for 3 Axis as well as 4th and even full simultaneous 5th Axis CNC Milling. The following CAM Clip video shows a direct side by side comparison between these two types of machining operations and how they relate to CAD-CAM software for advanced CNC metalworking.

Dynamic Machining Strategies™ | DMS™

CNC shops are always looking for faster, smarter and easier ways to program parts with the latest in CAD-CAM technologies. A significant attribute in CAM software is the Job Tree or CAM Tree Manager that allows the user to list out all of the machining strategies along with their parameters for cutting for a job, all within the software interface. Among CAM Tree features having to do with cutting conditions, tooling, post processing, material libraries and much more are the toolpath strategies themselves. An advantage in working with a CAM Tree is that machining strategies are easily accessible and sometimes "**Wizard Driven**" within CAD-CAM software. The wizard approach streamlines procedure and steps the user through process, removes programming guesswork and keeps machining input variables in proper order for the user to dictate what the toolpath outcome will be before actual cnc machining takes place.

A wizard is designed to provide a simplified workflow while continuing to give users the ability to control things themselves as they need to. An example of this is the tool page of the machining wizard which allows the programmer to use "system" tool parameters or override them such as the offsets, cutting feedrates, plunge feedrates or even adjust arc slowdown percentages for slowing down the cutting speeds as the tool approaches a corner amongst other important inputs. Wizards allow the user to make necessary changes on the fly without having to leave the wizard and edit variables in a VB script environment. Machining wizards also include parameters for toolpath linking, controlling options for tool lead-in and lead-outs, cutting direction controls for climb or conventional milling, toolpath offsets G41 or G42 and machining sequences along with the many other factors that go into determining the outcome of machine toolpath. Now we can introduce the latest achievements in CAD-CAM that includes what are now known as **Dynamic Machining Strategies** or **DMS** functionality in CAD-CAM CNC Software.

CAD-CAM Software and Feature Based Machining

Almost every manufacturing CNC shop deals with solid models. Decades of CAD Design technology advancements have allowed designers to create models faster, smarter and easier than ever before. In fact, Parametric CAD modeling has allowed designers to collaborate and make changes far easier than even 10 years ago. This is because CAD model components that make up a model assembly contain the data necessary to edit and "update" complete assemblies within the blink of an eye. A decade ago there were few design products that offered such capabilities that included stress and heat analysis among other benefits. Todays design systems allow you to collaborate freely, pass data back and forth from designer to designer with construction, feature and change histories including full detail as to what each component is. This is the future of innovation happening right now.

CNC Machining & The Need for Toolpath

It's no mystery that CNC businesses have to maintain a high efficiency level when it comes to machining parts. This is where programming automation can make a big difference in a shop's bottom line. The word "**Toolpath**" is a CAD/CAM related term that is basically a series of coordinate locations that a cutting tool will follow in the machining process. Toolpath is traditionally divided into two categories: **Roughing** and **Finishing**. A roughing toolpath is generally used in the CAD/CAM cnc programming phase for removing the most amount of material possible, as accurately and as efficiently as possible. Finishing toolpath comes after roughing and essentially "finishes" the cutting process removing the last amount of material on the machine to complete the machining process. CAD/CAM software toolpath has been under development for the last 20 years becoming smarter, faster and more robust in terms of what can be done with it by CAD/CAM developers.

Even in today's fast-paced, competitive manufacturing industry, cnc businesses are still learning about it and shopping for toolpath capabilities that make better sense of their machines and provide better ways to accommodate the needs of shops that want an edge in part-making. Without toolpath there is no CAD/CAM benefit – it's that simple. So what are the advantages of CAD/CAM toolpath? To answer this we should break it all down by complexity level.

Proposal 3: Consultancy Task / Project Design & Development

A program/machine/product of utility may be proposed to develop for in house usage/ Industrial requirements may be useful for any outside agency that can be marketable in order to generate revenue through consultancy

The following paper illustrates the importance of Chatter in CNC machining and methods to avoid it. A supportive paper is also enclosed here with which gives clear idea about the topic which involves an in house method of developing technology as well as marketing of a product through consultancies.

