

**Asymptotic Expansions and Perturbation Methods**

**Instructor:** Boubaker Smii- B5/R 203-3. Email: [boubaker@kfupm.edu.sa](mailto:boubaker@kfupm.edu.sa)

**Book:**

[1] C. Bender & S. Orszag, Advanced Mathematical Methods for Scientists and Engineers. Asymptotic Methods and Perturbation Theory. Springer 1999.

**Course Description:** Asymptotic sequences and series. Asymptotic expansions of integrals. Solutions of differential equations at regular and irregular singular points. Nonlinear differential equations. Perturbation methods. Regular and singular perturbations. Matched asymptotic expansions and boundary layer theory. Multiple scales. WKB theory.

Prerequisites: Math 430; Math 301 or Math 513.

**2. Syllabus**

Week	Date	section	Materials
1	26-30 Jan.	3.4	Introduction to Asymptotic, definition of $O$ and $o$
2	2-6 Feb.	3.5	Asymptotic sequences, Asymptotic power series
3	9-13 Feb.	6.1-6.3	Asymptotic expansion of Integrals
4	16-20 Feb.	6.4	Laplace's method and Watson's lemma
5	23-27 Feb.	6.5-6.6	Method of stationary phase, method of steepest Descents
6	2-6 Mar.	6.7	Asymptotic evaluation of Sums
7	9-13 Mar.	3.1-3.3	Solutions of Differential equations (DE) at regular and irregular singular points
8	16-20 Mar.	3.4-3.5	Asymptotic expansions for (DE)
			<b>Midterm Vacation: 23-27 March</b>
9	Mar.30- Apr.3	7.1	Perturbation Series
10	6-10 Apr.	7.2	Regular and singular perturbation theory
11	13-17 Apr.	7.4	Asymptotic matching
12	20-24 Apr.	8.1-8.2	Summation of Series
13	Apr 27-May.1	9.	Boundary-layer theory
14	4-8 May	10.	WKB theory
15	11-15 May	11.	Multiple-Scale Analysis

**Grading policy:**

**Exam I: 35%**

**HW&Projects: 25%**

**Final Exam: 40%**