CMR Engineering College

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

DEPARTMENT OF MECHANICAL ENGINEERING

LABORATORY IMPROVEMENT FOR FUTURE TRENDS (LIFT)--II 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)

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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 learnings, 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-II SEM	Mechanics of Fluids
2	II B.TECH-II SEM	Production Technology Lab
3.	III B.TECH-II SEM	Heat Transfer Lab

SUBJECTWISE LAB PLANNER

NAME OF THE SUBJECT:MECHANICS OF FLUIDS 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

2. SCOPE:

Understanding of the Fluid flows and their applications

3. PREREQUISITES:

Theoretical knowledge on the subject Mechanics of Fluids, which deals with the behavior and mechanics of fluids.

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 FLUIDS EXPERIMENTS

EXPERIMENT NO. 1

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 sress, strain and elastic moduli

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

To calculating the efficiency of pelton turbine at various speeds

Apparatus: Pelton wheel, casing,water sump,electrical motor,venturimeter,break drum mechanism, Delivery guage.

Abstract: Switch on the motor for supplying the water then water enter in to the venturimeter here the rate of flow of water is increased and the water strikes the turbine blades .The turbine is rotated at different speeds then we calculating the efficiency of turbine by taking the the values of different pressures at pressure gauge .

EXPERIMENT NO. 3

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

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

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

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

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							

SUGGESTED BOOKS

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

5. 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

6. 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 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, JNTUCE, 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

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:

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

WATER METER TEST RIG

Apparatus: Water meter**,**Sump tank ,Collecting tank.Piezometer,Electrical motor,pipe connections.

Abstract: When the motor is switch on the water is flowing in a pipe through water meter it is connected at mid section of the pipe. After water is flowing in a water meter the quantity of water is measured at water meter in LPM(liters per minute) and calculate the flow efficiency.

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):

OHJECTIVES 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	MECHTRIX	Machine manufacturers	1 WEEK	General Manager		

12. ACTIVITIES 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						

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:

(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.

PRODUCTION TECHNOLOGY 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 different manufacturing processes like Cutting, Forming, Welding and Casting Processes.

2. SCOPE:

The scope of this lab is to make understand students for producing and manufacturing of various components on different Machines by application of various sequences of operations.

3. PREREQUISITES:

Theoretical knowledge on subject Production Technology deals with the basic mechanism related to Casting Processes, Cutting operations and basics of welding processes, types of forming operations and Extrusion Processes.

PART - A
PREAMBLE

This lab covers the experiments in Production Technology 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 PRODUCTION TECHNOLOGY THEORY WITH THE LAB EXPERIMENTS:

UNIT-I : CASTING PROCESSES

EXPERIMENT NO.1
PREPARATION OF MOULD CAVITY USING SINGLE PIECE PATTERN.
OBJECTIVE:

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

PRE REQUISITES:

Basic mechanisms of Casting Processes, Pattern Making and its Design

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: 2
PREPARATION OF A MOULD CAVITY BY USING SPLIT PIECE PATTERN

OBJECTIVE:

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

PRE REQUISITES:

Basic mechanisms of Casting Processes, Pattern Making and its Design

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:

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

EXPERIMENT NO : 3
DESIGN OF A PATTERN AND PATTERN MAKING
OBJECTIVE:

To make different jobs with different cross sections on a 3 jaw chuck wood turning 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 and design of pattern
Study of mechanisms of lathe

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.

EXPERIMENT NO:4

MELTING PRACTICE

OBJECTIVE:

Determination of mechanisms involved in different furnaces and its functions.

PREREQUISITIES:

It requires basic level of melting practices of handling various materials

DESCRIPTION:

A Basic level of mechanism is studied related to furnaces.

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 II:

EXPERIMENT NO: 5

ARC WELDING PROCESSES

OBJECTIVE:

Making of a component subjected to arc welding operations. To shape the component both on Lap and Butt Joints, the arc welding process is used.

PREREQUISITES:

To make these operations a student has to know about the basics of welding operations.

DESCRIPTION:

1. To check welding components
2. To make alignment of workpieces.
3. To fix the workpieces and do the necessary operations.

