Ref No:

SRI KRISHNA INSTITUTE OF TECHNOLOGY , BANGALORE-90

LABORATORY PLAN

Academic Year 2019-20

Program:	B E – Civil Engineering
Semester :	3
Course Code:	18CVL38
Course Title:	Building Materials Testing Laboratory
Credit / L-T-P:	2 / 0-0-3
Total Contact Hours:	40
Course Plan Author:	HARISH GOWDA R PATIL

Academic Evaluation and Monitoring Cell

#29, Hesaragatta Main Road, Chimney Hills
Chikkabanavara Post Bangalore-560090
PH-080-23721477/23721315
www.Skit.org, Email: skitprinci1@gmail.com

INSTRUCTIONS TO TEACHERS

- Classroom / Lab activity shall be started after taking attendance.
- Attendance shall only be signed in the classroom by students.
- Three hours attendance should be given to each Lab.
- Use only Blue or Black Pen to fill the attendance.
- Attendance shall be updated on-line & status discussed in DUGC.
- No attendance should be added to late comers.
- Modification of any attendance, over writings, etc is strictly prohibited.
- Updated register is to be brought to every academic review meeting as per the COE.

Table of Contents

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

A. LABORATORY INFORMATION

1. Laboratory Overview

Degree:	BE	*Program:*	CV
Year / Semester :	3	*Academic Year:*	2018-19
Course Title:	Building Materials Testing Laboratory	*Course Code:*	18CVL38
Credit / L-T-P:	2 / 0-0-3	*SEE Duration:*	180 Minutes
Total Contact Hours:	42 Hrs	*SEE Marks:*	60 Marks
CIA Marks:	40	*Assignment*	-
Course Plan Author:	HARISH GOWDA R PATIL	*Sign*	Dt :
Checked By:	MOHAN K T	*Sign*	Dt :

2. Laboratory Content

Unit	**Title of the Experiments**	**Lab Hours**	**Concept**	**Blooms Level**
1	Tension test on mild steel and HYSD bars.	03	Tension Strength	L5 Evaluate
2	Compression test on mild steel, cast iron and wood.	03	Compression strength	L5 Evaluate
3	Torsion test on mild steel circular sections.	03	Twisting Moment	L5 Evaluate
4	Bending Test on Wood Under two point loading.	03	Bending Stress	L5 Evaluate
5	Shear Test on Mild steel- single and double shear.	03	Shear Strength	L5 Evaluate
6	Impact test on Mild Steel (Charpy & Izod).	03	Strength, Impact Value	L5 Evaluate
7	Hardness tests on ferrous and non-ferrous metals – Brinell's, Rockwell and Vicker's.	03	Hardness	L5 Evaluate
8	Tests on Bricks and Tiles.	03	Compression strength	L5 Evaluate
9	Tests on Fine aggregates – Moisture content, Specific gravity, Bulk density, Sieve analysis and Bulking.	03	Material Properties	L5 Evaluate
10	Tests on Coarse aggregates – Absorption, Moisture content, specific gravity, Bulk density and Sieve analysis.	03	Material properties	L5 Evaluate
11	Demonstration of Strain gauges and Strain indicators.	03	Understand stress and strain	L2 Understand

3. Laboratory Material

Books & other material as recommended by university (A, B) and additional resources used by Laboratory teacher (C).

Expt.	Details	Expt. in book	Availability
A	**Text books (Title, Authors, Edition, Publisher, Year.)**	**-**	**-**
1 -11	M.S. Shetty, Concrete Technology - Theory and Practice Published by S. Chand and Company, New Delhi.	1-11	In Lib / In Dept
B	**Reference books (Title, Authors, Edition, Publisher, Year.)**	**-**	**-**
1, 2	Davis, Troxell and Hawk, "Testing of Engineering Materials", International Student Edition – McGraw Hill Book Co. New Delhi.	1-11	In Lib

1-11	M L Gambhir and Neha Jamwal, "Building and construction materials-Testing and quality control", McGraw Hill education(India)Pvt. Ltd., 2014	1-11	In Lib / In Dept
1-11	Fenner, " Mechanical Testing of Materials", George Newnes Ltd. London.	1-11	In Lib / In Dept
1-11	Holes K A, "Experimental Strength of Materials", English Universities Press Ltd. London.	1-11	In Lib / In Dept
1-11	Suryanarayana A K, "Testing of Metallic Materials", Prentice Hall of India Pvt. Ltd. New Delhi	1-11	In Lib / In Dept
1-11	Kukreja C B, Kishore K. and Ravi Chawla "Material Testing Laboratory Manual", Standard Publishers & Distributors 1996.	1-11	In Lib / In Dept
1-11	Relevant IS Codes		
C	**Concept Videos or Simulation for Understanding**	**-**	**-**
c1	• http://nptel.ac.in/courses.php?disciplineID=111		Available
c2	• http://wwww.khanacademy.org/		
D	**Software Tools for Design**	**-**	**-**
E	**Recent Developments for Research**	**-**	**-**
			In lib
F	**Others (Web, Video, Simulation, Notes etc.)**	**-**	**-**
1			

4. Laboratory Prerequisites:

Refer to GL01. If prerequisites are not taught earlier, GAP in curriculum needs to be addressed. Include in Remarks and implement in B.5.
Students must have learnt the following Courses / Topics with described Content . . .