Proceedings of the International MultiConference of Engineers and Computer Scientists 2009
Vol II IMECS 2009, March 18 - 20, 2009, Hong Kong

Prediction of Chatter in CNC Machining based on Dynamic Cutting Force for Ball End Milling

R. Daud, N.K.Hasfa, S.H.Tomadi, M.A.Hassan,K.Kadirgama, M.M.Noor, M.R.M.Rejab

ABSTRACT

This paper presents the suitable depth of cut, spindle speed and feed rate that will be chosen during machining. If thus parameters are not considered, this can provoke abnormal tool behavior such as chatter. Chatter will limit the tool life which only can be use for just a few times. To predict the chatter occurs, the parameters will be use are spindle speed, depth of cut and feed rate. CNC machine will be use. This process will base on dynamic cutting force model for ball end milling. The selections of cutting tool are depends on the process that will done where the chatter can be observed during this machining process. Cold work tool steel (AISI-D2) chosen as a material and its parameter is 100x100x25 mm. Cutter used was high speed steel 2 flute ball nose. Force dynamometer will be use to measure force and 27 tests will be done to observe the chatter occur. Analysis done by referring the result that be measured by force dynamometer. The chatter in ball end milling can be detected from the calculated cutting forces and their frequency spectra. A comparison of the predicted and measured cutting forces demonstrated that the proposed method provides accurate results.

Keywords: Chatter, Dynamic Cutting Force Model, Kiestler Dynamometer

This paper gives the prediction of the chatter occurrence in end milling by using ball end mill cutter. The cutting forces of mild steel machining was successfully obtained by Kitsler® Force dynamometer. From the graph obtained by Kitsler® force dynamometer, it's obviously showed that, the most significant factor for the chatter occurred is depth of cut and spindle speed.

Even though the spindle speed and feed rate was slow, the depth of cut should not too depth. So, this will avoid chatter to occur. A commonly used method for avoiding chatter vibrations in machining is to select low spindle speed and small depth of cut.

C. FUNDED/UNFUNDED PROPOSALS (if any):

D. The proposals for AICTE grants like (SDPs, RPS and MODROBES etc) UGC grants, DST CPRI and other funding agencies by giving Title and abstract/objective OR Self Funded program proposals may be submitted for Management approvals.

10. GUIDELINES FOR SHADOW ENGINEERING (VIP) AND INDUSTRIAL VISITS (IIP – INNOVATIVE INDUSTRIAL LEARNING PROGRAM):

(WEEK WISE INDUSTRIAL VISITS IN HOUSE OR OUTSIDE VISIT OR TRAINING PROGRAMS)

TABLE 1 : INDUSTRIAL VISITS

S.no	Type of industry	Nature of industry	Date of visit	No. of students participated	Year/branch	remarks
1	IT	Infotech Enterprises Ltd	17/9/2014	60 per section	IV/IV B.tech	

TABLE 2: INDUSTRIAL TRAINING (Shadow Engineering)
(Career Visit Approval)

S.no	Name of the Course	Nature of industry	Duration of Training	Authority	Date of Training/Certificate No.	remarks
1	Mechatronics system Design	ATI,Ramanthapur	2 weeks	Dy.Director	03/10/14	

11. OBJECTIVES OF SHADOW ENGINEERING:

1. The program which uplifts the knowledge of the students related to laboratories.
2. To improve the industry-college interactions.
3. To create industry like environment for all the students in order to make future assignment.
4. This program leads to matrixing with the students.

ACTIVITIES IN LIFT PROGRAM:

12.CALIBRATION/INSTALLATION AND TESTING:

Calibration: Aim of this concept is to check:

i. whether all the equipment is functioning correctly as per the standards
ii. To bring correctness in the errors of instrument or equipment.
iii. To rectify the errors if any

Installation: Aim of this concept is to make and maintain installation procedure for a new equipment or already existing equipment

Testing: Aim of this concept is to test the equipment after installation whether it meets the existing standards.