EXPERIMENT NO: 6

RESISTANCE WELDING: SPOT WELDING

OBJECTIVE:

Making of a component subjected to arc welding operations. To shape the component both on Lap and Butt Joints, the arc welding process is used.

PREREQUISITES:

To make these operations a student has to know about the basics of welding operations.

DESCRIPTION:

1. To check welding components
2. To make alignment of workpieces.
3. To fix the workpieces and do the necessary operations.

UNIT III
EXPERIMENT NO: 7
TIG WELDING PROCESSES.
OBJECTIVE:

Making of a component subjected to arc welding operations. To shape the component both on Lap and Butt Joints, the arc welding process is used.

PREREQUISITES:

To make these operations a student has to know about the basics of welding operations.

DESCRIPTION:

1. To check welding components
2. To make alignment of workpieces.
3. To fix the workpieces and do the necessary operations.

UNIT IV:
EXPERIMENT NO:8
SHEET METAL WORKING PROCESSES: FLY SCREW PRESS

OBJECTIVE:

To make the blanking and piercing operations on a given workpiece.

PREREQUISITES:

It requires basic knowledge of sheet metal working operations and its mechanisms.

DESCRIPTION:

1.Introduction to Experiment – 30 Min
2. Fixing of workpiece on fixtures.
3. Check 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 blanking and piercing operations of workpieces.

EXPERIMENT NO:9
HYDRAULIC PRESS OPERATIONS

OBJECTIVE:

To make bending operation on a given workpiece

PREREQUISITES:

Basic knowledge of sheet metal working and forming operations

DESCRIPTION:

1. Introduction to Experiment – 45 min
2. Check the alignment for machine
3. Check for workpiece
4. Prepare the machine ready for operation
5. Select the suitable bending operation
6. Make the finish operation on a given workpiece.

APPLICATION:

1.It gives the correct idea to a student for making bending on workpieces.
2. It gives the student about the sheet metal working and forming

UNIT-V : There is no separate experiments as per JNTU under Unit V.

EXPERIMENT NO: 10
INJECT ION MOULDING
OBJECTIVE:

To make a injection moulding operation on a given component.

PREREQUISITES:

1.It requires knowledge about the injection moulding technique
2. It requires basics about different types of plastic wheels.
3. It requires knowledge about the different geometrical parameters related to injection moulding.

DESCRIPTION:

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

EXPERIMENT NO. 11
BLOW MOULDING
OBJECTIVE:

To prepare blow moulding operation on a workpiece

PREREQUISITES:

It requires basic knowledge about the plastic injection moulding operation.

DESCRIPTION:

1. Introduction to Experiment – 40 Min
2. Check for blow moulding machine
3. Align the workpiece
4. Check for dies

APPLICATION:

It can be useful for preparing the different work pieces

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 PRODUCTION TECHNOLOGY LAB:

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/metrologylab/opticalprojector/
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

7. 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.

8. 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:

IOSR Journal of Mechanical and Civil Engineering (IOSR-JMCE) ISSN(e) : 2278-1684, ISSN(p) : 2320–334X, PP : 55-61 www.iosrjournals.org Second National Conference on Recent Developments in Mechanical Engineering 55 | Page M.E.Society's College of Engineering, Pune

Die Casting Defect Analysis & Experimental Validation for Compressor Housing

P.Wadekar[1], B.A.Ahire[1], L.G.Navale[1], S.H.Gawande[1], R. Mathai[2], R.Mishra[2]
[1](Mechanical Department M.E.Societys College of Engineering, Pune, India) [2](Design Department, Spark Minda Co. Ltd, India)

ABSTRACT :

Gravity die casting is used to manufacture the complex metal components where there is a need for high structural integrity. The casting defects that are caused by molten metal include air entrapment, porosity, and shrinkage. But the control of casting defects has been based on the experience of the foundry engineers. This paper describes these defects in casting with the help of computer aided simulation. These are demonstrated using a simple two dimensional example which contains the essential features of compressor housing. The computer simulations have been carried out to analyse the flow of molten metal .The, flow ranging in 0.7 to 1 kgs/s in 5mm thin wall casting was examined to find the optimal parameters for the die-casting process. The results for compressor housing body are obtained by simulation and required corrective measures are implemented in actual component. It is seen that the most important physical situation during a casting process is solidification by cooling its surroundings where numerous defects can generate through changes during the heat transfer process from liquid form to a solid form. The design, simulation, analysis and testing work is carried at Spark Minda Co. Ltd, Chakan, Pune

Keywords -Gravity die casting ,Simulation, Compressor housing, Casting defect

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.

