Ref No:

SRI KRISHNA INSTITUTE OF TECHNOLOGY, BANGALORE

COURSE PLAN

Academic Year 2019-20

Program:	BE – MECHANICAL ENGINEERING
Semester :	4
Course Code:	18MEL48B
Course Title:	FOUNDRY FORGING and WELDING LAB
Credit / L-T-P:	2 / 0-2-2
Total Contact Hours:	36
Course Plan Author:	Dinesh P/CHANDRAIAH M T

Academic Evaluation and Monitoring Cell

No. 29, Chimney hills, Hesaraghatta Road, Chikkabanavara
BANGALORE-560090, KARNATAKA , INDIA
Phone / Fax :+91-08023721315/23721477, Web: www.skit.org.in

Table of Contents

FOUNDRY FORGING and WELDING LAB....1
18MEL48B : FOUNDRY FORGING and WELDING LAB....4
A. LABORATORY INFORMATION....4
1. Lab Overview....4
2. Lab Content....4
3. Lab Material....4
4. Lab Prerequisites:....4
5. General Instructions....5
6. Lab Specific Instructions....5
B. OBE PARAMETERS....5
1. Lab / Course Outcomes....5
2. Lab Applications....6
3. Articulation Matrix....6
4. Mapping Justification....6
5. Curricular Gap and Content....7
6. Content Beyond Syllabus....8
C. COURSE ASSESSMENT....8
1. Course Coverage....8
2. Continuous Internal Assessment (CIA)....8
D. EXPERIMENTS....9
Experiment 01 : Compression strength test for molding sand....9
Experiment 02 : shear strength test for molding sand....11
Experiment 03 : tensile strength test for molding sand....13
Experiment 04 : Permeability test....14
Experiment 05 : Clay content determination test for molding sand....17
Experiment 06: Sieve analysis test....18
Experiment 06:FOUNDRY PRACTICE....20
Foundry practice of solid pattern....20
Experiment 07:FOUNDRY PRACTICE....21
Foundry practice of split pattern pattern....21
Experiment 08:FOUNDRY PRACTICE....22
Foundry practice of solid pattern....22
Experiment 09:FOUNDRY MODELS....23
Preparation of forging models....23
Experiment 10:FOUNDRY MODELS....24
Preparation of forging models....24

Note : Remove “Table of Content” before including in CP Book
Each Laboratory Plan shall be printed and made into a book with cover page
Blooms Level in all sections match with A.2, only if you plan to teach / learn at higher levels

18MEL48B : FOUNDRY FORGING and WELDING LAB

A. LABORATORY INFORMATION

1. Lab Overview

Degree:	B.Tech	*Program:*	ME
Year / Semester :	4TH sem	*Academic Year:*	2018-19
Course Title:	Foundry Forging and Welding Lab	*Course Code:*	18MEL48B
Credit / L-T-P:	2 / 0-2-2	*SEE Duration:*	180 Minutes
Total Contact Hours:	Hrs	*SEE Marks:*	60Marks
CIA Marks:	40	*Assignment*	1 / Module
Course Plan Author:	Mr. Dinesh P	*Sign*	Dt :
Checked By:		*Sign*	Dt :

2. Lab Content

Unit	Title of the Experiments	Lab Hours	Concept	Blooms Level
1	Testing of molding sand and core sand compression,shear ,and tensile test on universal sand testing machine	06	Sand properties	L3
2	Permeability test, sieve analysis to find grain fineness number(GFN) clay content determination in base sand	06	casting	L3
3	Foundry practice use of foundry tools and equipment ,preparation of molding sand mixture,preparation of green sand mold ,preparation of casting	12	Metal forming	L2
4	Forging operation preparing minimum three forged models involving upsetting,drawing,bending.	12	Metal forming	L3

3. Lab Material

Unit	Details	Available
1	Text books	
	Foundry technology by peter beeley	In Lib
2	Reference books	
		In dept
3	Others (Web, Video, Simulation, Notes etc.)	
		Not Available

4. Lab Prerequisites:

-	-	Base Course:		-	-
SNo	Course Code	Course Name	Topic / Description	Sem	Remarks
1	18ME15/25	EME	Welding	1/2	

Note: If prerequisites are not taught earlier, GAP in curriculum needs to be addressed. Include in Remarks and implement in B.5.

5. General Instructions

SNo	Instructions	Remarks
1	Observation book and Lab record are compulsory.	
2	Students should report to the concerned lab as per the time table.	
3	After completion of the program, certification of the concerned staff in-charge in the observation book is necessary.	
4	Student should bring a notebook of 100 pages and should enter the readings /observations into the notebook while performing the experiment.	
5	The record of observations along with the detailed experimental procedure of the experiment in the Immediate last session should be submitted and certified staff member in-charge.	
6	Should attempt all problems / assignments given in the list session wise.	
7	It is responsibility to create a separate directory to store all the programs, so that nobody else can read or copy.	
8	When the experiment is completed, should disconnect the setup made by them, and should return all the components/instruments taken for the purpose.	
9	Any damage of the equipment or burn-out components will be viewed seriously either by putting penalty or by dismissing the total group of students from the lab for the semester/year	
10	Completed lab assignments should be submitted in the form of a Lab Record in which you have to write the algorithm, program code along with comments and output for various inputs given	

6. Lab Specific Instructions

SNo	Specific Instructions	Remarks
1		
2		
3		
4		
5		
6		
7		

B. OBE PARAMETERS

1. Lab / Course Outcomes

#	COs	Teach. Hours	Concept	Instr Method	Assessment Method	Blooms Level
1	Students should be able to Conduct various test on sand & determine sand strength	09	Properties of sand	Demonstrate	Pratical record ,IA test	L3
2	Students should be able to Demonstrate various skills of sand preparation and molding	03	Sand strength	Demonstrate	Pratical record ,IA test	L2
3	Students should be able to prepare the casting using with pattern	06	foundry	Demonstrate	Pratical record ,IA test	L2
4	Students should be able to prepare the casting without pattern	06	Metal forming	Demonstrate	Pratical record ,IA test	L2
5	Students should be able to understand	12	foundry	Demonstra	Pratical	L3

	and apply forging operations			te	record ,IA test	
-	**Total**	**36**	-	-	-	-

Note: Identify a max of 2 Concepts per unit. Write 1 CO per concept.