Expt.	Lab. Code	Lab. Name	Topic / Description	Sem	Remarks	Blooms Level
1	15CV32	Strength Of Materials	Knowledge on stress , strain, Deflection	3		
2						
3						
5						
-						
-						

5. Content for Placement, Profession, HE and GATE

The content is not included in this course, but required to meet industry & profession requirements and help students for Placement, GATE, Higher Education, Entrepreneurship, etc. Identifying Area / Content requires experts consultation in the area.
Topics included are like, a. Advanced Topics, b. Recent Developments, c. Certificate Courses, d. Course Projects, e. New Software Tools, f. GATE Topics, g. NPTEL Videos, h. Swayam videos etc.

Expt.	Topic / Description	Area	Remarks	Blooms Level
1				
3				
3				
5				
-				

B. Laboratory Instructions

1. 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 lab, 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	When the experiment is completed, should return all the components/instruments taken for the purpose.	
8	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	

2. Laboratory Specific Instructions

SNo	Specific Instructions	Remarks

C. OBE PARAMETERS

1. Laboratory Outcomes

#	COs	Teach. Hours	Concept	Instr Method	Assessment Method	Blooms' Level
1	Evaluate the properties of steel under static tension load by using UTM Machine and Compare the obtained results with standard graph.	03	Tension Strength	BB, Demonstration	Internal Assessment, Record	L5 Evaluate
2	Evaluate the properties of steel under static compression load by using UTM Machine and Compare the obtained results with standard graph.	03	Compression strength	BB, Demonstration	Internal Assessment, Record	L5 Evaluate
3	Evaluate the behavior of ductile steel subjected to torsion by using UTM Machine and Compare the obtained results with standard graph.	03	Twisting Moment	BB, Demonstration	Internal Assessment, Record	L5 Evaluate
4	Evaluate the bending stress of the wood material by using UTM Machine.	03	Bending Stress	BB, Demonstration	Internal Assessment, Record	L5 Evaluate
5	Evaluate the shear strength of the steel by using UTM Machine.	03	Shear Strength	BB, Demonstration	Internal Assessment, Record	L5 Evaluate
6	Evaluate the Impact strength of the steel by using standard testing machine.	03	Strength, Impact	BB, Demons	Internal Assessment,	L5 Evaluate

			Values	tration	Record	
7	Evaluate the hardness of the different materials by using standard testing machine	03	Hardness	BB, Demonstration	Internal Assessment, Record	L5 Evaluate
8	Evaluate the compression strength of the material by using UTM Machine	03	Compression strength	BB, Demonstration	Internal Assessment, Record	L5 Evaluate
9	Evaluate the Engineering Properties of the given samples and Compare the obtained results with standard graph	03	Material Properties	BB, Demonstration	Internal Assessment, Record	L5 Evaluate
10	Evaluate the Engineering Properties of the given samples and Compare the obtained results with standard graph	03	Material properties	BB, Demonstration	Internal Assessment, Record	L5 Evaluate
11	Understand the stress and strain	03	Understand stress and strain	BB, Demonstration	Internal Assessment, Record	L2 Understand
-	**Total**	**42**	-	-	-	-

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

2. Laboratory Applications

SNo	Application Area	CO	Level
1	Useful in determine the physical properties of the given steel specimen and confirming its suitability for use as concrete reinforcement.	CO1	L5
2	Useful in determine the physical properties of the given steel specimen and confirming its suitability for engineering applications.	CO2	L5
3	Useful in determine the physical properties of the given steel specimen and confirming its suitability for engineering applications	CO3	L5
4	Useful in determine the properties of the given wood specimen and confirming its suitability for engineering applications	CO4	L5
5	This test is useful in determine the Ultimate shear strength of the given steel specimen and confirming its suitability for engineering applications.	CO5	L5
6	This test is useful in determine the Ultimate impact strength of the given steel specimen and confirming its suitability for engineering applications.	CO6	L5
7	This test is useful in determine the Hardness of the given materials and confirming its suitability for engineering applications.	CO7	L5
8	This test is useful in determine the compressive strength of the given materials and confirming its suitability for engineering applications.	CO8	L5
9	This test is useful in concrete mix design	CO9	L5
10	This test is useful in concrete mix design	CO10	L5
11	To check the Quality of the Engineering materials	CO11	L2

Note: Write 1 or 2 applications per CO.

3. Mapping And Justification

CO – PO Mapping with mapping Level along with justification for each CO-PO pair.
To attain competency required (as defined in POs) in a specified area and the knowledge & ability required to accomplish it.

Mapping		Mapping Level	Justification
CO	**PO**	-	-
CO1	PO1	L5	Reproduce the basic knowledge of mathematics and engineering in finding the strength in tension, .
CO1	PO5	L5	By using tool as UTM and apply appropriate techniques, to understand of the limitations of material.
CO2	PO1	L5	Reproduce the basic knowledge of mathematics and engineering in finding the strength in compression,
CO2	PO5	L5	By using tool as UTM and apply appropriate techniques, to understand of

