SIR C R REDDY COLLEGE OF ENGINEERING
ELURU-534 007

MANUFACTURING TECHNOLOGY LAB-II
MANUAL

DEPARTMENT OF MECHANICAL ENGINEERING

MANUFACTURING TECHNOLOGY LAB-II

LIST OF EXPERIMENTS

1.ANALYSIS OF CUTTING FORCES ON A LATHE

AIM: To analyze various cutting forces by using a lathe tool dynamometer and to establish the following curves.

a) Depth of cut Vs cutting forces.
b) Cutting speed Vs cutting forces
c) Feed Vs cutting forces.

SEPECIFICATIONS:

Force	: X,Y,Z direction
Range of force	: 500 kg force in X,Y,Z direction
Bridge resistance	: 350 Ώ typical
Bridge voltage	: 12v Max

PROCEDURE:

1. Fix the lathe tool dynamometer sensor on the tool post.
2. Connect the end of inter connecting cable X,Y,Z out put sockets of the dynamometer and the other end to sensor socket in the front panel of the instrument.
3. Set the read cal switch at read position and switch on the instrument.
4. Adjust the zero potentiometer such that the display reads zero.
5. Turn the read-cal switch to cal. Adjust cal. Potentiometer until the display reads the range of force.
6. Turn the read-cal-switch to read position in X,Y,Z axis. Now the instrument is calibrated to read force values up to calibrated capacity of the dynamometer in respective axis. The setup is ready for conducting the experiment.
7. The spindle speed is varied by keeping feed and depth of cut constant. The three forces Fx, Fy, Fz are noted down for various speeds. Similarly feed is varied keeping speed and depth of cut constant and forces Fx, Fy, Fz are noted.

OBSERVATIONS:

a) Variation of cutting fores Fx,Fy,Fz with speed at a feed of 0.05 mm/rev and depth of cut = 0.5 (D = mm)

S.No.	Speed N rpm	Cutting speed $v = \frac{\pi DN}{1000}$ m/min	Fx (Kg)	Fy (kg)	Fz (Kg)
1 2 * * * 10					

b) Variation of cutting forces Fx, Fy, Fz with depth of cut at a feed = 0.1 mm/rev and speed =150 rpm

S.No.	Depth of cut (mm)	Fx (Kg)	Fy (Kg)	Fz (Kg)
1 2 * * * 10				

c) Variation of cutting forces Fx,Fy,Fz with feed at a depth of cut = 0.5 mm and speed =150 rpm

S.No.	Feed (mm/rev)	Fx (Kg)	Fy (Kg)	Fz (Kg)
1 2 * * * 10				

GRAPHS:

1. Cutting speed Vs Measured forces (Fx,Fy,Fz)
2. Depth of cut Vs Measured forces (Fx,Fy,Fz)
3. Feed Vs Measured forces (Fx,Fy,Fz)

VIVA QUESTIONS

1. Differentiate capstan lathe from turret lathe?
2. How is cutting power consumption in turning can be significantly reduced?
3. What are the advantages of collet chucks?
4. What is the function of a lathe bed?
5. What is the direction of movement of the carriage which cutting left hand thread on a lathe?
6. What is Indexing?
7. What is the most important parameter that specifies a lathe machine?
8. What is the use of tumbler gears in a lathe?
9. Why half nut is incorporated in Lathe?
10. Explain the principle of dynamometer?
11. What is the sensing element in dynamometer?
12. Why do you measure cutting forces on lathe?

2. GRINDING OF SINGLE POINT CUTTING TOOL

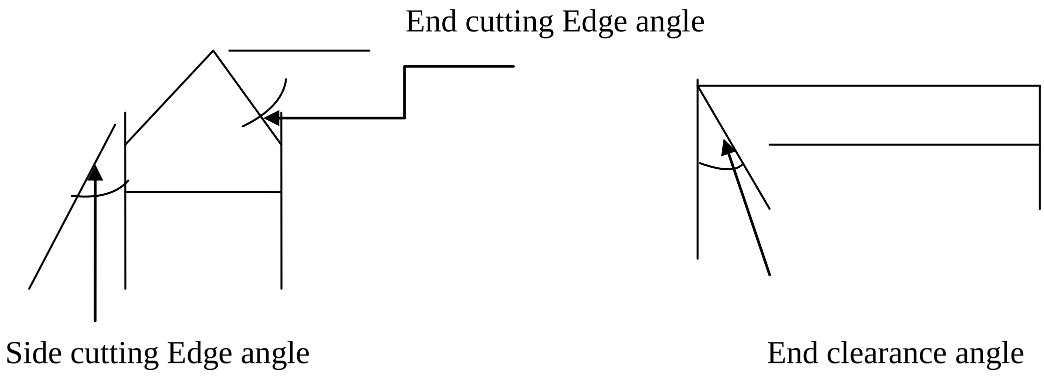
AIM:

To grind the given single point cutting tool as per given specifications.

TOOLS & EQUIPMENT :

1) Tool and cutter grinding machine
2) Profile projector
3) Mild steel square.

FIGURE:



PROCEDURE:

1. Swing the circular slide by operating the belt.
2. Set the table and the table slides at right angles to the grinding wheel spindle.
3. Mount the universal vice on the movable table and fix the job.
4. Set the required clearance angle on the vice.
5. Grind the face of the job at that particular side with cross-slide adjustment.
6. Similarly,set the vice to given end clearance and side clearance angles and grind the surfaces.

