CE 334L Mechanical Behavior of Materials 3 Units

USC | SONNY ASTANI DEPARTMENT OF CIVIL AND ENVIRONMENTAL ENGINEERING

ABET Course Syllabus

Course Information, Textbook and Supplementary Materials

Course Description: The course involves lectures and laboratory work. The course is focused on the study of actual mechanical behavior of engineering materials through experimental methods. The theoretical background and techniques for testing are extensively discussed, in parallel with the lab sessions. The lab work involves several class projects as well as various testing demonstrations. Most of the projects involve specimen design, analysis, instrumentation, theoretical prediction, etc. The class is divided into groups, with each group responsible for all aspects of particular projects. The course is concluded by a presentations of various individual or group final projects.

Required for: BSCE, BSCE-Structural, BSCE-Bldg. Science, and BSCE-ENE

Prerequisites: CE 225 Mechanics of Deformable Bodies, or ME 204

Co-Requisites: None

Required Textbook: Class and lab will be mainly based on lecture notes (available online). There is no required text; however, the followings are relevant reference texts:

1. The Testing of Engineering Materials," H.E. Davis, G.E. Troxell and G.F.W. Hauck,2010, McGraw-Hill Book Company.
2. Design and Control of Concrete Mixtures," S.H. Kosmatka and W.C. Panarese, 2011, Portland Cement Association.
3. Mechanical Behavior of Materials, Engineering Methods for Deformation, Fracture, and Fatigue", Norman E. Dowling, 2012
4. Experimental Stress Analysis," Third Edition, 1991, James W. Dally and William F. Riley.

Topics Covered	Learning Outcomes
Mechanical behavior of materials used in civil engineering; basic experimental methods as a companion means of analysis applied in solving real world structural problems	Students will be able to understand and perform analysis and testing in the following areas of study: 1. Atomic bonding and micro structures 2. Basic mechanical properties (Young's modulus, Poisson's ratio, shear and bulk modules, and strength) 3. Basic mechanics tests (specimens, methods and types) 4. Electrical resistance strain gauge 5. Cement, water, aggregates and their functions in concrete 6. Mix design of concrete 7. Basic properties of fresh and hardened concrete 8. Basic tests used in define properties of concrete 9. Class project, project report and presentation 10. Understand categories of engineering materials, fundamentals of atomic bonding, micro structures, crystalline and defects. 11. Understand isotropic and anisotropic materials, mechanical properties of isotropic materials. 12. Determine strength and failure of metals in combined stress conditions, using maximum shear.
Basic mechanical tests	13. Understand basic means to apply force, and types of basic mechanical testing machines. 14. Conduct basic tensile tests to experimentally define basic mechanical properties, such as modulus of elasticity, Poisson's ratio, strength, etc., for metals. 15. Conduct other types of basic tests and define associated properties, such as, compression, bending, hardness, impact, dynamic characteristics, damping, natural frequencies, etc.

Topics Covered	Learning Outcomes
	16. Understand concepts and techniques used in deformation measurement. 17. Use electrical resistance strain gauges to measure strains.
Construction materials	18. Understand composites and their functions in concrete. 19. Design proportion mix for normal strength concrete 20. Conduct basic tests to define properties of concrete and its composites.

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Topics Covered	Learning Outcomes
Conduct a class project	21. Work in a team on an open-ended project 22. Define objectives, design experimental program, prepare and conduct tests, analyze data and discuss results. 23. Write technical report or project paper. 24. Make technical presentation.

Lecture and Lab Schedule			
Lecture		**Lab**	
Sessions per Week	Duration per Session	Sessions per Week	Duration per Session
1	1.5 hours	1	3 hours

Relation of Course Objectives to Program Outcomes

The Civil Engineering program is designed to teach beyond the technical content of the curriculum and prepare the students to utilize what they learn in a professional setting.

This course contributes to the program outcomes as outlined in the adjacent table.

Course Contribution to Program Outcomes (a-k)	✓ Key
b. An ability to design and conduct experiments, as well as to analyze and interpret data.	✓
d. An ability to function on multi-disciplinary teams.	✓
g. An ability to communicate effectively.	
k. An ability to use the techniques, skills, and modern engineering tools necessary for engineering practice.	

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