Module title: Advanced Engineering Mathematics

Module code: 24-14-601-01

Module credit: 3

Module objectives

This course is intended for graduate students in Mechanical Engineering. The overall goal of the course is to provide the students with sufficient exposure to advanced mathematical methods and tools that are relevant to theoretical and mathematical aspects of mechanical engineering research.

Term: First Term

Lecturer: Dr. Faramarz Sarhaddi

                Associate Professor

                fsarhaddi@eng.usb.ac.ir

Assessments:

      30% mid-term exam

      60% final exam

      10% seminars and homework

References:

Advanced Engineering Mathematics (10th Edition), Erwin Kreyszig ISBN-13: 978-0470458365; ISBN-10: 9780470458365

Advanced Engineering Mathematics (6th Edition), Clarence Raymond Wylie, Louis C. Barrett, ISBN-13; 978-0070722064: ISBN-10: 0070722064

Advanced Engineering Mathematics (7th Edition), Peter V. O'Neil, ISBN-13: 978-1111427412; ISBN-10: 1111427410

Advanced Calculus for Engineers (third Edition), Francis Begnaud Hildebrand, ISBN-13: 978-1614273981; ISBN-10: 1614273987

Calculus of Variations (second Edition), L. D. Elsgolc, ISBN-13: 978-0486457994; ISBN-10: 0486457990

Introduction to Perturbation Methods (second Edition), Mark H. Holmes, ISBN: 978-1-4614-5477-9

Module subjects:

1st. week: Introduction, Fourier series and Fourier integral

2nd. week: Orthogonal functions, Sturm-Liouville equations

3rd. week: Elementary concepts on partial differential equations (PDEs), the characteristics method and the separation of variables method for the solution of first order PDEs

4th. week: D'Alembert's method for the solution of second order homogeneous and nonhomogeneous PDEs

5th. week: The separation of variables method for the solution of second order homogeneous and nonhomogeneous PDEs in Cartesian coordinate

6th. week: The separation of variables method for the solution of second order homogeneous and nonhomogeneous PDEs in cylindrical and spherical coordinate

Mid-term Exam

7th. week: Combination of variables (similarity solutions) in heat transfer and fluid mechanics problems

8th and 9th weeks: Eigen function expansion (Galerkin method) for the solution of nonhomogeneous PDEs in Cartesian, cylindrical and spherical coordinate

9th and 10th weeks: Laplace transforms (nonhomogeneous PDEs in Cartesian, cylindrical and spherical coordinate)

10th and 11th weeks: Fourier transforms (nonhomogeneous PDEs in Cartesian, cylindrical and spherical coordinate)

12th. week: Linear algebra, vectors and tensors

13th. week: Complex analysis

14th. week: Orthogonal curvilinear coordinates

15th. week: Perturbation method

16th. week: Calculus of variations

Final Term Exam