	Side cutting Edge angle	End cutting Edge angle	End clearance angle
Angle to be cut	50^o	40^o	10^o

Precautions:

1. Take care about the setting of the angle of the vice

VIVA QUESTIONS

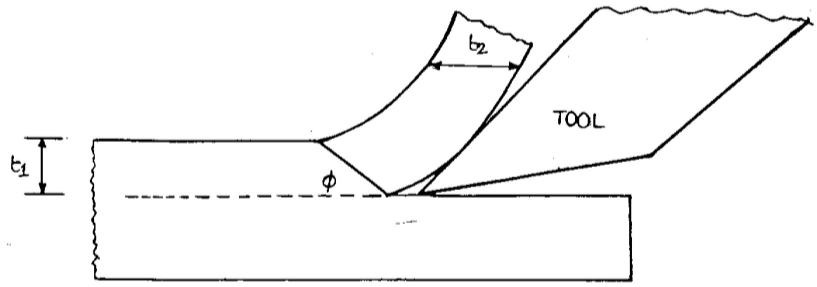
1. What parameters influence the tool life?
2. Whether hard grade or softer grade is required for internal grinding than external grinding?
3. What is the difference between dressing and trueing of a grinding wheel?
4. What are the principle angles in single point cutting tool?
5. Name the angle between the land and face?
6. Name the included angle between the land and cutting edges?
7. Which conventional machining process consumes maximum specific energy?
8. What are the first and last elements of tool singnatures?
9. What is the importance of Nose radius?
10. Name the two systems used in metal cutting to designate the tool shape?
11. How tool wear is specified?
12. What does good machinability imply?
13. Which factors affect tool size?
14. Name two criteria for cutting tool life?

3. STUDY OF CHIP FORMATION

AIM: To study the mechanism of chip formation and to find out the shear angle.

APPARATUS: Shaper, Profile Projector

FIGURE:



PROCEDURE:

1. The length and position of stroke is adjusted and a required amount of depth of cut is given.
2. Cutting operation is orthogonal and thus the chip will be continuous and does not break the lead sample.
3. Above procedure is followed for different depth of cuts.
4. This sample is placed on profile projector and the shear angle is plotted on graph which is again compared with shear angle obtained theoretically from the relation given below:

$$\varphi = \mathrm{Tan}^{-1} \frac{r\cos\alpha}{1 - r\mathrm{Sin}\alpha}$$

φ = Shear angle
r = Cutting angle
α = Rake angle of cutting tool

OBSERVATIONS:

Rake angle of the tool (α)=

S.No	Depth of cut ($t_1$mm)	Chip thickness ($t_2$mm)	Cutting ratio $r = \frac{t_1}{t_2}$	Shear angle $\varphi = \mathrm{Tan}^{-1} \frac{r\cos\alpha}{1 - r\mathrm{Sin}\alpha}$	Measured shear angles

PRECAUTIONS:

1. Take care about the formation of the chip.
2. Take care about handling the chip (formed specimen)

VIVA QUESTIONS

1. What are the factors of evaluating machinibility?
2. What kinds of chips are encountered when machining mild steel and cast iron?
3. What is the relationship for Merchant's constant in machining operation?
4. What are the units of specific power consumption and specific removal rate in metal cutting?
5. According to Merchant's theory of metal cutting, what is the relationship between shear plane angle 'θ', rake angle r and chip thickness ratio (t_1/t_2)?
6. What are the main factors that are responsible for the formation of built up edge?
7. When a built up edge is formed while machining?
8. What is built up edge? How to specify the size of a shaper?
9. Why shapers equipped with universal table?
10. What is the usual ratio of forward and return stroke in a shaper?
11. What are the advantages of a hydraulic shaper over a mechanically driver shaper?
12. Explain the differences between shaper and planer?
13. What are the applications of profile projector?
14. What type of mechanism used in shaper?

4.TORQUE MEASUREMENT ON MILLING MACHINE

AIM: To find the variation of torque with respect to depth of cut by using the milling machine.

APPARATUS & EQUIPMENTS:

1) Milling machine provided on a arbor
2) Dynamometer

TOOLS: Helical gear

PROCEDURE:

1. Fix the work piece between the vices
2. The tool is fixed to the arbor
3. Set the read cal switch at read position and switch on the instrument.
4. Adjust the zero potentiometer such that the display reads zero.
5. Turn the read-cal switch to cal. Adjust cal. Potentiometer until the display reads the range of force.
6. Turn the real can switch to read position. The setup is ready for measuring the torque.
7. Fix the rpm and feed to given values by operating the levers in the milling machine
8. The work piece is engaged to tool rotating in anti – clockwise direction.
9. The readings of the tangential force are taken from the dynamometer for different depth of cuts.
10. The torque can be obtained by multiplying the tangential force with the radius of the cutter.

OBSERVATIONS:

Speed =

Feed =

Radius of the cutter (r) =

S.No	Depth of cut (mm)	Tangential force Fx(Kg)	Torque (Fx r) Kg-m
1 2 • • 10			

GRAPH:

Torque vs depth of cut

PRECAUTIONS:

1) Care should taken while connecting the cables to dynamo meter

VIVA QUESTIONS

1. What are the factors affecting the rate of feed in a milling machine?
2. List out the types of milling machines?
3. What are the factors to be considered while evaluating the machinability?
4. Differentiate up milling and down milling?
5. In which type of milling process the surface finish is better and tool life is longer?
6. What is an arbor?
7. What types of chips are produced in plain milling of mild steel plate?