2. Lab Applications

SNo	Application Area	CO	Level
1	Inspection methods of Moulding sand	CO1	L3
2	Different moulding sands	CO2	L2
3	Manufacturing industries	CO3	L2
4	Different casting process	CO4	L2
5	Heat treatment processes	CO5	L3

Note: Write 1 or 2 applications per CO.

3. Articulation Matrix

(CO – PO MAPPING)

-	Course Outcomes	Program Outcomes											
#	COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Level
CO1	Students should be able to Conduct various test on sand & determine sand strength	2	2	-	-	-	-	-	-	2	-	-	-	L3
CO2	Students should be able to Demonstrate various skills of sand preparation and molding	2	-	-	-	-	-	-	-	2	-	-	-	L3
CO3	Students should be able to prepare the casting using with pattern	2	-	-	-	-	-	-	-	2	-	-	-	L3
CO4	Students should be able to prepare the casting without pattern	2	-	-	-	-	-	-	-	2	-	-	-	L3
CO5	Students should be able to understand and apply forging operations	2	2	-	-	-	-	-	-	2	-	-	-	L3
	Average													

Note: Mention the mapping strength as 1, 2, or 3

4. Mapping Justification

Mapping		Mapping Level	Justification
CO	**PO**	-	-
CO1	PO1	L3	Knowledge of sand preparation and pattern for making mould
CO1	PO9	L3	Individual and team work, mapping
CO2	PO1	L2	Knowledge on various test on sand
CO3	PO1	L2	Knowledge on preparation of casting using pattern
CO4	PO1	L2	Knowledge on applying forging operation
CO5	PO1	L3	Knowledge to prepare casting without pattern

Note: Write justification for each CO-PO mapping.

5. Curricular Gap and Content

SNo	Gap Topic	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1					
2					

Note: Write Gap topics from A.4 and add others also.

6. Content Beyond Syllabus

SNo	Gap Topic	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1					
2					
3					

Note: Anything not covered above is included here.

C. COURSE ASSESSMENT

1. Course Coverage

Unit	Title	Teaching Hours	No. of question in Exam							CO	Levels
			CIA-1	CIA-2	CIA-3	Asg-1	Asg-2	Asg-3	SEE		
1	Students should be able to Conduct various test on sand & determine sand strength	09	1	-	-	5	-	-	1	CO1	L3
2	Students should be able to Demonstrate various skills of sand preparation and molding	03	1	-	-	5	-	-	1	CO2	L2
3	Students should be able to prepare the casting using with pattern	06	-	1	-	-	5	-	1	CO3	L2
4	Students should be able to prepare the casting without pattern	06	-	1	-	-	5	-	1	CO4	L2
5	Students should be able to understand and apply forging operations	12	-	-	1	-	-	5	1	CO5	L3
-	**Total**	**36**	**2**	**2**	**1**	**2**	**2**	**1**	**5**	**-**	**-**

Note: Write CO based on the theory course.

2. Continuous Internal Assessment (CIA)

Evaluation	Weightage in Marks	CO	Levels
CIA Exam – 1	30	CO1, CO2	L3,L3
CIA Exam – 2	30	CO3, CO4	L2,L2
CIA Exam – 3	30	CO5	L3
Assignment - 1	05	CO1, CO2	L3,L3
Assignment - 2	05	CO3, CO4	L2,L2
Assignment - 3	05	CO5	L3
Seminar - 1	05	CO1, CO2	L3,L3
Seminar - 2	05	CO3, CO4	L2,L2
Seminar - 3	05	CO5	L3
Other Activities – define – Slip test	-	-	-
Final CIA Marks	**40**	**CO1 to Co5**	**L2,L3**

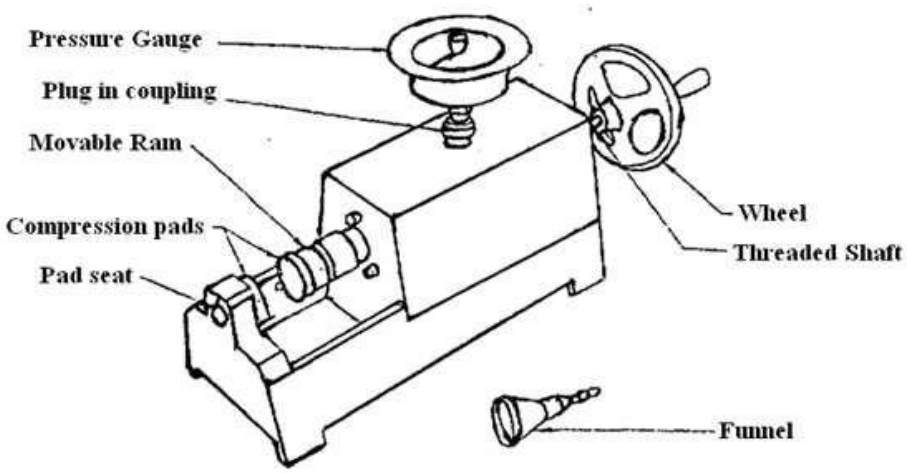
-

SNo	Description	Marks
1	Observation and Weekly Laboratory Activities	05 Marks
2	Record Writing	10 Marks for each Expt
3	Internal Exam Assessment	25 Marks
4	Internal Assessment	40 Marks
5	SEE	60 Marks
-	**Total**	**100 Marks**