			the limitations of material.
CO3	PO1	L5	Reproduce the basic knowledge of mathematics and engineering in finding the strength in torsion.
CO3	PO5	L5	By using tool as Torsion testing machine and apply appropriate techniques, to understand of the limitations of material.
CO4	PO1	L5	Reproduce the basic knowledge of mathematics and engineering in finding the strength in Bending.
CO4	PO5	L5	By using tool as UTM and apply appropriate techniques, to understand of the limitations of material.
CO5	PO1	L5	Reproduce the basic knowledge of mathematics and engineering in finding the strength in shear.
CO5	PO5	L5	By using tool as UTM and apply appropriate techniques, to understand of the limitations of material.
CO6	PO1	L5	Reproduce the basic knowledge of mathematics and engineering in finding the impact strength of material.
CO6	PO5	L5	By using tool as Impact testing machine and apply appropriate techniques, to understand the impact strength of specimen...
CO7	PO1	L5	Reproduce the basic knowledge of mathematics and engineering in finding the hardness of material.
CO7	PO5	L5	By using tool as Brinell, Rockwell and Vicker hardness testing machine and apply appropriate techniques, to understand the Hardness of specimen...
CO8	PO1	L5	Reproduce the basic knowledge of mathematics and engineering in finding the strength compression,
CO8	PO5	L5	By using tool as Sieves sets, measuring cylinder, weighing machine and apply appropriate techniques, to understand the engineering properties of given materials.
CO9	PO1	L5	Applying the basic knowledge of science and mathematics we need to find the engineering properties of given sample.
CO9	PO5	L5	By using tool as Sieves sets, measuring cylinder, weighing machine and apply appropriate techniques, to understand the engineering properties of given materials..
CO10	PO1	L5	Reproduce the basic knowledge of mathematics and engineering in finding the strength in tension, compression, shear and torsion.
CO10	PO5	L5	By using tool as Sieves sets, measuring cylinder, weighing machine and apply appropriate techniques, to understand the engineering properties of given materials..
CO11	PO1	L5	Applying the knowledge of fundamentals of engineering to find the stress and strain properties of given sample.

4. Articulation Matrix

CO – PO Mapping with mapping level for each CO-PO pair, with course average attainment.

-	Course Outcomes	Program Outcomes												
#	COs	PO1	PO2	PO3	PO4	PO5	PO6	PO7	PO8	PO9	PO10	PO11	PO12	Level
18CVL38.1	Evaluate the properties of steel under static tension load by using UTM Machine and Compare the obtained results with standard graph	2	-	-	-	3	-	-	-	-	-	-	-	L5
18CVL38.2	Evaluate the properties of steel under static compression load by using UTM Machine and Compare the obtained results with standard graph	2	-	-	-	3	-	-	-	-	-	-	-	L5
18CVL38.3	Evaluate the behavior of ductile steel subjected to torsion by using UTM Machine and Compare the obtained results with standard	2	-	-	-	3	-	-	-	-	-	-	-	L5

	graph													
18CVL38.4	Evaluate the bending stress of the wood material by using UTM Machine	2	-	-	-	3	-	-	-	-	-	-	-	L5
18CVL38.5	Evaluate the shear strength of the steel by using UTM Machine	2	-	-	-	3	-	-	-	-	-	-	-	L5
18CVL38.6	Evaluate the Impact strength of the steel by using standard testing machine	2	-	-	-	3	-	-	-	-	-	-	-	L5
18CVL38.7	Evaluate the hardness of the different materials by using standard testing machine	2	-	-	-	3	-	-	-	-	-	-	-	L5
18CVL38.8	Evaluate the compression strength of the material by using UTM Machine	2	-	-	-	3	-	-	-	-	-	-	-	L5
18CVL38.9	Evaluate the Engineering Properties of the given samples and Compare the obtained results with standard graph	2	-	-	-	3	-	-	-	-	-	-	-	L5
18CVL38.10	Evaluate the Engineering Properties of the given samples and Compare the obtained results with standard graph	2	-	-	-	3	-	-	-	-	-	-	-	L5
18CVL38.11	Understand the stress and strain	2	-	-	-	3	-	-	-	-	-	-	-	L2
18CVL38.	Average	**2**	**-**	**-**	**-**	**3**	**-**	**-**	**-**	**-**	**-**	**-**	**-**	

5. Curricular Gap and Experiments

Topics & contents not covered (from A.4), but essential for the course to address POs and PSOs.

Expt	Gap Topic	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1					
2					
3					
4					
5					

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

6. Experiments Beyond Syllabus

Topics & contents required (from A.5) not addressed, but help students for Placement, GATE, Higher Education, Entrepreneurship, etc.

Expt	Gap Topic	Actions Planned	Schedule Planned	Resources Person	PO Mapping
1					
2					
3					
4					
5					
6					
7					
8					
9					
10					
11					
12					
13					
14					
15					

D. COURSE ASSESSMENT

1. Laboratory Coverage

Assessment of learning outcomes for Internal and end semester evaluation. Distinct assignment for each student. 1 Assignment per chapter per student. 1 seminar per test per student.

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	Tension test on mild steel and HYSD bars.	03	1	-	-	-	-	-	1	CO1	L5
2	Compression test on mild steel, cast iron and wood.	03	1	-	-	-	-	-	1	CO2	L5
3	Torsion test on mild steel circular sections.	03	1	-	-	-	-	-	1	CO3	L5
4	Bending Test on Wood Under two point loading.	03	1	-	-	-	-	-	1	CO4	L5
5	Shear Test on Mild steel- single and double shear.	03	1	-	-	-	-	-	1	CO5	L5
6	Impact test on Mild Steel (Charpy & Izod).	03	1	-	-	-	-	-	1	CO6	L5
7	Hardness tests on ferrous and non-ferrous metals – Brinell's, Rockwell and Vicker's.	03	1	-	-	-	-	-	1	CO7	L5
8	Tests on Bricks and Tiles.	03	1	-	-	-	-	-	1	CO8	L5
9	Tests on Fine aggregates – Moisture content, Specific gravity, Bulk density, Sieve analysis and Bulking.	03	1	-	-	-	-	-	1	CO9	L5
10	Tests on Coarse aggregates – Absorption, Moisture content, specific gravity, Bulk density and Sieve analysis.	03	1	-	-	-	-	-	1	CO10	L5
11	Demonstration of Strain gauges and Strain indicators.	03	1	-	-	-	-	-	1	CO11	L2
-	**Total**	**42**	**11**						**11**	**-**	**-**

2. Continuous Internal Assessment (CIA)

Assessment of learning outcomes for Internal exams. Blooms Level in last column shall match with A.2.