5. TORQUE MEASUREMENT ON DRILLING MACHINE

AIM: To find out the torque required by the drilling machine for various cutting parameters.

APPARATUS: Drilling machine with dynamometer (Equipment)
1. Drilling Machine 2) Dynamometer

PROCEDURE:

1. Clamp the work – piece in the vice.
2. The vice along with drill dynamometer is clamped to the table.
3. Set the read cal switch at read position and switch on the instrument.
4. Adjust the zero potentiometer such that the display reads zero.
5. Turn the read-cal switch to cal. Adjust cal. Potentiometer until the display reads the range of force.
6. Select several speeds and feeds (i.e., coarse and fine).
7. The torque is noted.

OBSERVATIONS:

S.No	Speed (rpm)	Feed		Torque (Kg-m)
		Fine	Coarse	
1 2 • • 10				

GRAPH: Torque Vs Cutting Speed.

PRECAUTIONS:

1) Care should taken while connecting the cables to dynamo meter

VIVA QUESTIONS

1. State the important parts of twist drill as per Indian standard?
2. What do you mean by drill sleeve and a drill socket?
3. Mention the major difference between drilling and boring?
4. Why a drill cannot drill deeper than its flute length?
5. When do you recommend the use of straight fluted drill?
6. Under what condition a drill may not cut?
7. Name the tools used for hole starting, hole enlarging and hole finishing?
8. Some drills have straight shanks and some have tapered shark. Why?
9. Differentiate between counter sinking and counter boring?
10. Differentiate between drilling and reaming?
11. Helix angle of fast helix drill is normally?
12. What is the meaning of the term sensitive drill press?
13. List out types of drilling machines?

6.MEASUREMENT OF CUTTING TOOL TEMPERATURE IN TURNING

Aim:

To measure cutting tool temperature in turning using thermocouple with digital indicator

Equipment Required:

Tool tip temperature thermocouple with digital indicator

Tools & Material Required:

1) Dia 25mm x 100mm length M.S.Round
2) Single point cutting tool

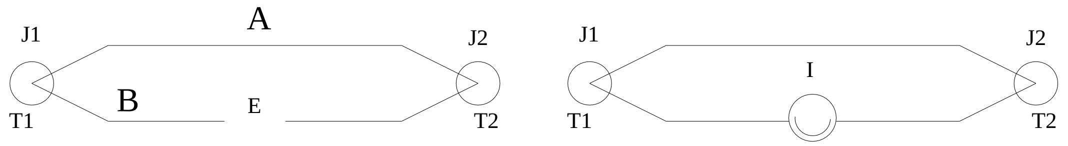
Theory:

Thermo – Electric Sensor:

The most common electrical method of temperature measurement uses the thermo - electric sensor also known as the thermocouple. The construction of the thermocouple consists of two wires of different metals twisted and brazed or welded together with each wire covered with insulation, which may be either:

1) Mineral (Magnesium oxide) Insulation for normal duty, or
2) Ceramic insulation for heavy duty.

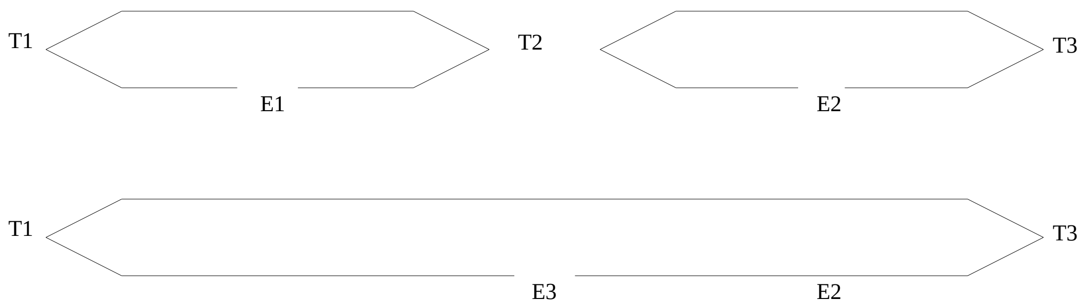
The basic principle of temperature measurement using a thermo - electric sensor was discovered by seebeck in 1821, when two conductors of dissimilar metals, say A & B are joined together to form a loop (thermocouple) and two unequal temperatures T 1 and T2 are interposed at two functions J 1 & J2 respectively then an infinite resistance voltmeter detects the electromotive force E, or if a low resistance ammeter is connected, a current flow I is measured.



Experimentally, it has been found that the magnitude of E depends upon the materials as well as the temperature Tl & T2. Now, the overall relation between EMF E and the temperatures T 1 & T2 forms the basis for thermoelectric measurements and is called seebeck effect. Thus in practical applications, a suitable device is incorporated to indicate the EMF E or the flow of current I. For convenience of measurement and standardization, one of the two functions is usually maintained at some known temperature. The measured EMF E then indicates the temperature difference relative to the reference temperature, such as ice point, which is very commonly used in practice.