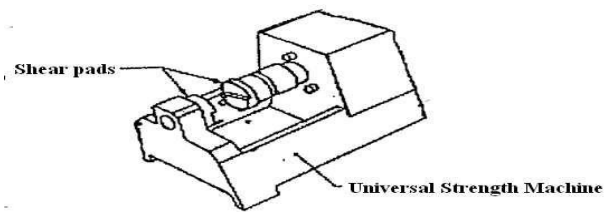
D. EXPERIMENTS

Experiment 01 : Compression strength test for molding sand

-	**Experiment No.:**	1	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Compression strength test						
2	Course Outcomes	The test determines the maximum Compression strength test of sand mixture						
3	Aim	To find the green Compression strength test for different percentage of clay and moisture						
4	Material Equipment Required	universal sand testing machine						
5	Theory, Formula, Principle, Concept	. 1.Periodic tests are necessary to check the quality of foundry sand and compression strength test is one among them. 2.The constituents of moulding sand are silica sand, clay, water and other special additives. 3.Clay imparts the necessary bonding strength to the moulding sand when it is mixed with water etc. bentonite. 4.Compression test determines the bonding or adhesiveness power of various bonding materials in green sand. 5.The green compressive strength of foundry sand is the maximum compression strength a mixture is capable of developing when it is in most condition						
6	Procedure, Program, Activity, Algorithm, Pseudo Code	1. Conduct the experiment in two parts: a) Vary the clay content keeping the water content constant b) Vary the water content keeping the clay content constant 2. Take weighed proportions of sand and clay and dry mix them together in a Muller for 3minutes. 3. Adjust the weight of the sand to get standard specimen 4. Remove the standard specimen by the stripper and place it between shackles which are fixed in the sand testing machine. 5. Rotate the handle of the testing machine to actuate the ram. Thus, hydraulic pressure is applied continuously till the specimen raptures. 6. Read the compression strength from the gauge and record the same. 7. Conduct the experiment for the above said two cases and tabulate the result.						

<table>
<tr><td></td><td>Block, Circuit, Model Diagram, Reaction Equation, Expected Graph</td><td> 
</td></tr>
<tr><td>8</td><td>Observation Table, Look-up Table, Output</td><td>
<table>
<tr><td colspan="4">VARYING THE % OF CLAY</td><td></td></tr>
<tr><td>Sl.</td><td>No. Percentage of sand</td><td>Percentage of clay</td><td>Percentage of water</td><td>Compression Strength gm/cm 2</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
</table>
VARYING THE % OF WATER
<table>
<tr><td>Sl.</td><td>No. Percentage of sand</td><td>Percentage of clay</td><td>Percentage of water</td><td>Compression Strength gm/cm 2</td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>9</td><td>Sample Calculations</td><td></td></tr>
<tr><td>10</td><td>Graphs, Outputs</td><td>Plot the graphs with Compression strength on Y-axis & percentage clay on X-axis and the other compression strength on Y-axis and percentage water on X-axis</td></tr>
<tr><td>11</td><td>Results & Analysis</td><td>Discuss the results with respect to the graphs plotted</td></tr>
<tr><td>12</td><td>Application Areas</td><td>Use to find compression strength for sand mixture</td></tr>
<tr><td>13</td><td>Remarks</td><td></td></tr>
<tr><td>14</td><td>Faculty Signature with Date</td><td></td></tr>
</table>

Experiment 02 : shear strength test for molding sand

-	**Experiment No.:**	2	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	shear strength test for molding sand						
3	Aim	To find shear strength test for molding sand						
4	Material / Equipment Required	universal sand testing machine						
5	Theory, Formula, Principle, Concept	1.Shear strength is the ability of sand particles to resist the shear stress and to stick together. 2.Insufficient Shear strength may lead to the collapsing of sand in the mould or its partial destruction during handling. The mould and core may also be damaged during flow of molten metal in the mould cavity. 3.The moulding sand must possess sufficient strength to permit the mould to be formed to the desired shape and to retain the shape even after the hot metal is poured into the mould cavity. 4.In shearing, the rupture occurs parallel to the axis of the specimen.						
6	Procedure, Program, Activity, Algorithm, Pseudo Code	Procedure: 1. Conduct the experiment in two parts: a) Vary the clay content keeping the water content constant b) Vary the water content keeping the clay content constant 2. Take weighed amount of foundry sand (mixture of sand, clay & water as specified). 3. Transfer the sand mixture into the tube and ram it with the help of a sand rammer thrice. 4. Fix the shackles to the universal sand testing machine. 5. Remove the specimen from the tube with the help of a stripper and load it into the universal sand testing machine. 6. Apply the hydraulic pressure by rotating the handle of the universal sand testing machine continuously until the specimen ruptures. 7. Read the shear strength directly from the scale and tabulate the readings.						
7	Block, Circuit, Model Diagram, Reaction Equation, Expected Graph							
8	Observation Table, Look-up Table, Output							

VARYING THE % OF CLAY

Sl.	No. Percentage of sand	Percentage of clay	Percentage of water	Compression Strength gm/cm 2

