

Yildirim Beyazit University

GRADUATE SCHOOL OF SCIENCES
MECHANICAL ENGINEERING (M D)

| MCE502 APPLIED MATHEMATICS FOR ENGINEERS | | | | | |
|--|-------------|-----------------------------------|-----|--------|------|
| Semester | Course Code | Course Name | L+P | Credit | ECTS |
| 2 | MCE502 | APPLIED MATHEMATICS FOR ENGINEERS | 3 | 0 | 7,50 |

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|--------------------------------|---|
| Language of Instruction | : English |
| Course Level | : Yüksek Lisans |
| Department / Program | : MECHANICAL ENGINEERING (M D) |
| Course Type | : Compulsory |
| Goals | : Provide graduate students with the advanced analytical methods that will be bases for their research areas |
| Content | : Matrices and system of linear equations, eigenvalue problems, ordinary differential equations, series solution, special functions, partial differential e |
| Prerequisites | : |
| Course Coordinator | : |
| Instructors | : |
| Assistants | : |

Recommended Sources

| | |
|--------------------|--|
| Textbook | : Textbook |
| Resources | : (Erwin Kreyszig, "Advanced Engineering Mathematics" John Wiley & Sons, Inc. New York, 9th Edition, 2006.) |
| Documents | : Other References |
| Assignments | : (1) Advanced Engineering Mathematics, Wylie, C.R., L.C. Barrett, McGraw-Hill, New York, 1995 |
| Exams | : (2) Elementary Applied Partial Differential Equations, Haberman, R., Prentice-Hall Inc., Englewood Cliffs, 1983. |
| | : (3) Advanced Mathematical Methods for Engineering and Science Students. Stephenson. G. P.M. Radmore. Cambridge University Press. Cambridge |

Course Category

| | |
|---------------------------------------|------|
| Mathematics and Basic Sciences | : 60 |
| Engineering | : 40 |
| Engineering Design | : |
| Social Sciences | : |
| Education | : |
| Science | : |
| Health | : |
| Field | : |

| Assessment | | | | ECTS Allocated Based on Student Workload | | | |
|-------------------------|----------|--------------|----------------------------------|--|----------|-----------------|--|
| In-Term Studies | Quantity | Percentage % | Activities | Quantity | Duration | Total Work Load | |
| Mid-terms | 1 | 40 | Course Duration | 14 | 3 | 42 | |
| Quizzes | | | Hours for off-the-classroom st | 14 | 3 | 42 | |
| Assignment | 1 | 15 | Assignments | 1 | 45 | 45 | |
| Attendance | | | Presentation | 1 | 45 | 45 | |
| Practice | | | Mid-terms | 1 | 2 | 2 | |
| Total | 2 | 55 | Projects | 1 | 45 | 45 | |
| Contribution of In-Term | | 55 | Final examination | 1 | 2 | 2 | |
| Contribution of Final | 1 | 45 | Total Work Load | | | 223 | |
| Total | 1 | 100 | ECTS Credit of the Course | | | 7,50 | |

Course Content

| Week | Topics | Study Materials | Materials |
|------|--|-----------------|-----------|
| 1 | Matrices and systems of algebraic equations. Eigenvalues | | |
| 2 | Ordinary differential equations. Systems of linear ordinary differential equations. | | |
| 3 | Ordinary differential equations: Approximate solutions via Power Series | | |
| 4 | Ordinary differential equations: Solution near a singular point, Frobenius Series | | |
| 5 | Special functions: Gamma function, Error function, Bessel functions. | | |
| 6 | Modified Bessel functions, Legendre polynomials. Applications. | | |
| 7 | Partial differential equations: Classification. Separation of variables. | | |
| 8 | Canonical problems: Laplace's equation, diffusion equation, wave equation. | | |
| 9 | Solution of PDEs employing special functions. | | |
| 10 | Non-homogeneous problems: Heat flow with sources and non-homogeneous boundary conditions | | |
| 11 | Laplace transform and applications. | | |
| 12 | Fourier transform and applications. | | |
| 13 | Green's functions and applications. | | |
| 14 | Introduction to perturbation methods. | | |

Program Learning Outcomes

| No | Learning Outcome |
|-----|---|
| C01 | A sound understanding of the matrices and ability solve system of various algebraic equations. |
| C02 | A sound understanding of the important special functions and their use in the solution of engineering problems. |
| C03 | Ability to solve nonlinear ODEs via series solution methods. |
| C04 | Ability to employ the separation of variables to solve partial differential equations. |
| C05 | Ability to select and use an appropriate integral transform technique to solve partial differential equations. |
| C06 | Ability to employ perturbation techniques to solve non-linear equations. |

Course Learning Outcomes

| No | Learning Outcomes |
|-----|--|
| P01 | Is able to produce and use new knowledge with scientific methods using existing knowledge in the area of mechanical engineering. |
| P02 | Has enough knowledge to combine knowledge from different areas to produce new knowledge. |
| P03 | Is able to evaluate and interpret the produced knowledge and use it in applications. |
| P04 | Has a comprehensive knowledge of methods and techniques used in engineering and the conditions and limits under they apply. |
| P05 | Ability to develop and apply new and/or original scientific thought and methods in engineering problem solving. |
| P06 | Being able to develop new and/or original scientific solutions in the design of dynamic, mechanical, thermic and electrical system components and processes. |
| P07 | Design and implementation ability in analytical, numerical and experimental research |
| P08 | Ability to analyze and interpret complex situations encountered in engineering problems. |
| P09 | Proficiency to reach information deeply and widely by doing scientific researches on mechanical and close engineering fields. |
| P10 | Proficiency to learn |
| P11 | Proficiency to work independently and take responsibility |
| P12 | Proficiency in communication and social relations. |
| P13 | Area specific proficiency |

Course Contribution To Program

Contribution: 1: Very Slight 2:Slight 3:Moderate 4:Significant 5:Very Significant

| | P01 | P02 | P03 | P04 | P05 | P06 | P07 | P08 | P09 | P10 | P11 | P12 | P13 |
|----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|-----|
| C1 | 1 | 2 | 1 | 1 | 5 | 1 | 3 | 5 | 1 | 1 | 1 | 1 | 5 |
| C2 | 1 | 2 | 1 | 1 | 5 | 1 | 3 | 5 | 1 | 1 | 1 | 1 | 5 |
| C3 | 1 | 2 | 1 | 1 | 5 | 1 | 3 | 5 | 1 | 1 | 1 | 1 | 5 |
| C4 | 1 | 2 | 1 | 1 | 5 | 1 | 3 | 5 | 1 | 1 | 1 | 1 | 5 |
| C5 | 1 | 2 | 1 | 1 | 5 | 1 | 3 | 5 | 1 | 1 | 1 | 1 | 5 |
| C6 | 1 | 2 | 1 | 1 | 5 | 1 | 3 | 5 | 1 | 1 | 1 | 1 | 5 |