It may be noted that temperature Tl and T2 of functions 11 and J2 respectively are slightly altered if the thermo-electric current is allowed to flow in the circuit. Heat is generated at the cold junction and is absorbed from the hot junction thereby heating the cold junction slightly and cooling the hot junction slightly. This phenomenon is termed peltiers effect. If the thermocouple voltage is measured by means of potentiometer, no current flows and peltier heating and cooling are not present. Further, these heating and cooling effects are proportional to the current and are fortunately quite negligible in a thermocouple circuit, which is practically a millivolt range circuit. In addition, the function EMF may be slightly altered if a temperature gradient exists along either or both the materials. This is known as Thomson effect. Again, the Thomson effect may be neglected in practical thermo-electric circuits and potentiometer voltage measurements are not susceptible to this error as there is no current flow in the circuit. The actual application of thermocouples of the measurements requires consideration of the laws of thermo-electricity.

Law of intermediate temperatures states that the EMF generated in a thermocouple with functions at temperatures Tl and T3 is equal to the sum of the EMFs generated by similar thermocouples, one acting between temperatures T 1 and T2 the other between T2 and T3 when T2 lies between T 1 & T2.



E3 = E1 + E2

Law Of Intermediate Temperature:

This law is useful in practice because it helps in giving a suitable correction in case a reference function temperature other than O°C is employed. For example if a thermocouple is calibrated for a reference function temperature of O°C and used with function temperature of say 20°C, then the correction required for the observation would be the EMF produced by the thermocouple between O°C and 20°C.

Law of intermediate metals the basic thermocouple loop consists of two dissimilar metals A & B. If a third wire is introduced then three functions are formed B-C and C-A and at the same temperature.

It may be noted that extension wires are needed when the measuring instrument is to be placed at a considerable distance from the reference function. Maximum accuracy is obtained when the leads are of the same material as the thermocouple element. However, this approach is not economical while using expensive thermocouple materials. Further, a small inaccuracy is still possible if the binding post of the instrument is made of say copper and two binding posts are at different temperatures. Therefore, it is preferable to employ the system shown in figure to keep the copper - iron and copper - constantan functions in the thermos flask at O°C and provide binding posts of copper. This ensures maximum accuracy in the thermocouple operation.

Thermocouple Materials:

The choice of materials for thermocouples is governed by the following factors:

1. Ability to withstand the temperature at which they are used.
2. Immunity from contamination / oxidation etc. which ensures maintenance of the precise thermo - electric properties with continuous use.
3. Linearity characteristics.

It may be noted that the relationship between thermo - electric EMF and the difference between hot and cold function temperature is approximately of the parabolic form.

$$E = aT + bT^2$$

A typical thermo - electric response of a copper - iron thermocouple is shown in fig. It has a nearly linear range between OA, which is usable range of the thermocouple.

As is clear from fig. as the temperature difference increases the thermo EMF increases and reaches a maximum at 285°C and after that it starts to fall. This feature of neutral temperature is interesting but has a disadvantage in practical measurements. In the region of the neutral temperature the thermocouple is extremely insensitive to the change in temperature and there is even a possibility of ambiguity in the temperature reading.

Thermocouples can be broadly classified in two categories.

1. Base - metal thermocouple
2. Rare - metal thermocouple

Base-metal thermocouple use the combination of pure metals and alloys of iron, copper and nickel and are used for temperature up to l450K. These are most commonly used in practice as they are more sensitive, cheaper and have nearly linear characteristics. Their chief limitation is the lower operating range because of their low melting point and vulnerability to oxidation. On the other hand, rare-metal thermocouples use a combination of pure metals and alloys of platinum for temperature up to 2000 K and tungsten, rhodium and molybdenum for temperature up to 2900 K.

Controls:

1. Connect the Thermocouple to the back panel of the instrument
2. POWER ON: This facility supply of power to the instrument
3. MIN: Potentiometer provided to calibrate for min temperature.
4. MAX: Potentiometer provided to calibrate for MAX temperature
5. FUSE: Protect the instrument against internal short circuit rating 500 mA.
6. MAIN CABLE: 3 Pin 230v 50Hz cable.

Operation / Procedure:

1. Connect the thermocouple to the back panel of the instrument.
2. Switch ON the power to the instrument
3. The display reads *room* temperature.
4. Fix the thermocouple *to* the tool tip.

Note the Temperature of tool tip using the digital temperature indicator.

Observations:

S.No	Room Temperature T1 ^0C	Tool Tip Temperature ^0C	Depteh of Cut (mm)
1 2 3 4 5			

S.No	Room Temperature T1 ^0C	Tool Tip Temperature ^0C	Speed (RPM)
1 2 3 4 5			

S.No	Room Temperature T1 ^0C	Tool Tip Temperature ^0C	Feed (mm/REV)
1 2 3 4 5			

Graphs To Be Drawn:

1. Tool tip temperature Vs Depth of cut
2. Tool tip temperature Vs Speed
3. Tool tip temperature Vs Feed

7. MOULD MOISTURE CONTENT TEST

AIM: To determine the moisture content in the given sample of moulding sand.