VARYING THE % OF WATER

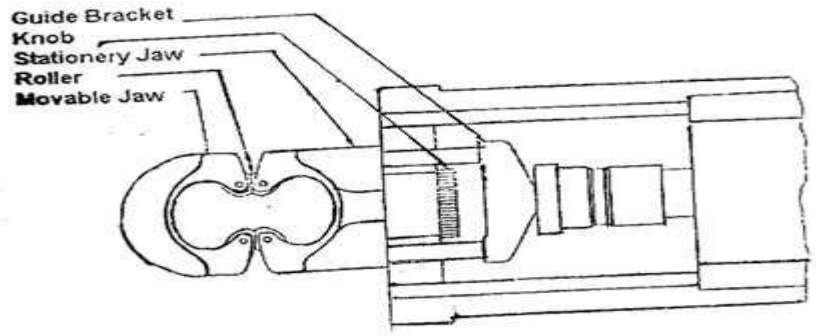
Sl.	No. Percentage of sand	Percentage of clay	Percentage of water	Compression Strength gm/cm 2

9	Sample Calculations	
10	Graphs, Outputs	Plot the graphs with shear strength on Y-axis & percentage clay on X-axis and the other compression strength on Y-axis and percentage water on X-axis
11	Results & Analysis	Discuss the results with respect to the graphs plotted
12	Application Areas	Use to find shear strength for sand mixture
13	Remarks	
14	Faculty Signature with Date	

Experiment 03 : tensile strength test for molding sand

-	**Experiment No.:**	3	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Tensile strength test for molding sand						
3	Aim	To find tensile strength test for molding sand						
4	Material Equipment	universal sand testing machine						

	Required	
5	Theory, Formula, Principle, Concept	1.A core is compacted sand mass of a known shape. 2.When a hallow casting (to have a hole through or bind) is required, a core is used in the mould or when a complex contour is required a mould is created out of cores. This core has to be properly seated in the mould on formed impressions in the sand. To form these impressions extra projections called core points are added on the pattern surface at proper places. 3.Core boxes are used for making cores. They are either made single or in two parts. Their classification is generally according to the shape of the core or the method of making the core. 4.Split core box is very widely used and is made in two parts , which can be joined together by means of dowels to form the complete cavity for making the core. 5.The purpose of adding binder to the moulding sand is to impart strength and cohesiveness to the sand to enable it to retain its shape after the core has been rammed. 6.binders used can be a) organic: ex. Dextrin, core oil b) Inorganic: ex. Sodium silicate, Bentonite 7. Classification of binders: a. Baking type: Binding action is realized in the sand after baking the sand mixture in an oven. b. Gassing type: Binding action is obtained in the sand after passing a known gas through the sand mixture. 8.Core oil is used as binder that hardens with the addition of heat. The sand and binder is mixed and backed at a temperature of 250O –300OC and binding action takes place within few hours. 9.Sodium silicate is a self setting binder and no external heat is required for the binding action which takes place at room temperature when Co2 gas is passed. 10.During casting the core is placed inside the mould and the molten metal is poured in to the cavity. As the molten metal begins to cool, it begins to contract on the inner radius as well as the outer radius. Due to the contraction of the inner radius the core sand will be pulled outwards causing a tensile load around the core. Hence knowledge of tensile strength of core sand is important.
6	Procedure, Program, Activity, Algorithm, Pseudo Code	1. Conduct the experiment in two parts. a. Using core oil as binder and b. Using sodium silicate as binder. 2. Take proper proportions of base sand and binder then mix them together thoroughly. 3. Assembly the core box and fill the mixture into it. 4. Place the core box under sand rammer and ram the sand thrice. 5. Using a wooden piece tap the core box gently from sides. Remove the core box leaving the rammed core on a flat metal plate 6. Bake the specimen (which is on a plate) for about 30 minutes at a temperature of 1500 –200O C in an oven. (When the binder is core oil) 7. If the binder is sodium silicate, pass Co_2gas for 5 secs. The core hardens instantly and the core can be directly used. 8. Fix the tension shackles on to the sand testing machine, and place the hardened specimen in the shackles. 9. Apply the load gradually by turning the hand wheel of the testing machine. Note down the readings when the specimen breaks. 10. Repeat the procedure for the different percentage of binder and tabulate the readings.
7	Block, Circuit, Model Diagram, Reaction Equation,	

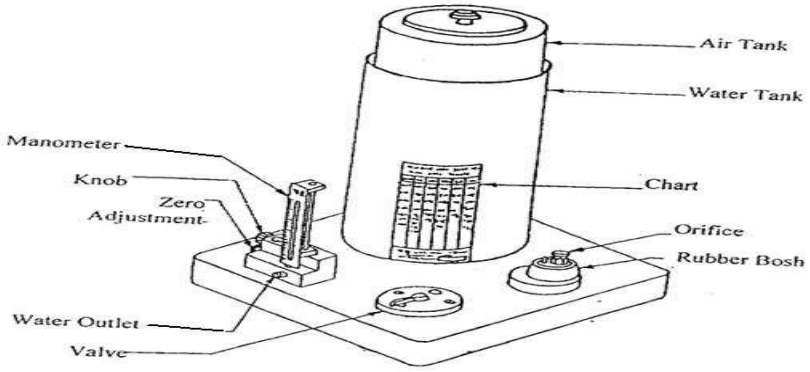
	Expected Graph	
8	Observation Table, Look-up Table, Output	
9	Sample Calculations	
10	Graphs, Outputs	Tensile strength v/s percentage binder
11	Results & Analysis	Discuss the effect of variation in % binder on tensile strength
12	Application Areas	
13	Remarks	
14	Faculty Signature with Date	

Sl. No.	Percentage of sand	Percentage of Sodium Silicate or core oil	Tensile strengthN/m 2

