



SULTAN QABOOS UNIVERSITY

COURSE OUTLINE

PROGRAM: Bachelor of Science Engineering

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| 1. Course Code | MATH4174 | |
| 2. Course Title | Differential Equations and Applications for Engineers | |
| 3. Credits | Credits: 3 Workload: 9 hours (4 contact hours in classroom and 5 hours self-study) | |
| 4. Pre-requisite Course(s) | MATH2108-Calculus II | |
| 5. Co-requisite Course(s) | | |
| 6. Equivalent Course(s) | | |
| 7. Incompatible Course(s) | | |
| 8. Course Category | <input type="checkbox"/> University Requirement | <input type="checkbox"/> University Elective |
| | <input checked="" type="checkbox"/> College Requirement | <input type="checkbox"/> College Elective |
| | <input type="checkbox"/> Department Requirement | <input type="checkbox"/> Department Elective |
| | <input type="checkbox"/> Specialization Requirement | <input type="checkbox"/> Specialization Elective |
| | <input type="checkbox"/> Other (specify): | |
| 9. Course Owner | College: Science | Department: Mathematics |
| 10. Course Type | <input type="checkbox"/> Lecture | <input type="checkbox"/> Lecture/Lab |
| | <input type="checkbox"/> Lecture/Seminar | <input type="checkbox"/> Lecture/Studio |
| | <input checked="" type="checkbox"/> Lecture/Tutorial | <input type="checkbox"/> Lecture/Lab/Tutorial or Seminar |
| | <input type="checkbox"/> Tutorial | <input type="checkbox"/> Laboratory (Practical) |
| | <input type="checkbox"/> Field or Work Placement | <input type="checkbox"/> Studio |
| | <input type="checkbox"/> Seminar | <input type="checkbox"/> Internship |
| | <input type="checkbox"/> Workshop | <input type="checkbox"/> Project |
| 11. Language of Instruction | English | |
| 12. Course Description | | |
| The course is designed exclusively to cater the needs of the students from the College of Engineering. It begins with preliminary concepts of differential equations. The material to be covered includes first order and second order differential equations, Laplace transforms, Fourier series, and partial differential equations. The emphasis would be given to expose the standard techniques of solving differential equations besides concentrating on various applications. | | |
| 13. Teaching/Learning Strategies | | |
| Problem solving and practice exercises. • Lecture-Discussion method. • Peer tutoring. • Cooperative learning. • Organize formative and summative assessment. • Analyze students' performance and provide feedback. | | |
| 14. Assessment Components and Weight [%] | | |
| <input checked="" type="checkbox"/> Quizzes 15% | <input type="checkbox"/> Practical | <input type="checkbox"/> Other (specify): |
| <input checked="" type="checkbox"/> Homework assignments 5% | <input type="checkbox"/> Project | |
| <input checked="" type="checkbox"/> In-term examination(s) 30% | <input checked="" type="checkbox"/> Final examination 50% | |
| 15. Grading Method | | |
| <input checked="" type="checkbox"/> A-F Scale <input type="checkbox"/> Pass/Not passed | | |
| 16. Textbook(s) and Supplemental Material | | |
| Dennis G. Zill and Michael R. Cullen, Advanced Engineering Mathematics, 3rd Edition Jones and Barlett Publishers, 2006 | | |

| 17. Matching Course Objectives with Program Outcomes and SQU Graduate Attributes | | |
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| SQU Graduate Attributes | | |
| A. SQU graduates should be able to: <ol style="list-style-type: none"> 1. apply the knowledge and skills relevant to the specialization 2. communicate effectively and use information and communication technologies 3. critically analyze complex information and present it in simple clear manner | B. SQU graduates possess <ol style="list-style-type: none"> 1. interpersonal communication skills and alignment with culture of international labour market to assist them in practical life and in living successfully 2. skills and motivation for independent learning and engagement in lifelong learning and research 3. work ethics and positive values, and intellectual independence and autonomy 4. teamwork skills and display potential leadership qualities | C. SQU graduates should <p>relish good citizenship qualities, be conscious of their national identity and be socially responsible, engage in community affairs and be mindful of contemporary issues.</p> |