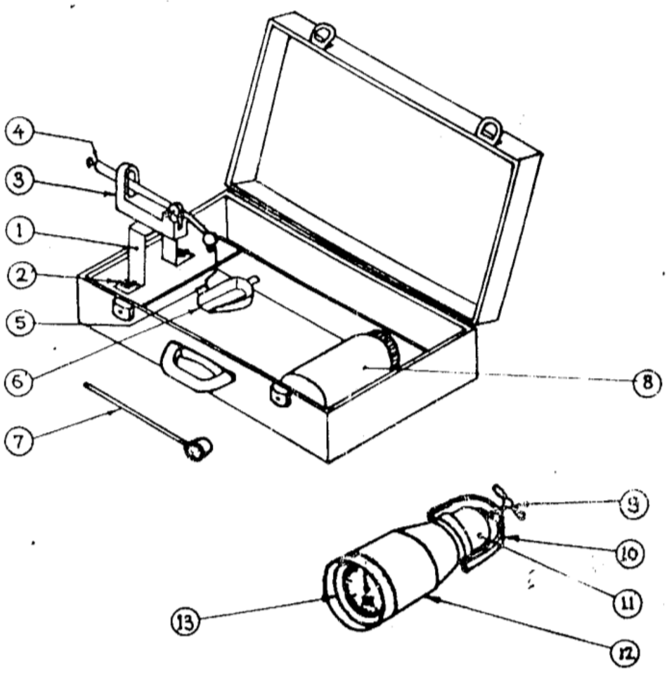
EQUIPMENT REQUIRED:

2. Rapid moisture tester
3. Pan
4. Balance for weighing
5. Absorbent bottle.

MATERIALS REQUIRED:

1. Moulding sand
2. Water
3. Calcium carbide as absorbent.

FIGURE:



SR.NO.	NAME OF THE PART
1.	BALANCE SUPPORT
2.	WING NUT
3.	BALANCE BRACKET
4.	LEVER
5.	PAN HANGER
6.	PAN
7.	SPOON
8.	ABSORBANT BOTTLE
9.	HANDLE
10.	'U' CLAMP
11	CAP
12	BODY
13	GAUGE

DESCRIPTION:

The instrument operates on the principle of gas pressure generated between the moisture in the sample and the absorbent compound.

The instrument is portable and needs no power supply. It is accommodated in a handy wooden case with calibrated balance ready for use. Absorbent compound (Calcium carbide) is provided with the instrument in the airtight bottle.

PRESETTING:

Keep the case on the plain platform. Open the case and observe the entire equipment thoroughly. Set the balance bracket to its seat providing at left side. While tightening the wing nuts, see the level. Place the balance lever, pan seat and pan in their proper position. Remove the cap. Clean both cap and body of the tester from inside.

PROCEDURE:

1. Weigh the sample accurately by matching the red lines marked on the bracket and the lever.
2. Transfer the sample in the cap.
3. Take two spoons of calcium carbide and transfer it in to the body of the tester.
4. Hold the body horizontally and place the cap in position.
5. Bring the clamp in position and tighten the cap with screw.
6. Shake the instrument vigorously.
7. This ensures the sample and the calcium carbide intimately mixed.
8. Immediately after this, the pointer of the gauge moves.
9. Keep the instruments in position.
10. Observe the reading when pointer stops moving further.
11. This will give the percentage of moisture in the sample directly.
12. Unscrew the handle and take out the cap.
13. Throw away the used material.
14. Clean the instrument for subsequent tests of other moulding sands with varying moisture content.

OBSERVATIONS:

S.No	Sample	% of moisture
1		
2		
3		
4		
5		
6		
7		
8		
9		
10		

PRECAUTIONS:

1. The moulding sand sample should not be exposed.
2. The absorbent compound (calcium carbide) should not be exposed to the atmosphere.
3. The instrument should be cleaned after every use.

8.MOULD HARDNESS TEST

AIM: To determine the mould hardness of a given sample of green sand.

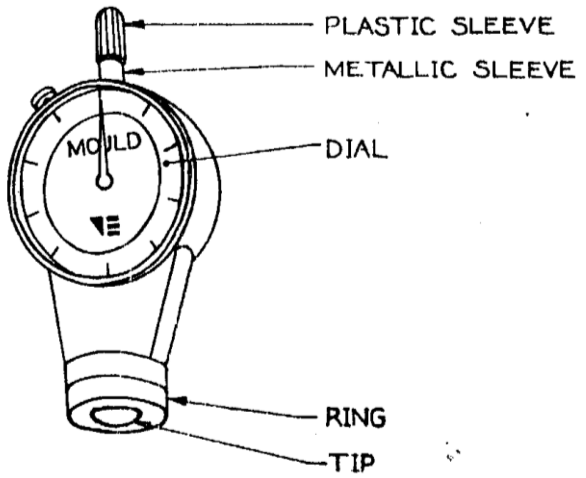
EQUIPMENT REQUIRED:

1. Sand rammer
2. Mould hardness tester
3. Specimen tube
4. Pedestal cap
5. Stripper
6. Weighing machine
7. Burette

MATERIALS REQUIRED:

Mould sand, water

FIGURE:



DESCRIPTION:

It is handy instrument with a special gauge to read the mould hardness number directly. The tip of the instrument is special in shape and made from alloy steel. This tester is supplied with the container.

Confirm free moment of the dial indicator and tip by pressing lightly. The needle should come to zero position when released. Test the instrument on optically flat surface by gently pressing vertically to touch the ring on the surface of the flat. The needle will rotate one complete rotation with zero reading.

PROCEDURE:

1. A known weight of moulding sand is to be taken in a specimen tube with pedestal cap under it. Add the water by vareing the % of moisture gradually in steps.

2. Then it is placed under the sand rammer and three blows are given by using cam. Then a 50x50mm cylindrical specimen is produced by the stripper.