Experiment 04 : Permeability test

-	**Experiment No.:**	4	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Permeability test for molding sand						
3	Aim	To find Permeability strength test for molding sand						
4	Material / Equipment Required	Permeability tester						
5	Theory, Formula, Principle, Concept	1.Molten metals always contain certain amount of dissolved gases, which are evolved when the metal starts freezing. 2.When molten meal comes in contact with moist sand, generates steam or water vapour. 3.Gases and water vapour are released in the mould cavity by the molten metal and sand. If they do not find opportunity to escape completely through the mould, they will get entrapped and form gas holes or pores						

		in the casting. The sand must therefore be sufficiently porous to allow the gases and water vapour to escape out. This property of sand is referred to as permeability. 4.Permeability is one of the most important properties affecting the characteristic of moulds which depends upon the grain size, grain shape, grain distribution, binder content, moisture level and degree of compactness. 5.Permeability is a physical property of the physical sand mixture, which allows gases to pass through it easily. 6.The AFS (American Foundry Men Society) definition of permeability is "the number obtained by passing 2000cc of air through a standard specimen under a pressure of 10 gm/cm2for a given time in minutes". 7.The permeability number PN can be found out by the equation PN= VH/PAT where V= volume of air passing through the specimen ,2000cc H= height of the specimen =50.8mm P = pressure as read from the manometer in gm/cm^2 A= cross -section area of the specimen in cm^2 T= time in minutes for 2000cc of air passed through the sand specimen
6	Procedure, Program, Activity, Algorithm, Pseudo Code	1. Conduct the experiment in two parts. In the first case vary water percent keeping clay percent constant. In the second case vary clay percent and keep water percent constant. 2. Take weighed proportions of sand dry mix them together for 3 minutes. Then add required proportions of water and wet mix for another 2 minutes, to get a homogeneous and mixture. Take the total weight of the mixture between 150-200 grams. The correct weight has to be determined by trial and error method. 3. Fill the sand mixture into the specimen tube and ram thrice using sand rammer. Use the tolerance limit provided at the top end of the rammer for checking the specimen size. If the top end of the rammer is within the tolerance limit, the correct specimen is obtained. If it lies below the limit, increase the weight of sand mixture and prepare a new specimen. The specimen conforming to within limits represent the standard specimen required. 4. Now the prepared standard specimen is having a dia. 50.8mm and height50.8mm. 5. Place the standard specimen along with the tube in the inverted position on the rubber seal or on the mercury cup (specimen in the top position in the manometer reading). 6. Operate the valve and start the stop watch simultaneously. When the zero mark on the inverted jar just touches the top of water tank, note down the manometer reading. 7. Note down the time required to pass 2000cc of air through the specimen. Calculate the

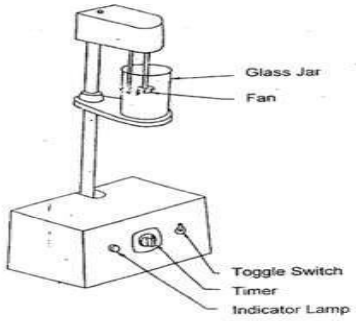
<table>
<tr><td></td><td></td><td></td></tr>
<tr><td>7</td><td>Block, Circuit, Model Diagram, Reaction Equation, Expected Graph</td><td> 
</td></tr>
<tr><td>8</td><td>Observation Table, Look-up Table, Output</td><td>
<table>
<tr><td>Sl.NO</td><td>% sand</td><td>% clay</td><td>% water</td><td>Manometer reading pressure(P)gm/cm^2

initial final P=P_i-P_f</td><td>Time in min</td><td>Permeability number

PN= VH/PAT</td></tr>
<tr><td></td><td></td><td></td><td>constant</td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
<tr><td></td><td></td><td></td><td></td><td></td><td></td><td></td></tr>
</table>
</td></tr>
<tr><td>9</td><td>Sample Calculations</td><td>Finding out premeability number using formula
PN= VH/PAT</td></tr>
<tr><td>10</td><td>Graphs, Outputs</td><td>Permeability number v/s % Clay
Permeability number v/s % water</td></tr>
<tr><td>11</td><td>Results & Analysis</td><td>Discuss the effect of water and clay on Permeability of sand</td></tr>
<tr><td>12</td><td>Application Areas</td><td>Give the information about sand properties</td></tr>
<tr><td>13</td><td>Remarks</td><td></td></tr>
<tr><td>14</td><td>Faculty Signature with Date</td><td></td></tr>
</table>

Experiment 05 : Clay content determination test for molding sand

-	**Experiment No.:**	5	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Clay content determination test for molding sand						
3	Aim	T o determine the percentage of clay present in base sand						
4	Material / Equipment Required	Mould hardness tester						
5	Theory, Formula, Principle, Concept	Clay can be those particles having less than 20 microns size. Moulding sand contains 2 to 50 percent of clay. When mixed with water it imparts, binding strength and plasticity. 2.Clay consists of two ingredients a) Fine silt and b) True clay. Fine silt as no binding power where as true clay imparts the necessary boundary strength to the moulding sand; thereby the mould does not loose its shape after ramming.						