Evaluation	Weightage in Marks	CO	Levels
CIA Exam – 1	40	CO1, CO2, CO3, CO4	L6
		CO5, CO6, CO7,	L6
		CO8, CO9, CO10,	L6
		CO11	L6
Assignment - 1	05		
Assignment - 2	05		
Assignment - 3	05		
Seminar - 1			
Seminar - 2			
Seminar - 3			
Other Activities – define – Slip test			
Final CIA Marks	**40**	**-**	**-**

-

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**

E. EXPERIMENTS

Experiment 01 : Tension test on mild steel and HYSD bars.

-	**Experiment No.:**	**1**	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Building Materials Testing Laboratory						
2	Course Outcomes	Evaluate the properties of steel under static tension load by using UTM Machine and Compare the obtained results with standard graph						
3	Aim	To observe the behavior of the given Mild Steel specimen under static tension upto failure & to determine, a) The value of young's modulus, b) Percentage elongation c) Percentage reduction in area, d) Ultimate stress, e) Breaking stress, f)Proportionality limit g) Yield stress						
4	Material / Equipment Required	Lab Manual Tensile testing machine (U T M of 100 T capacity) Specimens						
5	Theory, Formula, Principle, Concept	Mild Steel is suitable for all constructional purposes in general. Based on the carbon content steel is classified into mild steel, medium carbon steel and high carbon steel and the respective carbon content varies between 0.10 for mild steel, 0.25 to 0.60 in medium carbon steel and 0.60 to 1.10 in high carbon steel. Mild steel is malleable and ductile. It can be welded but rusts rapidly. Mild steel is used for motor body building, a distribution bars in reinforced concrete, etc.						
6	Procedure, Program, Activity, Algorithm, Pseudo Code	• step 1: Measure the diameter of the specimen at several sections with a micrometer and • obtain the mean initial diameter. • step 2: Make punch marks at a distance of 1 cm along the length of the specimen, & mark the • gauge length. • step 3: Mount the specimen in the machine & attach the extensometer to the required gauge • length. • step 4: Apply the load gradually at the rate of 0.5 kg/cm2/sec. • step 5: At equal increments of the load, note down the elongation on the extensometer & also • on the machine scale. • step 6:When the load reaches the ultimate load, disengage the extensometer, continue to load • the specimen recording the extension on machine scale up to the failure of the • specimen • step 7:Remove the broken specimen from the machine and measure the final diameter of the						

		• neck. Place the two parts together and the final length (lf) over the original gauge • length marks.
7	Block, Circuit, Model Diagram, Reaction Equation, Expected Graph	• - • - • -
8	Observation Table, Look-up Table, Output	• This test is useful in determine the physical properties of the given Mild steel • specimen and confirming its suitability for use as concrete reinforcement. •
9	Sample Calculations	• - • - • -
10	Graphs, Outputs	• - • -
11	Results & Analysis	• - • -
12	Application Areas	• confirming its suitability for use as concrete reinforcement.
13	Remarks	
14	Faculty Signature with Date	Shivashankar R

Experiment 02: Compression test on mild steel, cast iron and wood.

-	**Experiment No.:**	2	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Building Materials Testing Laboratory.						
2	Course Outcomes	Evaluate the properties of steel under static compression load by using UTM Machine and Compare the obtained results with standard graph						
3	Aim	To observe the behavior of the given specimen under static compression upto failure & to determine, a) The value of young's modulus, b) Percentage shortening c) Percentage increase in area d) Ultimate stress, e) Yield stress						
4	Material / Equipment Required	Lab Manual Tensile testing machine (U T M of 100 T capacity) Spceimens						
5	Theory, Formula, Principle, Concept	The behaviour of Mild Steel under compression is similar to tension upto yield point. Thereafter the specimen goes on bulging and does not fail.						
6	Procedure, Program, Activity, Algorithm, Pseudo Code	Step 1: Measure the diameter of the specimen at several sections with a micrometer and obtain the mean initial diameter. Step 2: Place the specimen in the machine & attach the dial gauge Apply the load gradually at the rate of 0, 5 kg/cm2/sec. Step 3: At equal increments of the load, note down the deformation on the dial gauge. Step 4: Stop the application of load after the specimen has undergone sufficient bulging. Step 5: Remove the specimen from the machine and measure the final diameter and height						
7	Block, Circuit, Model Diagram,							

	Reaction Equation, Expected Graph	
8	Observation Table, Look-up Table, Output	This test is useful in determine the physical properties of the given Mild steel specimen and confirming its suitability for engineering applications.
9	Sample Calculations	
10	Graphs, Outputs	
11	Results & Analysis	
12	Application Areas	confirming its suitability for engineering applications.
13	Remarks	
14	Faculty Signature with Date	Shivashankar R