3. Set the needle of the dial indicator in zero position.

4. Apply the hardness-measuring instrument vertically by placing the tip on the mould surface of which hardness is to be measured

.

5. Gently press on the surface until the surface of the ring contacts the mould surface, through out the periphery.

6. Now the depth of the penetration of the tip into the mould indicates the green hardness, which is indicated on the dial directly.

7. Repeat the entire procedure for different samples of moulding sand with varying moisture content.

OBSERVATIONS:

S.No	% of Moisture	Hardness		
		Bottom	Top	Average
1				
•				
•				
•				
10				

PRECAUTIONS:

1. The instrument should be cleaned and must be kept away form the dust.
2. All the striking sand must be completely removed before and after every test.
3. One should not temper with setting and calibration of the equipment.

GRAPH:

A graph can be plotted between the percentage of moisture and average hardness of the moulding sand.

9.MOULD COMPRESSION STRENGTH TEST

Aim: To determine the compressive strength of the given moulding sand sample

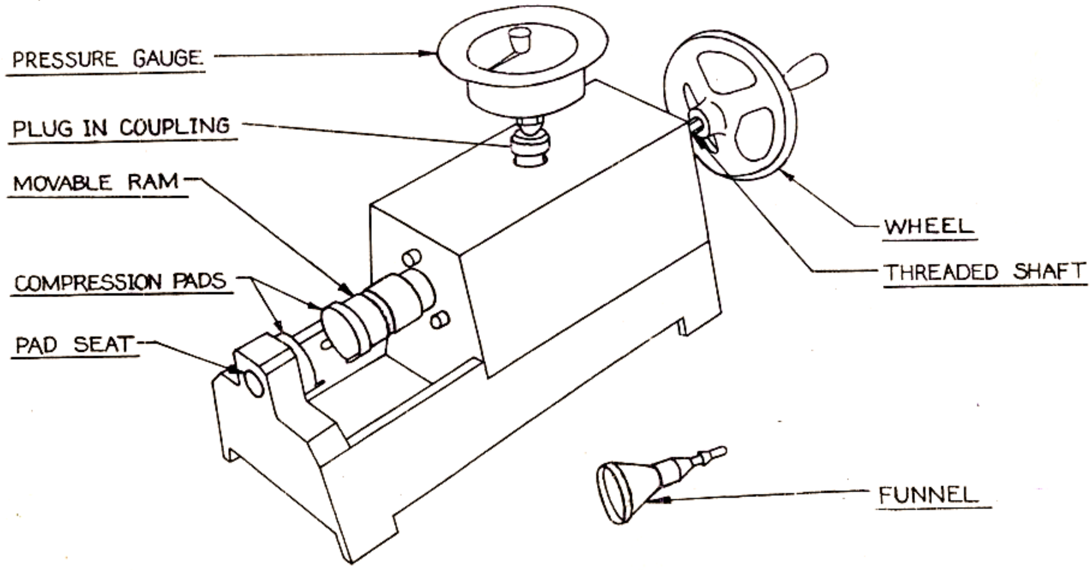
Equipment Required:

1. Sand rammer
2. Universal strength machine 3. Rapid moisture tester
4. Specimen Tube
5. Pedestal Cap
6. Stripper

Materials Required:

1. Moulding sand
2. Water

Figure:



Description:

The machine consists of an oil reservoir, movable ram, plug - in coupling, low & high pressure gauges to read 0 t01600 gm/cm^2 and compression strengths up to 13 kg/cm^2, loading piston connected to a threaded shaft and wheel, funnel with special connection, bottle of oil (Hydraulic oil No: l: 50 & 200). A pair of compression pads is also supplied with the machine.

Presetting:

Place the machine on plain sturdy platform. Rotate the wheel anti-clockwise to bring the piston assembly to the end of the reservoir. Remove the cap on the plug in coupling. The machine is supplied without oil in the reservoir. To fill the oil in it, press the funnel with special connection in the plug in coupling so that it will lock. Fill the funnel half its capacity hydraulic oil supplied along with the machine. Pull the movable ram to a distance of 25mm approximately. Some quantity of oil will enter the reservoir. Push the movable ram inside to remove the air inside the reservoir. Make the level of the oil in the funnel and repeat the procedure till all the air fro, the reservoir is expelled out and oil is filled in the reservoir. Push the movable ram completely in. Turn the knurled ring of plug in coupling anti-clockwise and pull out the funnel. Collect the oil remaining in the funnel~ in the container. Select a low pressure gauge and insert the same in the plug in coupling and press it to lock the gauge. The pressure gauge has an additional red pointer apart from the needle. Rotate the knob on the glass of the gauge anti-clockwise to bring the red pointer to touch the needle of the gauge.

Procedure:

1. A known weight of moulding sand is taken to prepare the standard specimen of dia 50 x 50 mm height.
2. Place the specimen between the compression pads so that the plain surfaces of the specimen touch against the pads.
3. Rotate the wheel clockwise until load starts applying on the specimen and then uniformly at about 16 rpm till the specimen collapses with the forward movement of the needle.
4. The red pointer also moves along with the needle.
5. As 800n as the specimen collapses, the needle returns while the red pointer remains at the maximum reading before the collapse of the specimen.
6. To determine the compression strength indicated by the red pointer, the compression scale should be used.
7. Repeat the entire procedure to have a minimum of three readings from the same moulding sand.
8. Take the average of the three readings to arrive at the compression strength of the moulding sand.
9. By varying the moisture content of the moulding sand, prepare another set of samples of the same standard size.
10. Repeat the above procedure to determine the compression strength of moulding sand with varying moisture content.