Storage Rack Welding Project

Most small businesses will need storage areas for large products require protection from water, fork lifts, or the other machines and tools found at a fabrication business. This simple rack is an ideal way to store supplies and materials that need extra protection in production shop and laboratories. A simple welding process is used to make storage racks as shown in Fig.

- 

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 Production technology laboratory
Proposed Equipment for usuage: Casting Foundry, Wood Turning Lathe, Melting Furnace

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. The initial operations that produce a semi finishing part ready for gear machining 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.

Casting Processes:

In this Process, Casting Process is usually applied to make Solid Gear by making use of pattern making, moulding and coring methodologies. First Step is preparation of suitable wood pattern for manufacture of gear and thereby moulding and coring processes. Usually Green Sand moulding process is used.

Solidification of Castings and Risering: After the Casting of gear is completed, the next step is solidification of the castings. In this, proper risering is made in order to avoid casting defects and promote directional solidification. Necessary Pattern allowances are made to make proper directional solidification procedure.

Finishing operations

As produced by any of the processes 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: MANUFACTURING OF SALINE BOTTLES BY BLOW MOULDING PROCESS

This involves operating Blow Moulding Machine with change of Die suitable to Saline storage bottles. It involves concept of Thermosetting plastics using low grade High density poly ethylene pallets.

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	Hinduja Foundries,Uppal	Industrial Castings	27/02/15	60	II/1V II SEM	
2	Greb Technologies, Medchal	Manufacturers of Steel Drums	24/3/15	60	II/IV II 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	Durationof Training	Authority	Date of Training/Certificate No.	remarks
1	MECHATRONICS	ADVANCED MACHINING	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						
2						
3						

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	Fly Screw Press		Cleaning and Lubrication	Working well
2	Hydraulic Press		Alignment	Working OK
3	Injection Moulding Machine		Lubrication	Working OK
4	Wood Turning Lathe		Lubrication	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.

HEAT TRANSFER 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

Laboratory exercises will include studies of conduction, convection, and radiation heat transfer processes. Particular emphasis will be placed on thermal measurements including use of thermocouples and an infrared camera. The course will also emphasize good experimental techniques including prelab preparations.

(2) SCOPE

Knowledge of physical processes for heat transfer and how they are applied in real devices and systems. Ability to make thermal measurements in flows, on surfaces and within solids. Skills in experimental planning including uncertainty analysis for experimental measurements Knowledge needed to understand design of thermal systems and various advance heat transfer courses.

(3) PREREQUISITES

Knowledge and skill in use of differential and integral calculus. Understand physical quantities employed in Thermodynamics and Fluid Mechanics. Ability to apply basic laws of Thermodynamics to control volume energy and mass balances. Understand the meaning of physical quantities employed in Newtonian Mechanics. Ability to apply basic laws of Newtonian Mechanics to compute various quantities.

(4.) SYLLABUS – JNTU

1. Heat transfer in natural convection
2. Heat transfer in forced convection apparatus.
3. Stefan Boltzman Apparatus.
4. Parallel and counter flow heat exchanger.
5. Heat transfer in pin-fin
6. Experiment on Transient Heat Conduction
7. Heat transfer through lagged pipe.
8. Composite Slab Apparatus – Overall heat transfer co-efficient.
9. Thermal Conductivity of given metal rod
10. Emissivity apparatus.
11. Heat Transfer through a Concentric Sphere
12. Critical Heat flux apparatus

LEAD

1. Critical Heat flux apparatus.

PART - A.

SYLLABUS-JNTU

EXPERIMENT NO. 1
Heat transfer in natural convection

OBJECTIVE:
To determine the surface heat transfer coefficient for a vertical tube losing heat by natural convection.