| # | Intended Student Learning Outcome /Course Learning Objective | Relevant Program Outcome(s) | Applicable Attribute(s) |
|-----|---|---|-------------------------|
| 1. | Distinguish between an Ordinary Differential Equation (ODE) & an initial- or a boundary-value problem involving an ODE. | The ability to apply the knowledge and skills acquired in mathematics and statistics in solving real life problems. | A1 |
| 2. | Recognize and solve a separable ODE. Reduce an ODE to a separable type. | The ability to apply the knowledge and skills acquired in mathematics and statistics in solving real life problems. | A1 |
| 3. | Identify exact ODEs and Find an integrating factor to convert a non-exact ODE as exact. | The ability to identify, formulate and solve mathematical and/or statistical problems. | A1, A3, B2 |
| 4. | Convert linear ODEs to exact ODEs and apply methods of exact ODEs to solve them. | The ability to identify, formulate and solve mathematical and/or statistical problems. | A1, A3 |
| 5. | Use method of characteristics to solve linear homogeneous second order ODEs with constant coefficients and the Cauchy-Euler equations. | The ability to identify, think critically and to engage in innovative applications of mathematics and statistics in diverse area. | A1, A3, B2 |
| 6. | Apply the method of undetermined coefficients and the method of variations of parameters to solve non-homogeneous ODEs of second order. | The ability to identify, formulate and solve mathematical and/or statistical problems. | A1, A3 |
| 7. | Study a mass spring system by applying methods used to solve linear second order ODEs. | The ability to identify, formulate and solve mathematical and/or statistical problems. | A1, A3 |
| 8. | Comprehend free & damped oscillations, resonance, beats etc. | The ability to identify, formulate and solve mathematical and/or statistical problems. | A1, A3 |
| 9. | Find Fourier series of a periodic function. Understand the concept of a half range Fourier series. | The ability to identify, formulate and solve mathematical and/or statistical problems. | A1, A3 |
| 10. | Apply methods of linear ODEs with constant coefficients to solve linear partial differential equations with constant coefficients. | The ability to identify, formulate and solve mathematical and/or statistical problems. | A1, A3 |
| 11. | Identify the wave, heat and Laplace equations. Use the methods of: separation of variables and Fourier series to solve these equations. | The ability to identify, think critically and to engage in innovative applications of mathematics and statistics in diverse area. | A1, A3, B2 |
| 12. | Use Laplace transform to solve linear first and second order partial differential equations. | The ability to identify, think critically and to engage in innovative applications of mathematics and statistics in diverse area. | A1, B2 |
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16. Student Responsibilities

It is the student's responsibility to know and comply with all University Academic Regulations relevant to participation in this course. These regulations specifically include attendance requirement and students' academic code of conduct.

For attendance, it is the student's responsibility to be punctual and to attend all classes.

Students are expected to perform their work with honesty and avoid any academic misconduct, which is defined as the use of any dishonest or deceitful means to gain some academic advantage or benefit. This can take many forms, including but not limited to, the following: copying, plagiarism, collusion and forging documents. For full details, please refer to the Undergraduate Academic Regulations and to the Student Academic Misconduct Policy.

Additionally, this course requires that you:

- 1) are responsible for getting help. If you have questions or problems, ask the instructor either in the classroom or during the office hours. Alternatively, make an appointment with your instructor.
- 2) read the solved examples and do the suggested exercises. Because of time constraint, all solved examples or suggested exercises cannot be discussed by the instructors in the classroom.
- 3) should check the Moodle regularly for new announcements and postings related to the course updates and for additional useful course materials such as the previous semester Tests and Final exams. To enroll in the Moodle page do the following steps in the SQU website.
 - Choose "Online Services", then "E-Learning".
 - Choose "E-Learning (Academic)", then login using your SQU user name and password.
 - From the available courses under "College of Science", "Mathematics ", choose "MATH4174-Differential Equations and Applications for Engineers Spring 2020".
 - No Enrolment key:

| COURSE INFORMATION | | | |
|-----------------------------|-----------------------|---------------------|---|
| Course Code | MATH4174 | Course Title | Differential Equations and Applications for Engineers |
| Semester/ Year | Spring2020 | Section(s) | multi |
| Day, Time, and Place | See Appendix A | | |
| Course Coordinator | Dr. Tayfour El-Bashir | | |
| Office Location | 0117 | Office Hours | SUN8:00-10:00; THU10:00-11:00 |
| Office Tel. Ext. | 1409 | Email | elbashir@squ.edu.om |

