K. S. INSTITUTE OF TECHNOLOGY

An Autonomous Institution under VTU, Approved by AICTE

Department of Mechanical Engineering

FIRST / SECOND SEMESTER SYLLABUS

Course : **Mechanics & Materials Laboratory**		Semester	I/II
Course Code	**25BPSL107A/207A**	CIE Marks	50
Teaching Hours/Week (L:T:P: S)	**0-0-0-2**	SEE Marks	50
Total Hours of Pedagogy	24	Total Marks	100
Credits	01	Exam Hours	03
Examination type (SEE)	**Laboratory**		

Course Objectives (Course Skill Set)

1. To provide hands-on experience in verifying fundamental principles of engineering mechanics such as Lami's theorem, equilibrium of forces, and beam reactions.
2. To develop the ability to perform laboratory tests on construction materials (aggregates, cement, soil) for determining properties like specific gravity and gradation.
3. To train students in analyzing and interpreting experimental data through graphical methods such as soil gradation curves.
4. To familiarize students with visual identification and classification of commonly used building materials in civil engineering practice.
5. To encourage creativity and critical thinking by engaging students in open-ended experiments, enabling them to design, conduct, and explore solutions to practical engineering problems.

PART-A
CONVENTIONAL EXPERIMENTS

1. Verification of Lami's Theorem.
2. Equilibrium of concurrent forces.
3. Parallel force system- Simply supported beam.
4. Specific Gravity of
   i. Fine aggregates.
   ii. Coarse aggregates.
   iii. Cement.
   iv. Soil.
5. Sieve analysis of soil-Graphical representation of the gradation curve & Visual identification of building materials: Bricks, Stones, Tiles, M-Sand, Bitumen, Fly-Ash, GGBS, Steel Bars of Various Sizes.

PART-B
OPEN ENDED EXPERIMENTS

Open-ended experiments are a type of laboratory activity where the outcome is not predetermined and students are given the freedom to explore, design, and conduct the experiment based on the problem statements as per the concepts defined by the course coordinator. It encourages creativity, critical thinking, and inquiry-based learning.

1. Reactions.
2. Field tests on cement.
3. Particle size distribution.
4. Gap graded.
5. Uniformly graded
6. Well graded.

Course outcome (Course SkillSet)

At the end of the course, the student will be able to:

CO1. Apply fundamental principles of engineering mechanics by conducting experiments on equilibrium of forces and beams.

CO2. Determine physical properties of construction materials such as aggregates, cement, and soil through specific gravity and particle size distribution tests.

CO3. Analyze and interpret soil gradation data using sieve analysis and represent results graphically for classification and engineering applications.

CO4. Identify and classify commonly used building materials (bricks, stones, tiles, M-sand, bitumen, fly ash, GGBS, and steel) through visual inspection and standard field tests.

CO5. Design and perform open-ended experiments to investigate material behavior and force systems, fostering creativity, critical thinking, and inquiry-based problem solving

Suggested Learning Resources: (Textbook/ Reference Book/ Manuals):

Textbooks:

1. M. L. Gambhir : Concrete Manual : Dhanpat Rai & sons New – Delhi, ISBN-135551234001965.
2. Bansal R. K., Rakesh Ranjan Beohar and Ahmad Ali Khan, Basic Civil Engineering and Engineering Mechanics, third edition, 2015, Laxmi Publications, ISBN: 9789380856674
3. Ramamrutham.S, Engineering Mechanics, Dhanpat Rai Books, 2013,ISBN: 9789352164271.
4. Soil Mechanics and foundation Engineering by B C Punmia, Ashok kumar jain, Arun kumar jain, 18th edition, 2023, Laxmi Publications New Delhi.

Reference books / Manuals:

1. Meriam J. L. and Kraige L. G, Engineering Mechanics-Statics, Vol I–sixth Edition,2008, Wiley publication
2. Rattan S.S., Strength of Materials, Third edition, 2017, McGraw Hill Education; New Delhi. ISBN13978-9385965517.
3. Bansal R K, Strength of Materials, Laxmi Publications. 2023, 4th Edition, ISBN:978-8131808146.
4. IS 4031 (Part 11):1988 – Specific gravity test for hydraulic cement
5. IS 383:1970 – Specification for coarse and fine aggregates from natural sources for concrete.
6. IS 2386(Part 3):1963 Methods of test for aggregates for concrete: Part 3 Specific gravity, density, voids, absorption and bulking.