PREREQUISITES:
Basics of modes heat transfer, fluid mechanic and Thermodynamics.

DESCRIPTION:
1. Introduction to experiment -30 min
2. Switch ON mains and the CONSOLE.
3. Set the heater regulator to the known value.
4. Wait for sufficient time to allow temperature to reach steady values.

APPLICATIONS:

Heat transfer of transformers, motors, air cooled IC engines and refrigerators.

EXPERIMENT NO. 2
Heat transfer in forced convection apparatus.

OBJECTIVE:
To calculate heat transfer rate and heat transfer coefficient in forced convection.

PREREQUISITES:
Basics of modes heat transfer, fluid mechanic and Thermodynamics.

DESCRIPTION:
1. Introduction to experiment -30 min
2. Switch ON mains and the CONSOLE.
3. Set the heater regulator to the known value.
4. Wait for sufficient time to allow temperature to reach steady values.

APPLICATIONS:

Heat transfer in Car Radiators, boilers, heat exchangers.

EXPERIMENT NO. 3
Stefan Boltzman Apparatus.

OBJECTIVE:
To determine the Stefan Boltzmann constant.

PREREQUISITES:
Basics of modes heat transfer, fluid mechanic and Thermodynamics.

DESCRIPTION:
1. Introduction to experiment -30 min
2. Switch ON mains and the CONSOLE.
3. Set the heater regulator to the known value.
4. Wait for sufficient time to allow temperature to reach steady values.

APPLICATIONS:

Solar panels, furnace

EXPERIMENT NO. 4
Parallel and counter flow heat exchanger.

OBJECTIVE:
To study the experiment on concentric tube heat exchanger

PREREQUISITES:
Type's o heat exchangers, Basics of modes heat transfer, fluid mechanic and Thermodynamics.

DESCRIPTION:
1. Introduction to experiment -30 min
2. Switch ON mains and the CONSOLE.
3. Set the heater regulator to the known value.
4. Wait for sufficient time to allow temperature to reach steady values.

APPLICATIONS:
Cold storages, milk chiller of Pasteurizing plant, preheaters, and other industrial processes

EXPERIMENT NO. 5
Heat transfer in pin-fin

OBJECTIVE:
The aim of the experiment is to study the temperature distribution and the effectiveness of the fin

PREREQUISITES:
Basics of modes heat transfer, fluid mechanic and Thermodynamics.

DESCRIPTION:

1. Introduction to experiment -30 min
2. Switch ON mains and the CONSOLE.
3. Set the heater regulator to the known value.
4. Wait for sufficient time to allow temperature to reach steady values.

APPLICATIONS:

Radiators of automobile, air cooled engine cylinder head and small capacity compressors.

EXPERIMENT NO. 6
Experiment on Transient Heat Conduction

OBJECTIVE:
To determine heat transfer coefficient and instantaneous heat transfer rate for transient heat conduction and draw the graph of temperature variation with time

PREREQUISITES:
Basics of modes heat transfer, fluid mechanic and Thermodynamics.

DESCRIPTION:

1. Introduction to experiment -30 min
2. Switch ON mains and the CONSOLE.
3. Set the heater regulator to the known value.
4. Wait for sufficient time to allow temperature to reach steady values.

APPLICATIONS:

Boiler tubes, rocket nozzles, electric irons, automobile engines, cooling of IC engines, cooling and freezing of food, heat treatment of metals by quenching, heating and cooling of buildings etc.

EXPERIMENT NO. 7
Heat transfer through lagged pipe.

OBJECTIVE:

1. To determine the heat flow rate through the lagged pipe and compare it with the heater input for known valve of thermal conductivity of lagging material.

2. To determine the approximate thermal conductivity of lagging material by assuming the heater input to be the heat flow rate through lagged pipe.

3. To plot the temperature distribution across the lagging material.

PREREQUISITES:

Basics of modes heat transfer, fluid mechanic and Thermodynamics.

DESCRIPTION:

1. Introduction to experiment -30 min
2. Switch ON mains and the CONSOLE.
3. Set the heater regulator to the known value.
4. Wait for sufficient time to allow temperature to reach steady values.