		3.Clay also can define as those particles which when mixed with water, agitated and then made to settled, fails to settle down at the rate of 1"/mm. 4.The particles of clay are plate like from and have a very large surface area compared to its thickness and therefore have a very high affinity to absorb moisture. 5.Clay is the main constituent in a moulding sand and mixture other than sand grains. Clay imparts binding action to the sand and hence the strength. 6.Clay is of mineral origin available in plenty on earth. It is made of alumina silicate. The types of clay are a) montmorillonite b) Kaolinite and c) illite the first type is generally referred to as Bentonite. Clay is the main constituent in a moulding sand mixture other than sand grain. Clay help impart binding action to the sand and hence strength to the sand % clay = 50 -w_d/50 x 100
6	Procedure, Program, Activity, Algorithm, Pseudo Code	1. the green sand mixture with a suitable percentage of clay and moisture is prepared accordingly 2. with the help of a solid pattern ,the mould is prepared with this mixture. alternately ,instead of a mould , a core of 50.8x50.8 mm can be prepared using sand rammer 3. the ball of the indenter is pressed manually against the mould /core the depth of penetration indicated on the dial indicator is noted down readings are taken at three different locations and their average is tabulated as the hardness of mould or core
7	Block, Circuit, Model Diagram, Reaction Equation, Expected Graph	
8	Observation Table, Look-up Table, Output	
9	Sample Calculations	
10	Graphs, Outputs	

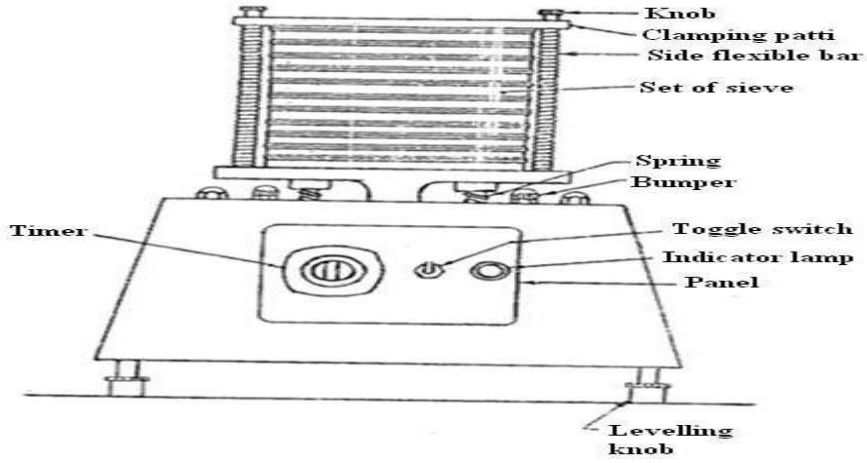
Experiment 06: Sieve analysis test

-	**Experiment No.:**	6	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Sieve analysis test for molding sand						
3	Aim	To determine average grain fineness number(GFN) of given sand						
4	Material / Equipment Required	Sieve testing appartus						
5	Theory, Formula, Principle, Concept	1.The base sand is a mixture of grains having a variety of shapes such as a) Round						

<table>
<tr><td></td><td></td><td>b) subangular
c) angular
d) compounded grains.
Base sand is relatively free from any binder or additives.
2.Depending on the average size of the grains, the sand can be grouped into: a) Fine b) Medium and c) Coarse grains.

3.The shape and size of grains has a large influence on the permeability of sand mix as well as on the bonding action.

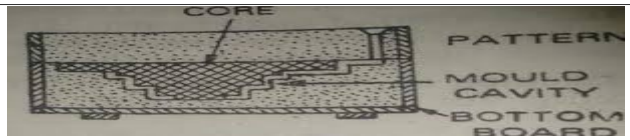
4.The shape and size of grains determine the possibility of its application in various types of
foundry practice.
Ex: Fine grain sand results in good surface, on the casting but gases cannot escape out of the mould made from it.
5.Coarse grain sand allows gases to escape out easily but the casting surface will be very rough. Hence grain size should select
appropriately.
6.The given size of sand grains is designated by a number called grain fineness number that indicates the average size of grains in the mixture.
he size is determined by passing the sand through sieves having specified apparatus which are measured in microns.
7.The sieve number designates the pore size through which the sand grains, may pass through it or retained in it.
8.Average grains fineness number can be found out by the equation

GFN = Q/P
Q= sum of product of percentage sand retained in sieves & corresponding multiplier
P= sum of percentage of sand retained in sieves</td></tr>
<tr><td>6</td><td>Procedure, Program, Activity, Algorithm, Pseudo Code</td><td>1. take 100 grams of dry silica sand and place it in the top sieve of a series and close the lid
2. place the whole assembly of sieve on yhe vibrator sieve shaker and clamp it
3. switch ON the motor and allow the sieve assembly to vibrate for 15 minutes . Then switch OFF the motor
4.collect the sand particles retained in each of the sieves & record their weighs
5. calculate the percentage weight retained by each of the sieves. Multiply this value with the multiplier for each sieve
6. calculate the average GFN</td></tr>
<tr><td>7</td><td>Block, Circuit, Model Diagram, Reaction Equation, Expected Graph</td><td> 
</td></tr>
<tr><td>8</td><td>Observation Table, Look-up Table, Output</td><td><table>
<tr><td>Sl.NO</td><td>sieve</td><td>Weight of</td><td>Percentag</td><td>multiplier</td><td>Product(DX</td></tr>
</table></td></tr>
</table>

				sand retained(B)	e sand retained) c)		C)
		1 2 3 4 5 6 7 8					
		9		TOTAL	P =C		Q=(DXC)
9	Sample Calculations	Calculation is done by using formula GFN = Q/P					
10	Graphs, Outputs	To find average grain fineness number(GFN) of given sand					
11	Results & Analysis						
12	Application Areas	A sieve analysis (or gradation test) is a practice or procedure used (commonly used in civil engineering) to assess the particle size distribution (also called gradation)					
13	Remarks	Application Areas					
14	Faculty Signature with Date	Remarks					

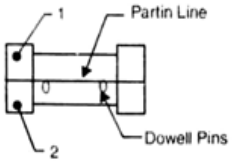
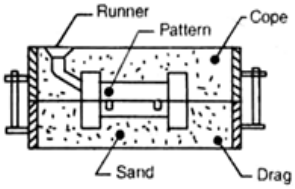
Experiment 06:FOUNDRY PRACTICE