Web links and Video Lectures (e-Resources):

1. https://www.nptel.ac.in/courses/122104015/
2. https://nptel.ac.in/courses/112103109/
3. http://vlab.co.in/

Assessment Structure:

- The assessment for each course is equally divided between Continuous Internal Evaluation (CIE) and the Semester End Examination (SEE), with each component carrying 50% weightage (i.e., 50 marks each). The CIE Theory component will be 25 marks and CIE Practical component will be 25 marks.
- The CIE marks awarded shall be based on the continuous evaluation of the laboratory report using a defined set of rubrics. Each experiment report can be evaluated for 30 marks.
- The laboratory test (duration 03 hours) at the end of the last week of the semester /after completion of all the experiments (whichever is early) shall be conducted for 50 marks and scaled down to 20 marks.
- For both CIE and SEE, the student is required to conduct one experiment each from both Part A and Part B.

Rubrics for Continuous Assessment: 30 Marks

Performance Indicators	Excellent	Good	Satisfactory	Needs Improvement	Poor
Technical Skills & Procedure (PO1 & PO5) (10)	Performs operations flawlessly, correct sequence, excellent tool use. (9-10)	Minor errors, generally correct sequence and tool use. (7-8)	Performs task with some errors; needs occasional help. (5-6)	Many errors, requires frequent guidance. (3-4)	Cannot perform task without continuous supervision. (0-2)
Safety Compliance (PO6) (5)	Strictly follows all safety protocols, proper PPE usage at all times. (5)	Follows safety rules, occasional minor lapses. (4)	Mostly safe, some reminders needed. (3)	Frequent safety violations. (2)	Unsafe behavior, ignores safety rules. (0-1)
Interaction with the Group (PO8) (5)	Naturally leads, encourages, and includes all group members. Facilitates communication and ensures tasks are distributed fairly. Respects all opinions. (5)	Cooperates well with group members. Communicates clearly, shares the workload, and is a reliable and positive team member. (4)	Works alongside others but with limited communication or collaboration. Tends to work in isolation or contributes unevenly to the group effort. (3)	Fails to cooperate with the group. Is dismissive of others' ideas or causes friction and disagreement within the team. (2)	Refuses to work with the group or actively disrupts the group's ability to complete the experiment. (1)
Lab Report (PO9) (10)	Report is exceptionally well-organized, detailed, and insightful. All data and analysis are accurate. Submitted on time. (9-10)	Report is complete, well-organized, and accurate. All required sections are present and data is correctly reported. Submitted on time. (7-8)	Report has minor errors in data or analysis, or is missing some minor components. Organization could be clearer. (5-6)	Report is incomplete, contains significant errors, is poorly organized, or is submitted late without a valid reason. **(3-4)**	Fails to submit a report, or the submitted work is of completely unacceptable quality and lackscritical information **(0-2)**

Rubrics for SEE / CIE :

CIE-To be conducted for 100 Marks and the marks obtained shall be reduced to 20.

SEE to be conducted for 100 Marks

Performance Indicators	Excellent	Good	Satisfactory	Needs Improvement	Poor
Execution (PO3 & PO5) (8)/ (40)	Executes operations accurately with correct parameters; smooth, safe handling of equipment. (7-8) / (33-40)	Minor execution errors; mostly correct handling of tools/ machines. (5-6) / (25-32)	Acceptable performance with some parameter or handling errors. (3-4) / (17-24)	Multiple execution errors; needs frequent correction. (2) / (9-16)	Unable to perform operation independently. (0-1)/ (0-8)
Result and Discussion (PO4) (7)/ (40)	Presents accurate results; clearly compares with standards; insightful discussion of deviations and causes. (7-8) / (33-40)	Accurate results; some useful discussion. 5-6) / (25-32)	Results mostly correct; discussion basic. (3-4) / (17-24)	Results incomplete or partially wrong; weak discussion. (2) / (9-16)	Presents accurate results; clearly compares with standards; insightful discussion of deviations and causes. (0-1)/ (0-8)
Viva Voce (PO9) (5)/ (20)	Answers all questions confidently, showing deep conceptual and practical understanding. (5) / (17-20)	Answers most correctly; minor conceptual gaps. (4) / (13-16)	Answers some but lacks depth. (3) / (9-12)	Gives vague or incomplete answers. (2) / (5-8)	Unable to answer. (1) / (0-4)

- To qualify and become eligible to appear for SEE, in the **CIE component**, a student must secure **a minimum of 40% of 50 marks**, i.e., **20 marks**.
- To pass the SEE component, a student must secure a minimum of 35% of 50 marks, i.e., 18 marks.
- A student is deemed to have **successfully completed the course** if the **combined total of CIE and SEE is at least 40 out of 100 marks**.