Observations:

S.No	% of moisture by weight	Compression strength (gm/cm^2)			
		Trial - 1	Trial - 2	Trial - 3	Average
1					
2					
*					
*					
10					

Precautions:

1) Air from the hydraulic system must be completely removed.
2) The gauge of the machine should not be overloaded.
3) Keep the equipment clean.
4) Turn the wheel slowly for correct readings.

Graph:

A graph can be plotted between the percentage of moisture and compression strength of the moulding sand.

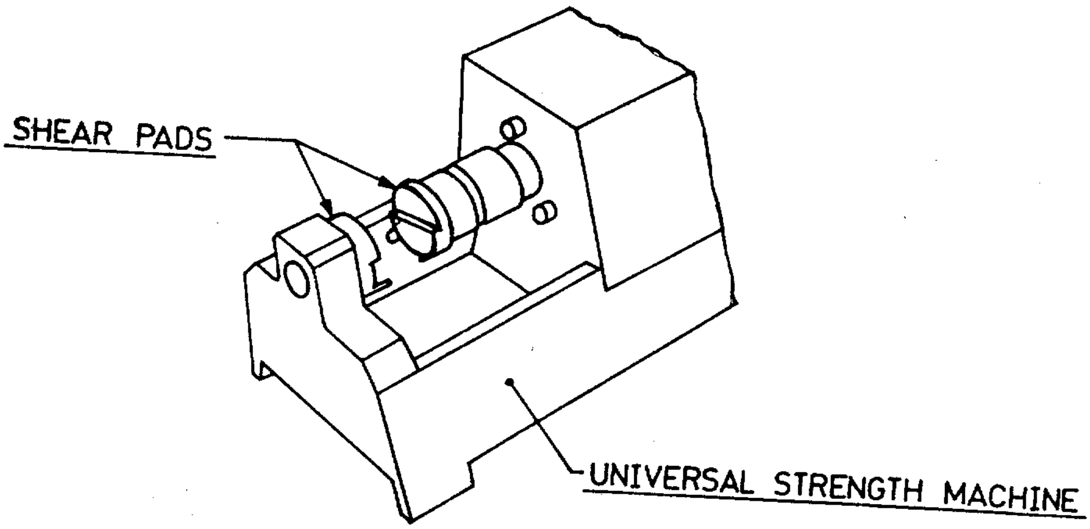
10.SHEAR STRENGTH TEST

AIM: To determine the shear strength of the moulding sand.

APPARATUS:

1. Sand Rammer
2. Specimen tube
3. Pedestal cup
4. Stripper
5. Universal testing machine (shear strength)

FIGURE:



DESCRIPTION:

The machine consists of an oil reservoir, movable ram, plug – in coupling, low & high pressure gauges to read 0 to1600 gm/cm² and compression strengths up to 13 kg/cm², loading piston connected to a threaded shaft and wheel, funnel with special connection, bottle of oil (Hydraulic oil No:150 & 200). A pair of shear pads is also supplied with the machine.

PRESETTING:

Place the machine on plain sturdy platform. Rotate the wheel anti-clockwise to bring the piston assembly to the end of the reservoir. Remove the cap on the plug in coupling. The machine is supplied without oil in the reservoir. To fill the oil in it, press the funnel with special connection in the plug in coupling so that it will lock. Fill the funnel half its capacity hydraulic oil supplied along with the machine. Pull the movable ram to a distance of 25mm approximately. Some quantity of oil will enter the reservoir. Push the movable ram inside to remove the air inside the reservoir. Make the level of the oil in the funnel and repeat the procedure till all the air fro, the reservoir is expelled out and oil is filled in the reservoir. Push the movable ram completely in. Turn the knurled ring of plug in coupling anti-clockwise and pull out the funnel. Collect the oil remaining in the funnel, in the container. Select a low pressure gauge and insert the same in the plug in coupling and press it to lock the gauge. The pressure gauge has an additional red pointer apart from the needle. Rotate the knob on the glass of the gauge anti-clockwise to bring the red pointer to touch the needle of the gauge.

PROCEDURE:

1. Preparing the necessary moulding sand sample with the help of pedestal cup, cam and stripper.
2. Place the specimen between the shear pads, and rotate the wheel in anticlockwise direction until the applied load shears the specimen.
3. The reading of the gauge (shear strength) at which the specimen shears is noted down.

OBSERVATIONS:

S.No	**% Moisture by weight**	Shear strength (gm/cm^2)		
		Trial -1	**Trail -2**	**Average**
1 2 • • 10				

PRECAUTIONS:

1. Do not overload the gauges.
2. Keep the equipment clean.
3. Turn the wheel slowly for correct reading.

GRAPH:

% of moisture (vs) shear strength

11.SIEVE SHAKER ANALYSIS OF MOULDING SAND

Aim:

To ascertain the frnenes8 member i.e. grain size fraction of the given dry silica sand

Equipment Required:

1. Grain fineness Tester
2. Weighing machine
3. Timer.

Materials Required: Clay free silica sand

Description:

A panel of switch and a timer is fitted separately to the body. The instrument is having a facility to accommodate 10 sieves, a lid and a pan. The side springs are fixed on the shaking mechanism

Presetting:

Fix the ins1rument on a strong and steady base, which can with stand the vibration of the ms1rument during shaking. Level the ms1rument. Remove the clamping patti by pulling the knobs of side springs. Take out the set of sieves. Check the timer and switch for off position. Connect single phase A.C. supply.

