



University of Puerto Rico
 Mayagüez Campus
 College of Engineering
 Department of Mechanical Engineering
 M.S./Ph.D. in Mechanical Engineering



Course Syllabus

1. General Information:	
Alpha-numeric codification: INME 6024 Course Title: Numerical Analysis of Transport Phenomena Number of credits: 3 Contact Period: Three hours of lecture per week	
2. Course Description:	
English: Numerical solution of governing equations stemming from heat and mass transfer and fluid flow phenomena.	
Spanish: Solución numérica de las ecuaciones gobernantes derivadas de la transferencia de calor y masa y los fenómenos de flujo de fluidos.	
3. Pre/Co-requisites and other requirements:	
Pre-requisite: Authorization of the Director of the Department	
4. Course Objectives:	
<ul style="list-style-type: none"> • Construct differential equations that govern transport processes for mass, heat and momentum transfer phenomena in discretized form. • Solve the resulting discrete approximation. • Check the solution for consistency and stability. 	
5. Instructional Strategies:	
<input checked="" type="checkbox"/> conference <input type="checkbox"/> discussion <input type="checkbox"/> computation <input type="checkbox"/> laboratory <input type="checkbox"/> seminar with formal presentation <input type="checkbox"/> seminar without formal presentation <input type="checkbox"/> workshop <input type="checkbox"/> art workshop <input type="checkbox"/> practice <input type="checkbox"/> trip <input type="checkbox"/> thesis <input type="checkbox"/> special problems <input type="checkbox"/> tutoring <input type="checkbox"/> research <input type="checkbox"/> other, please specify:	
6. Minimum or Required Resources Available:	
None.	
7. Course time frame and thematic outline	
General Topics	Contact Hours
Mathematical nature of physical phenomena in heat, mass and momentum transfer	6
Basic discretization techniques, including finite difference and finite volume methods	9
Numerical schemes for diffusion and convection phenomena	9
Source term modeling and linearization	3
Solution techniques and algorithms for discretization equations	4

Generalized curvilinear coordinates	3
Numerical schemes for two-and three-dimensional parabolic flows	5
Concepts of consistency, stability, and convergence	3
Special topics including grid generation and multigrid techniques	3
Total hours: (equivalent to contact period)	45

8. Grading System

Quantifiable (S/NS) Not Quantifiable

9. Evaluation Strategies

	Quantity	Percent
<input checked="" type="checkbox"/> Exams	1-2	50
<input type="checkbox"/> Final Exam		
<input type="checkbox"/> Short Quizzes		
<input type="checkbox"/> Oral Reports		
<input type="checkbox"/> Monographies		
<input type="checkbox"/> Portfolio		
<input checked="" type="checkbox"/> Projects	1	25
<input type="checkbox"/> Journals		
<input checked="" type="checkbox"/> Other, specify: Assignments	5	25
TOTAL:		100%

10. Bibliography:

Textbook:

- Ferziger, J. and Peric, M., (2001) Computational Methods for Dynamics, 3rd ed., Springer, New York, NY. (**)

Other References:

- Farmer, R.C., Pike, R.W., Cheng, G.C., Chen, Y., (2009) Computational Transport Phenomena for Engineering Analyses, CRC Press, Boca Raton, FL.
- Patankar, S.V., (1980) Numerical Heat Transfer and Fluid Flow, Taylor & Francis, Oxford, UK. (**)
- Versteeg, H.K., Malalasekera, W., (2007) An Introduction to Computational fluid Dynamics: The Finite Volume Method, 2nd ed., Prentice Hall, Upper Saddle River, NJ.
- Jaluria, Y., (2002) Computational Heat Transfer, 2nd ed., Taylor & Francis, Oxford, UK.
- Hirsch, C., (2002) Numerical Computation of Internal and External Flows, Volume 1: The Fundamentals of Computational Fluid Dynamics, 2nd ed., Butterworth-Heinemann, Oxford, UK.
- Kreith, F., (2001) CRC Handbook of Thermal Engineering, CRC Press, Boca Raton, FL. (*)

* These are classical handbooks

** These books are key classic references and remain as the top books for the subjects covered in the course and there are no up-to-date textbooks to substitute these books.

11. Law 51: The Comprehensive Educational Services Act for People with Disabilities:

States that after identifying with the instructor and the institution, the student with disabilities will receive reasonable accommodation in their courses and evaluations. For more information, contact the Department of Counseling and Psychological services at the Office of the Dean of Students (Office DE 21) or call 787-265-3864 or 787-832-4040 x 3772, 2040 and 3864.

12. Academic Integrity

The University of Puerto Rico promotes the highest standards of academic and scientific integrity. Article 6.2 of the UPR Students General Bylaws (Board of Trustees Certification 13, 2009-2010) states that academic dishonesty includes, but is not limited to: fraudulent actions; obtaining grades or academic degrees by false or fraudulent simulations; copying the whole or part of the academic work of another person; plagiarizing totally or partially the work of another person; copying all or part of another person answers to the questions of an oral or written exam by taking or getting someone else to take the exam on his/her behalf; as well as enabling and facilitating another person to perform the aforementioned behavior. Any of these behaviors will be subject to disciplinary action in accordance with the disciplinary procedure laid down in the UPR Students General Bylaws. —

13. Certification 06-43 of the Academic Senate

"The academic guidelines for offering online courses," defines: Traditional face-to-face courses are those that have less than 25% of the course's regular contact hours via the Internet. Therefore, a three-credit course will be considered "face to face" if, of the 45 hours of regular contact, 11 or less are taught via the Internet. According to certification 06-43 of the Academic Senate, a course may include up to 25% of its total contact hours via the Internet. The objective of this is so that all professors have this alternative in the case of any unscheduled eventuality.

14. Sexual Harassment: Certification 130-2014-2015 states:

Sexual harassment in the workplace and in the study environment is an illegal and discriminatory act and is against the best interests of the University of Puerto Rico. All persons who understand they have been subject to acts of sexual harassment at the University of Puerto Rico may file a complaint and request that the institution investigate, where necessary, and assume the corresponding action by the university authorities. If the complainant is a student, he or she must refer his or her complaint to the Office of the Student Ombudsperson or that of the Dean of Students.

Revised: February, 2019