

Academic Year: ( 2023 / 2024 )

Review date: 14-04-2023

Department assigned to the subject: Mathematics Department

Coordinating teacher: LOPEZ BONILLA, LUIS FRANCISCO

Type: Electives ECTS Credits : 6.0

Year : 1 Semester : 2

## OBJECTIVES

### LEARNING RESULTS

- Recognize and classify a singular or regular problem.
- Understand and use the concepts of distinguished limit, dominant balance and scaling.
- Understand and use elementary methods to approximate integrals.
- Understand and use boundary layer and matched asymptotic expansion methods for ODEs.
- Use métodos de escalas múltiples for linear and nonlinear oscillator problems.
- Understand and use the Chapman-Enskog method.

## DESCRIPTION OF CONTENTS: PROGRAMME

- Basic notion of asymptotic analysis.
- Approximation of integrals.
- Solvability condition for a non-homogeneous linear problem.
- Eigenvalue problems.
- Poincaré-Linstedt method.
- Scaling of singular perturbation problems.
- Boundary layer and asymptotic matching.
- Method of matched asymptotic expansions.
- Method of multiple scales.
- Chapman-Enskog method.
- Realistic examples in science and engineering

## ASSESSMENT SYSTEM

<b>% end-of-term-examination:</b>	0
<b>% of continuous assessment (assignments, laboratory, practicals...):</b>	100

Criteria for both the 1st and 2nd assessment opportunity:  
Continuous evaluation of the students' work (homework, participation in class).

## BASIC BIBLIOGRAPHY

- C.A. Bender, S.A. Orszag Advanced mathematical methods for scientists and engineers, Addison Wesley, 1978
- E.J. Hinch Perturbation Methods, Cambridge U.P., 1991
- J. Kevorkian, J. Cole Multiple Scale and Singular Perturbation Methods, Springer, 1996
- L.L. Bonilla, M. Carretero Perturbaciones singulares, copyred, 2009

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#### ADDITIONAL BIBLIOGRAPHY

- A. H. Nayfeh Introduction to Perturbation Techniques, Wiley, 1981

- G. B. Whitham Linear and nonlinear waves, Wiley, 1974

- J. C. Neu Singular Perturbations in the Physical Sciences, American Mathematical Society, 2015

- L. L. Bonilla, S. W. Teitsworth Nonlinear wave methods for charge transport, Wiley-VCH, 2010

- M. van Dyke Perturbation methods in Fluid Mechanics, Parabolic Press, 1975

- P.A. Lagerstrom Matched asymptotic expansions, Springer, 1988