Experiment 03 : Torsion test on mild steel circular sections

-	**Experiment No.:**	3	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Building Materials Testing Laboratory						
2	Course Outcomes	Evalute the behavior of ductile steel subjected to torsion by using UTM Machine and Compare the obtained results with standard graph						
3	Aim	To determine the Behavior of ductile steel when subjected to torsion and obtain the following torsional properties: 1. Modulus of rigidity C 2. Elastic shear strength 3. Resilience 4. Ultimate shear strength 5. Toughness 6. Ductility						
4	Material / Equipment Required	Lab Manual Torsion testing machine specimen						
5	Theory, Formula, Principle, Concept	The test is carried out on specially designed torsion tasting machines to determine modulus of elasticity in shear, yield strength and modulus of rupture. Torsion testing machine consists of a rigid frame with two clutches for gripping the ends of the specimen and weighing head, which grips the other end of the specimen.						
6	Procedure, Program, Activity, Algorithm, Pseudo Code	Step 1: Measure the diameter and length of the specimen accurately using vernier calipers. Step 2: Place the specimen inside the shackles of the torsion-testing machine. One end is rigidly fixed. Step 3: The indicator of the torque scale and the indicator of graduated wheel are kept to the initial reading zero. Step 4: Now the handle is slowly turned so that the graduated wheel moves. Record the torque on the torque scale for every 10 deg upto 100 deg and for 20 deg beyond 100 deg. The Expt is continued till the specimen fractures. Step 5: The values are recorded in tabular form. Step 6:Draw a graph of torque on y – axis and angle of twist - (in rad) on x-axis. The graph gives the torsional stiffness						
7	Block, Circuit, Model Diagram, Reaction Equation, Expected Graph							

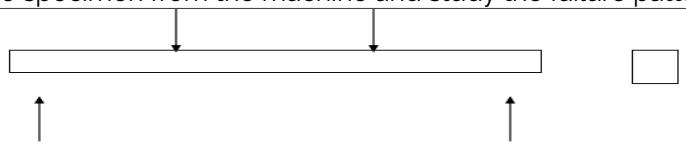
8	Observation Table, Look-up Table, Output	
9	Sample Calculations	
10	Graphs, Outputs	
11	Results & Analysis	
12	Application Areas	confirming its suitability for engineering applications.
13	Remarks	
14	Faculty Signature with Date	Shivashankar R

Experiment 04 : IZOD IMPACT TEST ON MILD STEEL

-	**Experiment No.:**	**4**	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Building Materials Testing Laboratory						
2	Course Outcomes	Evaluate the behavior of ductile steel subjected to impact by using impact testing machine.						
3	Aim	To observe the behavior of the given Mild Steel specimen under impact & to determine the energy absorbed by the specimen when tested as per : Izod Impact test.						
4	Material / Equipment Required	Lab Manual Impact testing machine specimen						
5	Theory, Formula, Principle, Concept	THE IZOD TEST: In this test a standard specimen with a V-notch of 2mm depth with apex angle of 45^{o} is supported as a cantilever beam & a sudden load is applied at the free end. The angle of fall of the pendulum is 85 ^{o} 21' & the corresponding energy released 164J.						
6	Procedure, Program, Activity, Algorithm, Pseudo Code	Step 1: Measure the diameter and length of the specimen accurately using vernier calipers. Step 2: Place the specimen inside the shackles of the torsion-testing machine. One end is rigidly fixed. Step 3: The indicator of the torque scale and the indicator of graduated wheel are kept to the initial reading zero. Step 4: Now the handle is slowly turned so that the graduated wheel moves. Record the torque on the torque scale for every 10 deg upto 100 deg and for 20 deg beyond 100 deg. The Expt is continued till the specimen fractures. Step 5: The values are recorded in tabular form. Step 6:Draw a graph of torque on y – axis and angle of twist - (in rad) on x-axis. The graph gives the torsional stiffness						
7	Block, Circuit, Model Diagram, Reaction Equation, Expected Graph							
8	Observation Table, Look-up Table, Output							
9	Sample Calculations							
10	Graphs, Outputs							
11	Results & Analysis							

12	Application Areas	confirming its suitability for engineering applications.
13	Remarks	
14	Faculty Signature with Date	Shivashankar R

Experiment 05 : BENDING TEST ON WOOD UNDER TWO POINT LOADING

-	**Experiment No.:**	**5**	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Building Materials Testing Laboratory						
2	Course Outcomes	Evalute the bending stress of the wood material by using UTM Machine						
3	Aim	To observe the behavior of the given timber beam specimen subjected to two point loading up to failure & to determine . a. The modulus of rupture of timber b. The Young's Modulus of Elasticity of timber						
4	Material / Equipment Required	Universal testing machine (UTM 100 Tonne (1000kN) capacity) , Bending testing assembly, Vernier Scale and Scale						
5	Theory, Formula, Principle, Concept	The bending stresses at any load can be calculated using pure bending theory equation. Modulus of rupture is the value of bending stress corresponding to the bending moment at which the specimen fractures. A graph of load Vs deflection is plotted which is used to determine the value of Young's Modulus. The specifications of the test are covered in IS: 1708(part 6) – 1986 .						
6	Procedure, Program, Activity, Algorithm, Pseudo Code	1. Note down the length, width and depth of the beam specimen. 2. Mark the effective span, load position and the points at which deflection is recorded.(1/3rd span point) 3. Place the specimen in the machine over the supports and place the loading points on the marked position. 4. Arrange the dial gauges on the specimen so as to read the deflection. 5. Apply the load gradually at such a rate that the deflection is 1.5 mm per minute. 6. At equal interval of load note the dial gauge reading up to failure. 7. Stop the application of the load after the specimen has failed and note the crushing load. 8.Remove the specimen from the machine and study the failure pattern.						
7	Block, Circuit, Model Diagram, Reaction Equation, Expected Graph							
8	Observation Table, Look-up Table, Output							

SL. NO	Total load applied 'P'		Deflection under the load in mm
	In kgs	In N	
1	50		
2	100		
3	150		
4	200		
5	250		
6			
7			