Procedure:

1. A known weight of clay free silica sand is taken in to the top sieve of the set.
2. Switch on the instrument and allow the machine to shake for a known time, and switch off.
3. Remove the clamping patti and observe the grains of sand, in the sieves, which are just below the top sieve
4. Now weigh the grains that are retained in the individual sieves
5. The sieve opening number of the sieve indicates the grain size fraction of the originally taken dried and clay free sand.
6. The percentage of retained grains on each sieve and the pan is to be multiplied with the multiplier and the results are to be added.
7. The sum is divided by the total percentage of the sand grains to find out A.F.S. number of sand sample
8. Repeat the entire procedure for different weights (100, 150, 200, 250 gms) of clay free silica sand

Method Of Fineness Number:

S.No	Sieve opening	Weight In the	% retained	Multiplying	Product
	No (Microns)	Sieve (Grams)		factor	
	A	B	C	D	E = C x D
1	1700			'5	
2	850			10	
3	600			20	
4	425			30	
5	300			40	
6	212			50	
7	150			70	
8	106			100	
9	7'5			140	
10	53			200	
11	Sieve pan			300	

$$\text{Fineness Number} = \frac{\text{Total of E}}{\text{Total of C}} = \frac{\text{E}}{\text{C}}$$

Precautions:

1. The instrument should be cleaned and must be kept in tidy condition
2. All the grains must be removed from each individual sieve by using a soft brush
3. Please ensure that the sieves fit exactly into each other before tightening the knob
4. The timer knob should not be rotated in anti-clockwise direction

12.CLAY CONTEST TEST

AIM: To determine the clay content in the moulding sand.

APPARATUS: Wash bottle, stirrer, Measuring Jar.

PROCEDURE:

1. Dry thoroughly a small quantity of prepared moulding sand.
2. Separate 50 gms of dry moulding sand and transfer the same to wash bottle.
3. Add in it 475 cc of distilled water and 25 cc of 3% NaOH solution.
4. Using a rapid sand stirrer, agitate the whole mixture for about 10 minutes.
5. Full the wash bottle with water up to the mark indicated on the same.
6. After the sand etc., has settled for about 10 minutes, siphon out the water from the wash bottle.
7. clay is dissolved in water (due to stirring action) and gets removed along with the same.
8. To the sand thus left in the wash bottle, add more water stir the constituents again and let the sand settle down.
9. Repeat step 7 till the water over the settled sand is clean.
10. Dry the settled down sand.
11. The clay content can be determined from the difference in weights of the initial and final sand samples.

PRECAUTIONS:

1. Proper care should be taken while stirring the sand.
2. Proper care should be taken while. handling wash bottle.

FOUNDRY VIVA QUESTIONS

1. What is the function of the core in sand mould?
2. List out parameters to be considered in the gating design for moulds?
3. The best shape of a runner in sand casting is an inverted frustum of a cone – why?
4. What are the uses of runner and riser?
5. Why uniform ramming is considered describe in green sand moulding process?
6. What is the composition of moulding sand?
7. What are the properties moulding sand?
8. Describe the moulding procedure?
9. List out the types of sands?
10. Which is the most widely used metal for castings?
11. What is meant by permeability? What is it effect on sand grains?
12. What is the purpose of patterns in casting? List out the different types of patterns?
13. What are the pattern materials?
14. Why chills are often incorporated in moulds?
15. What is refractoriness? What happiness if it is poor?
16. Differentiate cohesivenss and adhesiveness of sand?
17. What is porosity? What is its effect on casting?
18. What is collapsibility and flowability?
19. What is shear strength of moulding sand?
20. Why do you take 175 gm of moulding sand, during shear strength test?
21. Explain the presetting of universal strength machine?
22. What is the effect of shear strength, if moisture content is increasing in moulding sand?
23. What is grain fineness number? What does it exactly indicates?
24. What is meant by A.F.S. number?
25. Which type of sand grains is most suitable for casting?
26. What is the general range of moisture content in the moulding sand?
27. Why do you add calcium carbide during moisture content test?
28. What is the effect of mould hardness, if percentage of moisture content is increased?
29. Explain the compression strength of moulding sand?
30. What is the ideal range of compression strengths of moulding sand?
31. What is the ideal range of shear strength of moulding sand?
32. What is the effect of compression strengths, if percentage of moisture is increased in moulding sand?

33. What are the different types of clay?
34. How to identify surface cracks?
35. What are the defects in Casting?
36. How to identify blow holes?
37. Which type of heat treatment is required, for parts manufacturing process in casting?
38. What is the purpose of core in casting?
39. What is the purpose of core prints?
40. Why do colour system is used in casting process?
41. What is fettling?
42. What are the different types of allowances provided for patterns?
43. What is shrinkage allowance and which metal requires more allowance?
44. What is draft allowance?
45. What is machining allowance?
46. What is distortion allowance?
47. Explain gating system?
48. What are different types of risers?
49. What are the different types of Gate?
50. What are the various elements of gating system?