

PRGR 634
Moisture and Control of Humidity in Buildings (2 credits)

Catalog description:

Sources of moisture and factors affecting its entry and buildup inside the buildings such as construction practices and choice of building materials and furniture. Impact of moisture on thermal comfort and energy performance of the air-conditioning system. Solid/liquid desiccant dehumidification and hybrid air-conditioning systems. Modeling of moisture transport. Industrial need to control indoor humidity. Moisture-caused health issues including mold formation and growth.

Textbook:

Handouts

References:

- 1) Water Transport in Brick, Stone and Concrete by Chris Hall, Spon Press, 2002, ISBN 0-419-22890-X
- 2) Transport Processes in Concrete (Hardcover) by Robert Cerny Taylor & Francis; 1 edition, 2002, ISBN 0415242649
- 3) Burch, D. M., Thomas, W. C., Fanney, A. H., 1992, "Water Vapor Permeability Measurements of Common Building Materials," *ASHRAE Transactions*, V98.
- 4) ASTM, 1990, "Standard Test Methods for Water Vapor Transmission of Materials," *Annual Book of ASTM Standards*, ASTM E96-90, pp 688-695.

Coordinator:

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Prerequisite by Topic:

Thermodynamics, Heat Transfer and Fluid Mechanics

Educational Objectives/Learning Outcomes

Students that successfully complete this course will have:

- The student will be able to identify and differentiate between moisture sources and prepare the corrective actions.
- Assess building material strength and weaknesses for moisture transport, & choose appropriately.
- The student will recognize the theory and practice of managing building moisture.

- The student will be able to comment on building designs to minimize moisture risks in new and existing construction
- The student will be able to analyse heat and moisture transport in porous media
- The student will be able to design and size a desiccant air-conditioning system.

Topics covered

- Introduction, sources of moisture: controllable and uncontrollable
- Porosity, Definition, measurement, values
- Flow in a porous media, permeability, capillary forces, diffusivity
- Diffusion in the gaseous phase
- Models of water and vapor transport in porous materials, convection models and diffusion models
- Moisture penetration in foundation, wall, and roof elements.
- Coupled heat and moisture transport in Concrete
- Effect of moisture condensation on building insulation
- Experimental methods for determination of field variables and of material properties of concrete
- Ventilation requirement to control humidity
- Efficient dehumidification air conditioning systems, liquid and solid desiccants

Assessment and grades

- Class Participation (10%)
- Projects and homework (50%)
- Term Exam (40%)

Resources for the course

- Course handouts and slides
- Research publications and reports