		8	Failure load P		
9	Sample Calculations				
10	Graphs, Outputs				
11	Results & Analysis				
12	Application Areas	confirming its suitability for engineering applications.			
13	Remarks				
14	Faculty Signature with Date	Shivashankar R			

Experiment 06 : HARDNESS TEST ON FERROUS AND NON-FERROUS MATERIALS BRINELL HARDNESS TEST

-	**Experiment No.:**	6	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Building Materials Testing Laboratory						
2	Course Outcomes	This test is useful in determine the Hardness of the given materials and confirming its suitability for engineering applications.						
3	Aim	To determines the indentation of mild steel, cast iron, brass, aluminum, etc and hence determine Brinell hardness number.						
4	Material / Equipment Required	Brinell hardness testing machine, Specimens, Inventor.						
5	Theory, Formula, Principle, Concept	The property of hardness of a metal is usually associated with its resistance to scratching, wear, indentation or deformation. In the Brinell hardness test, which measures resistance to indentation, a ball having a diameter 'D' is pressed on the material to be tested on the a load 'P'. the load is maintained for 10 to 15 seconds. The diameter's' of the produced impression is measured. The Brinell hardness number HB is defined as the ratio of the test load to the surface area of indentation. For hard materials like mild steel and cast iron $P = 30 D^2$ (P in kg and D in mm). For medium hard materials like brass, copper, bronze and other alloys $P = 10 D^2$. For soft materials like pure aluminum, magnesium, zinc, cast brass $P = 5 D^2$.						
6	Procedure, Program, Activity, Algorithm, Pseudo Code	1. The surface of the material to be tested is first cleared of dirt, oil, scale etc. 2. The selected load P is suspended from the hanger. The indicator is put into its position. 3. The specimen is put on the supporting table and the large hand wheel is turned in the clockwise direction till the gap between the surface of the specimen and the clamping bush is about 5 mm. 4. The hand lever is brought into position I- from the initial position –O. This operation rises the supporting table and the specimen is clamped against the bush. 5.Now, the hand lever is put into position –II- to press the indenter on to the surface of the specimen under the load P. the load is allowed to act for a duration of 10 to 15 sec. after which a hand lever is put back into position –I. 6The diameter of impression is read from the reading microscope in two perpendicular directions.						

7	Block, Circuit, Model Diagram, Reaction Equation, Expected Graph	
8	Observation Table, Look-up Table, Output	
9	Sample Calculations	
10	Graphs, Outputs	
11	Results & Analysis	
12	Application Areas	confirming its suitability for engineering applications.
13	Remarks	
14	Faculty Signature with Date	Shivashankar R

Experiment 07 : HARDNESS TEST ON FERROUS AND NON-FERROUS MATERIALS ROCKWELL HARDNESS TEST

-	**Experiment No.:**	7	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Building Materials Testing Laboratory						
2	Course Outcomes	This test is useful in determine the Hardness of the given materials and confirming its suitability for engineering applications.						
3	Aim	To find the Rockwell, hardness number of mild steel cast iron , copper, brass, aluminum and spring steel.						
4	Material / Equipment Required	Rockwell hardness testing machine, Specimens, Indentor.						
5	Theory, Formula, Principle, Concept	A minor load of 10 kg is applied to penetrate, causing an indentation d_1 in the test specimen. With the minor load steel operating a major load is added which is 90 kg, for the Rockwell B test and 140 kg for the Rockwell C test so that the total applied load will be 100 kg and 150 kg for the 'B' and 'C' tests respectively. The application of the major load results in an increase in the depth of penetration. The major load is then removed with the minor load still acting. This operation affects a partial recovery in the depth of the indentation. If d_2 is the total depth of indentation under this condition, then the permanent increase of depth of indentation due to the application of the major load is d_2-d_1.						
6	Procedure, Program, Activity, Algorithm, Pseudo Code	1.The surface of the specimen is cleared from oil, dirt and scale and rubbed with sand paper. 2.Depending on the material to be tested either the ball indenter or the cone indenter is inserted and screwed to the thrust member. 3.The load stage fixed for the chosen method is adjusted by pushing the appropriate button. The lamps for the dial gauge and the single lamp are switched on. 4. The test piece is placed on the supporting table and the hand wheel is turned to the right until the specimen contacts the clamping sleeve and the minor load of 10 kg is applied. This is indicated by the signal lamp being extinguished. 5. To apply the major load, the button is pulled out. Now the pointer of the dial						

		gauge will start moving in the anticlockwise direction. 6. Two seconds after the pointer comes to rest, the major load is removed pushing down the hand lever. Now the pointer will move in clockwise direction to the extent of partial recovery in the depth of indentation. 7. Depending on the indenter used, the Rockwell hardness number is directly read on the gauge from the relevant scale of graduation.
7	Block, Circuit, Model Diagram, Reaction Equation, Expected Graph	
8	Observation Table, Look-up Table, Output	
9	Sample Calculations	
10	Graphs, Outputs	
11	Results & Analysis	
12	Application Areas	confirming its suitability for engineering applications.
13	Remarks	
14	Faculty Signature with Date	Shivashankar R