| Tentative Schedule | | | |
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| Week | Lecture # | Topic/Material to be covered | Assessment |
| 1 | Section 1.1 | Section 1.1: Definitions & Terminology Example: 1-4& Exercise: 1,3-4,8-9,11,13-15,17,43 | |
| | Section 1.2 | Section 1.2: Initial Value Problem Example: 1-4& Exercise: 1,3,7,9,13-14 | |
| 2 | Section 2.2 | Section 2.2: Separable Variables Example: 1-4& Exercise: 2,4,6,8,10,12,20,22,30,33-36 | |
| 3 | Section 2.3 | Section 2.3: Linear Equations Example: 1-5 & Exercise: 3,6,10,12,15-16,21,26,30 | |
| 4 | Section 2.4 | Section 2.4: Exact Equations Example: 1-4 & Exercise: 1-5,17-18,21-22,31-32,37-38 | Quiz 1: Syllabus: TBA In Tutorial Class |
| | Section 2.5 | Section 2.5: Solutions by Substitutions Example: 1-3 & Exercise: 2,4,6,8,11-12,15,18,21-22,24,26-27,30 | |
| 5 | Section 2.7 | Section 2.7: Linear Models Example: 1-2,4-5& Exercise: 4-5,13,17,19,21 | |
| 6 | Section 3.1 | Section 3.1: Preliminary Theory: Linear Equations Example: 4-5,7-8,11 & Exercise: 2-3,23-28,31-32,34-35 | |
| | Section 3.2 | Section 3.2: Reduction of Order Example: 1-2 & Exercise: 1-3,10-11,15-16 | |
| 7 | Section 3.3 | Section 3.3: Homogeneous Linear Equations Example: 1-3& Exercise: 2,4,6,12,14,21,29,31,32,34 | Quiz 2: Syllabus: TBA In Tutorial Class |
| | Section 3.4 | Section 3.4: Undetermined Coefficients Example: 1-9 & Exercise: 2-3,6-7,10,14,18-19,28,30,38-40 | |
| 8 | Section 3.5 | Section 3.5: Variation of Parameters Exercise: 1-3 & Exercise: 2,4,6,11-13 | |
| | Section 3.6 | Section 3.6: Cauchy-Euler Equation Example: 1-3,5 & Exercise: 2,6,9,12,20,22 | |
| 9 | Section 3.8 | Section 3.8: Linear Models Examples: 1-5& Exercise: 1-4,22-23 | Interm Test: Syllabus: TBA 25March2020 Wednesday 18:10-19:25 CMT/E10-E14 |
| | Section 4.1 | Section 4.1: Definition of Laplace Transform Example:1-5 & Exercise: 2,4,6,8,20,24,26,37,39 | |
| 10 | Section 4.2 | Section 4.2: The Inverse Transform and Transform of Derivatives Example:1-5 & Exercise: 2,4,6,12,14,18,20,29,30,32,34,36,38 | Homework to be Posted |
| | Section 4.3 | Section 4.3: Translation Theorems Example:1-8 & Exercise: 14,16,18,20,22,24,26,38,40,44,46,48,60,65 | |
| 11 | Section 12.1 | Section 12.1: Orthogonal Functions Example: Self Study & Exercise: Self Study | Homework: Submission & Quiz In Tutorial Class Late submission of the HW will not be accepted. |
| | Section 12.2 | Section 12.2: Fourier Series Example:1-2 & Exercise: 2,4-6,8,10,12,14,17 | |

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| 12 | Section 12.3 Section 13.1 | Section 12.3: Fourier Cosine and Sine Series Example: 1-3(a)-(b) & Exercise: 11-12,14,18,25,26,29-30,32 Section 13.1: Separable Partial DEs Example:1-2 & Exercise:1-5,7-8,17-20 | |
| 13 | Section 13.3 Section 13.4 | Section 13.3:Heat Equation Pages: 699-701 & Exercise: 1-4 Section 13.4: Wave Equation Pages: 702-703 & Exercise: 1, 5 | |
| 14 | Section 13.5 | Section 13.5: Laplace Equation Pages 707-709 & Exercise: 1,3,4-5 | Quiz 3: Syllabus: TBA |
| 15 | Section 15.2 | Section 15.2: Applications of Laplace Transform Example:1-3 & Exercise:1-6 | |
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APPENDIX B: ADDITIONAL INFORMATION

1) During a class, all mobile phones must be switched OFF (or put on silent mode). Mobile phones are NOT allowed to be used as calculators during Quizzes or Tests.

2) Students must NOT share pencils, erasers, calculators, ... during Quizzes, Tests and Final exam.

3) There will be NO make-up Quizzes or Tests if you missed any scheduled quiz or test.

If a student misses a Quiz or Test without a valid excuse, the mark in that Quiz or Test will be ZERO. If within ONE week after a Test, a student (who misses a Test) brings a valid excuse supported by proper documents that proves the reason of absence, his/her grade will be based on the remaining part of the assessment components.

4) Model solutions for Test should have been posted on the Moodle page by the time Test papers are returned during a class. Students should check their totals and that all their answers have been marked. Any requests to review the answers must be made immediately to their instructor while in the classroom. NO request will be accepted after it leaves the classroom.

5) Final Exam is comprehensive and its date is scheduled on Thursday, 14May2020 from 11:30 to 14:30.