APPLICATIONS:

Fields of Applications of insulations are boilers and steam pipes, insulating bricks, preservation of liquid gases and air-conditioning systems.

EXPERIMENT NO. 8
Composite Slab Apparatus – Overall heat transfer co-efficient.

OBJECTIVE:

The main aim of this experiment is to determine total thermal resistance of composite wall. And to plot temperature gradient along composite wall structure

PREREQUISITES:

Basics of modes heat transfer, fluid mechanic and Thermodynamics.

DESCRIPTION:

1. Introduction to experiment -30 min
2. Switch ON mains and the CONSOLE.
3. Set the heater regulator to the known value.
4. Wait for sufficient time to allow temperature to reach steady values.

APPLICATIONS:

Brick wall of furnace. Metal sheet of boiler, Metal wall of heat exchanger tube
Reactor surfaces.

EXPERIMENT NO. 9
Thermal Conductivity of given metal rod

OBJECTIVE:
To find the thermal conductivity of metal rod.

PREREQUISITES:
Basics of modes heat transfer, fluid mechanic and Thermodynamics.

DESCRIPTION:
1. Introduction to experiment -30 min
2. Switch ON mains and the CONSOLE.
3. Set the heater regulator to the known value.
4. Wait for sufficient time to allow temperature to reach steady values.

APPLICATIONS:

Nuclear reactors, thermal power plants

EXPERIMENT NO. 10
Emissivity apparatus.

OBJECTIVE:

To determine the emissivity of test plate and black plate.

PREREQUISITES:
Basics of modes heat transfer, fluid mechanic and Thermodynamics.

DESCRIPTION:

1. Introduction to experiment -30 min
2. Switch ON mains and the CONSOLE.
3. Set the heater regulator to the known value.
4. Wait for sufficient time to allow temperature to reach steady values.

APPLICATIONS:

Thermal power plants, solar energy applications

EXPERIMENT NO. 11
Heat Transfer through a Concentric Sphere

OBJECTIVE:

To determine the thermal conductivity of concentric sphere.

PREREQUISITES:
Basics of modes heat transfer, fluid mechanic and Thermodynamics.

DESCRIPTION:

1. Introduction to experiment -30 min
2. Switch ON mains and the CONSOLE.
3. Set the heater regulator to the known value.
4. Wait for sufficient time to allow temperature to reach steady values.

APPLICATIONS:

Design of boilers, spherical vessels

EXPERIMENT NO. 12
Critical Heat flux apparatus

OBJECTIVE:
To determine the critical heat flux at various bulk temperature water can be calculated.

PREREQUISITES:
Basics of modes heat transfer, fluid mechanic and Thermodynamics.

DESCRIPTION:

1. Introduction to experiment -30 min
2. Switch ON mains and the CONSOLE.
3. Set the heater regulator to the known value.
4. Wait for sufficient time to allow temperature to reach steady values.

APPLICATION:

Steam power plants, melting of metal in furnace, rocket motors.

LAB EXPERIMENT SCHEDULE

Week	Exp No	Name of the Experiment	Date Conducted
I	1	Heat transfer in natural convection	
II	2	Heat transfer in forced convection apparatus.	
III	3	Stefan Boltzman Apparatus.	
IV	4	Parallel and counter flow heat exchanger.	
V	5	Heat transfer in pin-fin	
VI	6	Experiment on Transient Heat Conduction	
VII	7	Heat transfer through lagged pipe.	
VIII	8	Composite Slab Apparatus – Overall heat transfer co-efficient.	
IX	9	Thermal Conductivity of given metal rod	
X	10	Emissivity apparatus.	
XI	11	Heat Transfer through a Concentric Sphere	
XII	12	Critical Heat flux apparatus	

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	Exp.6
B2	Demo	Exp.2	Exp.3	Exp.4	Exp.5	Exp.6	Exp.1
B3	Demo	Exp.3	Exp.4	Exp.5	Exp6	Exp.1	Exp.2
B4	Demo	Exp.4	Exp.5	Exp.6	Exp.1	Exp.2	Exp.3
B5	Demo	Exp.5	Exp.6	Exp.1	Exp.2	Exp.3	Exp.4
B6	Demo	Exp.6	Exp.1	Exp.2	Exp.3	Exp.4	Exp.5