Experiment 08: TESTS ON BRICK COMPRESSION TEST ON BRICK

-	**Experiment No.:**	8	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Building Materials Testing Laboratory						
2	Course Outcomes	Evaluate the compression strength of the material by using UTM Machine						
3	Aim	Evaluate the compression strength of the material by using UTM Machine						
4	Material / Equipment Required	Brick testing machine, Brick sample, Steel scale.						
5	Theory, Formula, Principle, Concept							
6	Procedure, Program, Activity, Algorithm, Pseudo Code	1. Soak the Brick in water 48 hours. 2. Cement mortar is applied on the labeled surface and it is leveled. 3. The Brick is allowed for air-drying for 4 hours. 4. The dimension of the brick is measured. 5. Place the Brick between two metal plates and then it is placed in a Brick testing machine. The load applied till the given Brick specimen is fractured. Fractured load is noted and the compressive strength is calculated						
7	Block, Circuit, Model Diagram, Reaction Equation, Expected Graph							
8	Observation Table, Look-up Table, Output							
9	Sample							

	Calculations	
10	Graphs, Outputs	
11	Results & Analysis	
12	Application Areas	confirming its suitability for engineering applications.
13	Remarks	
14	Faculty Signature with Date	Shivashankar R

Experiment 09: Test on Fine Aggregates

-	**Experiment No.:**	9	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Building Materials Testing Laboratory.						
2	Course Outcomes	Evaluate the Engineering Properties of the given samples and Compare the obtained results with standard graph						
3	Aim	To determine the particle size distribution and fineness modulus of given sample of fine aggregates.						
4	Material / Equipment Required	(i) Balance having sensitivity equal to 0.1% of the weight of the test sample (ii) A set of sieves arranged in the following order of sizes 10mm, 4.75mm, 2.36mm 1.18mm, 600micron 300micron 150micron and pan.						
5	Theory, Formula, Principle, Concept	The particle size distribution is a important physical property of the aggregate which affects the rheological and mechanical properties of concrete. Aggregates are classified into coarse aggregate and fine aggregate based on particle size. The aggregates higher than 4.75 mm sizes are considered as coarse aggregates and those passing through 4.75 mm sieve are considered fine aggregate. The fine aggregates are classified as Grading zone I,II,III and IV as per Table 4 of IS : 383 – 1970 on the basis of particle size distribution. Sieve analysis is conducted to determine the particle size distribution of an aggregate sample. Sieve analysis is a simple test consisting of sieving a measured quantity of material through successively smaller sieves. The weight retained on each sieve is expressed as a percentage of the total sample. Fineness modulus is an empirical factor indicating the relative coarseness or fineness of the aggregate sample and is obtained by adding the cumulative percentages of aggregate retained on each sieve and dividing by 100.						
6	Procedure, Program, Activity, Algorithm, Pseudo Code	1. Take about 1 Kg of air-dry fine aggregate sample 2. Choose the appropriate sieve set as per IS: 383 – 1970 [Refer table No. _ _ of appendix A]. 3. The weighed sample is placed on the largest of the appropriate sieve set and sieving is carried out either manually or in an sieving machine. Manual sieving is carried out with varied motion, backwards and forwards, left to right, circular clockwise and anti-clockwise with frequent jarring, so that the material is kept moving over the sieve. The period of sieving should not be less than 2 minutes. If sieving is done on a machine, not less than 10 minutes sieving will be required for each test. 4. The fraction of the sample which passes the sieve is placed on the next successive sieve and sieving is done in the same manner. 5. On completion of sieving the material retained on each sieve is weighed and recorded.						
7	Block, Circuit, Model Diagram,							

	Reaction Equation, Expected Graph	
8	Observation Table, Look-up Table, Output	
9	Sample Calculations	
10	Graphs, Outputs	
11	Results & Analysis	
12	Application Areas	Specific gravity of aggregates is made use in concrete mix design. Knowing the specific gravity of each constituent its weight can be converted into solid volume and the yield of concrete calculated. Specific gravity is also required for the determination of moisture content. Water absorption of aggregate is used to calculate the extra water to be added to a concrete mix to compensate for the loss of water due to absorption.
13	Remarks	
14	Faculty Signature with Date	Shivashankar R

Experiment 10: Specific gravity and Water Absorption of Fine Aggregates

-	**Experiment No.:**	9	**Marks**		**Date Planned**		**Date Conducted**	
1	Title	Building Materials Testing Laboratory.						
2	Course Outcomes	Evaluate the Engineering Properties of the given samples and Compare the obtained results with standard graph						
3	Aim	To determine the specific gravity and water absorption of the given fine aggregate sample						
4	Material / Equipment Required	(I) Balance of 3 Kg capacity having a sensitivity of at least 0.5gms. (ii) Measuring flask; this could be a pycnometer or other suitable graduated volumetric flask of glass. (iii) Balance of 2 Kg capacity having a sensitivity of at least 0.5gms. (iv) Metal tray. (v) Oven to maintain a temperature of 100^{o}C to 110^{o}C. (vi) A means of supplying a current of warm air.						
5	Theory, Formula, Principle, Concept	Specific gravity of an aggregate is the measure of its strength or quality of the material. Aggregate having low specific gravity are generally weak in strength. Specific gravity is defined as the ratio of the mass of a given volume of aggregates sample to the mass of an equal volume of distilled water at the same temperature. Water absorption of an aggregate is a measure of its porosity. Water absorption is expressed as a percentage of the weight of the oven dried aggregate. The aggregate having greater water absorbing capacity will seriously affect the durability of the structure. Water absorption affects the bond between the aggregates cement paste, the resistance of concrete to abrasion and specific gravity etc. Good aggregates should have low water absorption capacity.						
6	Procedure, Program, Activity, Algorithm, Pseudo	1. Fill the pycnometer or graduated container with water up to the mark. Determine the mass in gms.						