-	**Experiment No.:**	6	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Foundry practice of solid pattern						
3	Aim	To prepare mould cavity using solid pattern						
4	Material / Equipment Required	mould box,sprue ,riser,wooden leveler,wedge and round hammer,shovel, trowel ,gate cutter,vent rod, solid pattern						
5	Theory, Formula, Principle, Concept							
6	Procedure, Program, Activity, Algorithm, Pseudo Code	1. prepare the green sand mixture for making mould 2. place the drag box in its inverted position on pre cleaned floor and keep the solid pattern in the mid position of the mould box. 3. fill and ram the green sand mixture till the top of the drag box .invert the drag box so that the pattern faces the top. 4. place the cope box on top of drag box and place sprue and riser at suitable locations 5. fill and ram the green sand mixture till the top of core box 6. level the sand using wooden leveler and remove the sprue and riser from the mould box 7. vent the cope box with vent rod 8. roll over the cope box on the floor and eject the pattern without causing damage to the mould cavity 9. cut the gate using gate cutter and clean the mould cavity with a blower.						

		10. replace the cope box over the drag box and make the mould ready for pouring
7	Block, Circuit, Model Diagram, Reaction Equation, Expected Graph	
8	Observation Table, Look-up Table, Output	
9	Sample Calculations	To make prepare mould cavity by using pattern ,cope and drag
10	Graphs, Outputs	
11	Results & Analysis	A mould cavity is prepared using solid pattern
12	Application Areas	1.Casting is the cheapest and most direct way of producing the shape of the component 2.Casting is best suited to work where components required is in low quantity. 3.Complicated shapes having internal openings and complex section variation can be produced quickly and cheaply by casting since liquid metal can flow into any form/ shape. Example: 1. Outer casing of all automobile engines. 2. Electric motor housing 3. Bench vice, Irrigation pumps etc. 4. Heavy equipment such as machine beds of lathe, milling machine, shaping, drilling planing machine etc. can be cast/easily 5.Casting is best suited for composite components Example.1. steel screw threads in zinc die casting All conductors into slot in iron armature for electric motor.
13	Remarks	
14	Faculty Signature with Date	

Experiment 07:FOUNDRY PRACTICE

-	**Experiment No.:**	6	**Marks**		**Date Planned**		**Date Conducted**	

1	Title	Foundry practice of split pattern pattern
3	Aim	To prepare mould cavity using solid pattern
4	Material / Equipment Required	mould box,sprue ,riser,wooden leveler,wedge and round hammer,shovel, trowel ,gate cutter,vent rod, solid pattern
5	Theory, Formula, Principle, Concept	
6	Procedure, Program, Activity, Algorithm, Pseudo Code	1. prepare the green sand mixture for making mould 2. place the drag box in its inverted position on pre cleaned floor and keep the solid pattern in the mid position of the mould box. 3. fill and ram the green sand mixture till the top of the drag box .invert the drag box so that the pattern faces the top. 4. place the cope box on top of drag box and place sprue and riser at suitable locations 5. fill and ram the green sand mixture till the top of core box 6. level the sand using wooden leveler and remove the sprue and riser from the mould box 7. vent the cope box with vent rod 8. roll over the cope box on the floor and eject the pattern without causing damage to the mould cavity 9. cut the gate using gate cutter and clean the mould cavity with a blower. 10. replace the cope box over the drag box and make the mould ready for pouring
7	Block, Circuit, Model Diagram, Reaction Equation, Expected Graph	 (a) Split pattern.  (b) Pattern in moulding sand. Fig. 3.2. Split pattern.
8	Observation Table, Look-up Table, Output	
9	Sample Calculations	To make prepare mould cavity by using pattern ,cope and drag
10	Graphs, Outputs	
11	Results & Analysis	A mould cavity is prepared using split pattern
12	Application Areas	1.Casting is the cheapest and most direct way of producing the shape of the component 2.Casting is best suited to work where components required is in low quantity. 3.Complicated shapes having internal openings and complex section variation can be produced quickly and cheaply by casting since liquid metal can flow into any form/ shape. Example: 1. Outer casing of all automobile engines. 2. Electric motor housing 3. Bench vice, Irrigation pumps etc. 4. Heavy equipment such as machine beds of lathe, milling machine, shaping, drilling planing machine etc. can be cast/easily 5.Casting is best suited for composite components Example.1. steel screw threads in zinc die casting All conductors into slot in iron armature for electric motor.

13	Remarks	
14	Faculty Signature with Date	

Experiment 08:FOUNDRY PRACTICE

-	**Experiment No.:**	6	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Foundry practice of solid pattern						
3	Aim	To prepare mould cavity of cube of sides 80mm with out using pattern						
4	Material / Equipment Required	mould box,sprue ,riser,wooden leveler,wedge and round hammer,shovel, trowel ,gate cutter,vent rod, solid pattern						
5	Theory, Formula, Principle, Concept							
6	Procedure, Program, Activity, Algorithm, Pseudo Code	1. prepare the green sand mixture for making mould 2. place the drag box in its inverted position on pre cleaned floor and keep the solid pattern in the mid position of the mould box. 3. fill and ram the green sand mixture till the top of the drag box .invert the drag box so that the pattern faces the top. 4. place the cope box on top of drag box and place sprue and riser at suitable locations 5. fill and ram the green sand mixture till the top of core box 6. level the sand using wooden leveler and remove the sprue and riser from the mould box 7. vent the cope box with vent rod 8. roll over the cope box on the floor and eject the pattern without causing damage to the mould cavity 9. cut the gate using gate cutter and clean the mould cavity with a blower. 10. replace the cope box over the drag box and make the mould ready for pouring						
7	Block, Circuit, Model Diagram, Reaction Equation, Expected Graph							
8	Observation Table, Look-up Table, Output							
9	Sample Calculations							
10	Graphs, Outputs							