CYCLE 2

Batches	**week-1**	**week-2**	**week-3**	**week-4**	**week-5**	**week-6**	**week-7**
B1	Exp.7	Exp.8	Exp.9	Exp.10	Exp.11	Lead	test
B2	Exp.8	Exp.9	Exp.10	Exp.11	Lead	Exp.7	test
B3	Exp.9	Exp.10	Exp.11	Lead	Exp.7	Exp.8	test
B4	Exp.10	Exp.11	Lead	Exp.7	Exp.8	Exp.9	test
B5	Exp.11	Lead	Exp.7	Exp.8	Exp.9	Exp.10	test
B6	Lead	Exp.7	Exp.8	Exp.9	Exp.10	Exp.11	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							

EXACT PAPER FROM A NATIONAL/INTERNATIONAL JOURNAL:

CFD ANALYSIS OF HEAT TRANSFER IN A HELICAL COIL HEAT EXCHANGER USING FLUENT

Siddhartha Shankar Behera ,Dr. A. K. Satapathy

Heat exchangers are the important engineering systems with wide variety of applications including power plants, nuclear reactors, refrigeration and air-conditioning systems, heat recovery systems, chemical processing and food industries. Helical coil configuration is very effective for heat exchangers and chemical reactors because they can accommodate a large heat transfer area in a small space, with high heat transfer coefficients. This project deals with the analysis of the helical coiled heat exchanger with various correlations given by different papers for specific conditions. Although various configurations are available, the basic and most common design consists of a series of stacked helically coiled tubes placed in a cylindrical outer cover. The inner tube ends are connected to manifolds, which act as fluid entry and exit locations. And the outer tube is also provided with inlet and outlet manifolds so that cooling fluid can be passed through it. The tube bundle is constructed of a number of tubes stacked atop each other, and the entire bundle is placed inside a helical casing, or shell. The complex fluid-dynamic inside curved pipe heat exchangers gives them important advantages over the performance of straight tubes in terms of area/volume ratio and enhancing of heat transfer and mass transfer coefficient. Convective heat transfer between a surface and the surrounding fluid in a heat exchanger has been a major issue and a topic of study for a long time. The analysis of these various correlations with certain defined data is presented in this project. In this study, an attempt has been made to analyze the effect of counter-flow on the total heat transfer from a helical tube. The temperature contours, velocity vectors, surface nusselt number, total heat transfer rate from the wall of the tube was calculated and plotted using ANSYS 13.0. Copper was chosen as the metal for the construction of the helical tube. The fluid flowing through the inner tube and outer casing was taken as water.

PROPOSAL FOR PROJECT ACTIVITY :

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

PROPOSAL FOR CONSULTANCY:

ABSTRACT:

In present day shell and tube heat exchanger is the most common type heat exchanger widely use in oil refinery and other large chemical process, because it suits high pressure application. The process in solving simulation consists of modeling and meshing the basic geometry of shell and tube heat exchanger using CFD package ANSYS 13.0. The objective of the project is design of shell and tube heat exchanger with helical baffle and study the flow and temperature field inside the shell using ANSYS software tools. The heat exchanger contains 6 tubes and 750 mm length shell diameter 110 mm. The helix angle of helical baffle will be varied from 15 to 30. In simulation will show how the pressure varies in shell due to different helix angle and flow rate. The flow pattern in the shell side of the heat exchanger with continuous helical baffles was forced to be rotational and helical due to the geometry of the continuous helical baffles, which results in a significant increase in heat transfer coefficient per unit pressure drop in the heat exchanger.

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						

ACTIVITIES 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	Parallel and counter flow					
2	Critical heat flux					
3	Forced convection					

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.

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	Parallel and counter flow		Cleaning	
2	Lagged pipe		Cleaning	
3	Forced convection		Cleaning	
4	Pin fin		Cleaning	

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

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

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.