	Code	2. Take about 500 Gms. of the fine aggregate sample and soak it in water in the tray for 24 + ½ hours. 3. Take out the sample and spread on a clean flat surface and pass a current of warm air until no free surface moisture can be seen and the material just attains a free running condition. 4. Weigh the saturated and surface dry aggregate sample. And place it into the pycnometer/ graduated container 5. Fill the pycnometer/container with water upto the mark removing the entrapped air. 6. Dry the outside of the pycnometer/container and weigh accurately. 7. Calculate the Specific gravity of sample. 8. The fine aggregate sample in taken out of the pycnometer/container, the water is drained and the sample is placed in a tray and dried in an oven for 24 + ½ hours at a temperature of 100°C to 110°C. 9. Allow the aggregate sample to cool to the room temperature and weigh it. Calculate the water absorption capacity as the percentage of oven dry mass.
7	Block, Circuit, Model Diagram, Reaction Equation, Expected Graph	
8	Observation Table, Look-up Table, Output	
9	Sample Calculations	
10	Graphs, Outputs	
11	Results & Analysis	
12	Application Areas	Specific gravity of aggregates is made use in concrete mix design. Knowing the specific gravity of each constituent its weight can be converted into solid volume and the yield of concrete calculated. Specific gravity is also required for the determination of moisture content. Water absorption of aggregate is used to calculate the extra water to be added to a concrete mix to compensate for the loss of water due to absorption.
13	Remarks	
14	Faculty Signature with Date	Shivashankar R

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	Tension test on mild steel and HYSD bars.	6	L5	L5	Tension	Lecture	Assignment
2	Compression test on mild steel, cast iron and wood.	6	L5	L5	Compression	Lecture	Assignment
3	Torsion test on mild steel circular sections.	3	L5	L5	Torsion	Lecture	Assignment
4	Bending Test on Wood Under two point loading.	3	L5	L5	Bending	Lecture	Assignment
5	Shear Test on Mild steel- single and double shear.	3	L5	L5	Shear	Lecture	Assignment
6	Impact test on Mild Steel (Charpy & Izod).	3	L5	L5	Impact	Lecture	Assignment
7	Hardness tests on ferrous and non-ferrous metals – Brinell's, Rockwell and Vicker's.	3	L5	L5	Hardness	Lecture	Assignment
8	Tests on Bricks and Tiles.	3	L5	L5	Compression	PPT/ Lecture	Assignment
9	Tests on Fine aggregates – Moisture content, Specific gravity, Bulk density, Sieve analysis and Bulking.	3	L5	L5	Variation in sizes.	PPT/ Lecture	Assignment
10	Tests on Coarse aggregates – Absorption, Moisture content, specific gravity, Bulk density and Sieve analysis.	3	L5	L5	Variation in sizes.	PPT/ Lecture	Assignment
11	Demonstration of Strain gauges and Strain indicators.	3	L2	L2	Stress & strain.	PPT/ Lecture	Assignment

2. Concepts and Outcomes:

Table 2: Concept to Outcome

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	Evaluate the properties of steel under static tension load by using UTM Machine and Compare the obtained results with standard	Tension Strength	Tension Strength	Detailed drawing for beams	Evaluate/ tension	Evaluate the properties of steel under static tension load by using UTM Machine and Compare the obtained results with standard graph.

	graph.					
2	Evaluate the properties of steel under static compression load by using UTM Machine and Compare the obtained results with standard graph.	Compression strength	Compression strength	Detailed drawing for slabs	Evaluate/ compression	Evaluate the properties of steel under static compression load by using UTM Machine and Compare the obtained results with standard graph.
3	Evaluate the behavior of ductile steel subjected to torsion by using UTM Machine and Compare the obtained results with standard graph.	Twisting Moment	Twisting Moment	Detailed drawing for stair case.	Evaluate/ torsion.	Evaluate the behavior of ductile steel subjected to torsion by using UTM Machine and Compare the obtained results with standard graph.
4	Evaluate the bending stress of the wood material by using UTM Machine.	Bending Stress	Bending Stress	Detailed drawing for Retaining wall.	Evaluate/ stress	Evaluate the bending stress of the wood material by using UTM Machine.
5	Evaluate the shear strength of the steel by using UTM Machine.	Shear Strength	Shear Strength	Detailed drawing for retaining wall.	Evaluate/ shear	Evaluate the shear strength of the steel by using UTM Machine.
6	Evaluate the Impact strength of the steel by using standard testing machine.	Strength, Impact Value	Strength, Impact Value	Detailed drawing for water tank.	Evaluate/ impact	Evaluate the Impact strength of the steel by using standard testing machine.
7	Evaluate the hardness of the different materials by using standard testing machine	Hardness	Hardness	Detailed drawing for steel connections.	Evaluate/ hardness.	Evaluate the hardness of the different materials by using standard testing machine
8	Evaluate the compression strength of the material by using	Compression strength	Compression strength	Detailed drawing for steel connections.	Evaluate/ compression.	Evaluate the compression strength of the material by using UTM Machine

	UTM Machine					
9	Evaluate the Engineering Properties of the given samples and Compare the obtained results with standard graph	Material Properties	Material Properties	Detailed drawing for steel connections.	Evaluate/ transform.	Evaluate the Engineering Properties of the given samples and Compare the obtained results with standard graph
10	Evaluate the Engineering Properties of the given samples and Compare the obtained results with standard graph	Material properties	Material properties	Detailed drawing for steel connections.	Evaluate/ transform.	Evaluate the Engineering Properties of the given samples and Compare the obtained results with standard graph
11	Understand the stress and strain	Understa nd stress and strain	Understand stress and strain	Detailed drawing for steel connections.	Evaluate/ stress & strain.	Understand the stress and strain