Experiment 09:FOUNDRY MODELS

-	**Experiment No.:**	6	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Preparation of forging models						
3	Aim	To prepare a 9x9 mm square bar from a 12mm dia cylinder bar						
4	Material	mould box,sprue ,riser,wooden leveler,wedge and round hammer,shovel,						

	Equipment Required	trowel ,gate cutter,vent rod, solid pattern
5	Theory, Formula, Principle, Concept	A= 3.142/d^2
6	Procedure, Program, Activity, Algorithm, Pseudo Code	1. ignite the coal in open hearth type furnance and switch on the blower 2. keep the given square bar work piece in the hearth and heat to red hot temperature 3. with the help of hammer ,anvil draw down the heated circular rod to the calculated length 4. finish the work piece using the flatter 5. cool the finished model by keeping it in air or quenching in cold water
7	Block, Circuit, Model Diagram, Reaction Equation, Expected Graph	
8	Observation Table, Look-up Table, Output	
9	Sample Calculations	Calculations are done for different shape and find out area for given diameter
10	Graphs, Outputs	
11	Results & Analysis	Prepared a given model to the required dimension
12	Application Areas	Hexagonal nut and bolt , model preparation
13	Remarks	
14	Faculty Signature with Date	

Experiment 10:FOUNDRY MODELS

-	**Experiment No.:**	6	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Preparation of forging models						
3	Aim	To forge a L shaped bar 9x9 mm square bar from a 12mm bar						
4	Material Equipment Required	mould box,sprue ,riser,wooden leveler,wedge and round hammer,shovel, trowel ,gate cutter,vent rod, solid pattern						
5	Theory, Formula, Principle, Concept	A= 3.142/d^2						
6	Procedure, Program, Activity, Algorithm, Pseudo Code	1. Ignite the coal in open hearth type furnance and switch on the blower 2. keep the given square bar work piece in the hearth and heat to red hot temperature 3. with the help of hammer ,anvil draw down the heated circular rod to the calculated length 4. finish the work piece using the flatter 5. cool the finished model by keeping it in air or quenching in cold water						
7	Block, Circuit, Model Diagram, Reaction Equation, Expected Graph	Calculation of length of the raw material required to prepare the model considering scale loss.						
8	Observation Table, Look-up Table, Output							

9	Sample Calculations	Calculations are done for different shape and find out area
10	Graphs, Outputs	Preparing minimum three forged models involving upsetting, drawing and bending operations
11	Results & Analysis	Prepared a given model to the required dimension
12	Application Areas	Hexagonal nut and bolt , model preparation
13	Remarks	
14	Faculty Signature with Date	

F. Content to Experiment Outcomes

1. TLPA Parameters

Table 1: TLPA –

Expt-#	Course Content or Syllabus (Split module content into 2 parts which have similar concepts)	Content Teaching Hours	Blooms' Learning Levels for Content	Final Blooms' Level	Identified Action Verbs for Learning	Instruction Methods for Learning	Assessment Methods to Measure Learning
A	*B*	*C*	*D*	*E*	*F*	*G*	*H*
1	Testing of Molding sand and Core sand Preparation of sand specimens and conduction of the following tests: 1. Compression, Shear and Tensile tests on Universal Sand Testing Machine. 2. Permeability test 3. Sieve Analysis to find Grain Fineness Number(GFN) of Base Sand Clay content determination in Base Sand	3	L3 (Apply)	L3 (Apply)	Test	Chalk & Board, Demo	Practical record & IA
2	Foundry Practice 1. Use of foundry tools and other equipment's. 2. Preparation of molding sand mixture. 3. Preparation of green sand molds using two molding boxes kept ready for pouring. · Using patterns (Single piece pattern and Split pattern) · Without patterns. · Incorporating core in the mold. (Core boxes). · Preparation of one casting (Aluminum or cast iron-Demonstration only)	3	L3 (Apply)	L3 (Apply)	Model	Chalk & Board, Demo	Practical record & IA
3	Forging Operations : Use of forging tools and other equipment's • Calculation of length of the raw material required to prepare the model considering scale losses. • Preparing minimum three forged models involving upsetting, drawing and bending operations.	3	L3 (Apply)	L3 (Apply)	Model	Chalk & Board, Demo	Practical record & IA

	Demonstration of forging model using Power Hammer						
4	WELDING PRACTICE L-Joint, T-joint, Butt Joint, V-Joint Lap Joint	3	L3 (Apply)	L3 (Apply)	Model	Chalk & Board, Demo	Practical record & IA

2. Concepts and Outcomes:

Table 2: Concept to Outcome – Example Course

Expt - #	Learning or Outcome from study of the Content or Syllabus	Identified Concepts from Content	Final Concept	Concept Justification (What all Learning Happened from the study of Content / Syllabus. A short word for learning or outcome)	CO Components (1.Action Verb, 2.Knowledge, 3.Condition / Methodology, 4.Benchmark)	Course Outcome **Student Should be able to ...**
A	*I*	*J*	*K*	*L*	*M*	*N*
1	Testing of Molding sand	Preparation of sand specimens	Clay content determination in Base Sand	Will be able to understand the basic testing operations	Test	Different Testing Method
2	Molding Sand Mixture	Foundry	Foundry	Will be able to understand preparation of molding sand mixture	Model	Preparation of molding sand mixture
3	Forging Operations	Forging	Forging	Will be able to understand preparation of forging models	Model	Preparation of forging model
4	Welding	Arc Welding	Arc Welding	Will be able to understand arc welding operation	Model	Welding models