The list of equipments (hardware/software):

Necessity of tools for development and testing
Equipment to be calibrated
Installation of supporting equipment if any.

After calibration the details of equipment should be submitted in following format.

S.no	Type of equipment	Certificate no	Certificate issued by	Date of calibration	Date of calibration due	Remarks
1	CNC Lathe					
2	CNC Milling					

Calibration, Testing and Installation details equipment wise are mentioned as follows:

Case 1: Calibration of Equipment -------------------------------------- if any

Case 2: Installation of Equipment -------------------------------------- if any

Case 3: Testing of Equipment --- if any

13. MAINTAINANCE AND TROUBLESHOOTING:

Maintenance:

Maintenance and trouble shooting of each equipment in a laboratory must follow the following guidelines:

Maintenance Schedules:

(1) Preventive Maintenance Schedules of lab will be decided by lab in charge along with concerned HOD. The details of schedule should be recorded in the following format.

S.No.	Name of the Equipment	Date of Maintenance	Type of Activity	Remarks
1	System Monitor	08.08.2014	Cleaning	
2	CPU CHECKING	11.08.14	Checking	

(2) Maintenance Reports duly signed by in charges as well as HODs and duly approved by Principal periodically.

14.TROUBLE SHOOTING SCHEDULES:

A proposal is to be made from each lab branch wise. The proposal should carry following details related to specific equipment in lab.

S.No., Equipment Name , Type of Problem (Too much Noise, Abnormal Sound, Corrupt Software, Anti Virus Problem, Missing of Display, CRT not working, Motor is not giving signal,

Digital display is not working, Break of tools, Mis alignment of machine elements, PLC is not properly working), Expected Reasons (Bearing failure, Improper alignment of machine centres, Missing of vibration pads etc)

Trouble shooting exercises should be properly recorded in a separate format as mentioned below:

S.No.	Date of recording activity	Equipment Name	Type of Trouble	Remedial Activity	Remarks
1.	Checking of Monitor	System Code 1	Virus Problem	Activated Anti virus system	

ASSESSMENT AND ACCREDITATION PROCESDURE AS PER NABL

Accreditation is the formal recognition, authorization and registration of a laboratory that has demonstrated its capability, competence and credibility to carry out the tasks. It provides the feedback to laboratories as to whether they are performing according to technical competence as per guidelines of NABL (National Accreditation Board for Testing and Calibration Laboratories)

The laboratory should carry out the following important tasks towards getting ready for accreditation from NABL.

1. Preparation of methodology in each experiment
2. Preparation of Standard Operating procedure for each equipment
3. Preparation of Laboratory Manual as per the guidelines specified by Combined Lab Team(CLT) headed by Principal/HOD/Dean/incharge
4. Ensure Effective environmental conditions (temperature, humidity, storage and placement) in the laboratories by implementing proper housekeeping and cleaning of the equipments from dust, dirt etc.
5. Ensure Calibration of instruments/equipment (Only NABL accredited authorized laboratories provide calibration.
6. All the details of Calibration should be included in the format specified exclusively for calibration procedure.
7. Ensure proper implementation of all the documents, formats to be included in the lab manual.
8. Impart training for all the technicians working in labs about the importance of documentation, log sheets, operating procedure of the lab.
9. Incorporate Internal Lab audits for effective functioning of the laboratories. Audits may be once in a month or 3 months or at the end of the semester. The audit schedule will be decided by the Chairman and Principal of the CLT team.
10. Auditors should submit the detailed report of each lab duly signed to the Principal.
11. Each lab should maintain all the bills/invoices of each instrument or equipment in a separate file.
12. All the stock registers either consumable or non consumable should be updated whenever any purchases of consumables or equipment takes place.
13. All the safety precautions are properly displayed in front of each lab.
14. All the Lead experiments should be maintained separately in a record /record in a separate folder.
15. Based on Pre Assessment report submitted by auditor, corrective actions should be carried out by each lab in charge and that must be forwarded to concerned HOD and Principal.