**TEMPLATE FOR COURSE SPECIFICATION**

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| HIGHER EDUCATION PERFORMANCE REVIEW: PROGRAMME REVIEW |

**COURSE SPECIFICATION**

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| This Course Specification provides a concise summary of the main features of the course and the learning outcomes that a typical student might reasonably be expected to achieve anddemonstrate if he/she takes full advantage of the learning opportunities that are provided. It should be cross-referenced with the programme specification. |

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| College of EngineeringUniversity of Baghdad | ***1. Teaching Institution*** |
| Mechanical Engineering Department (MED) | ***2. University Department/Centre*** |
| Engineering & Numerical Analysis / ME301This course introduces the description of phenomena associated:**Engineering Analysis:**Topics covered: Ordinary Differential equations, First, second and higher order D.Es., Power series solution of D.Es, Fourier Series techniques, Laplace Transform method and solution of known Partial D.Es. **Numerical Analysis:**Topics covered: Numerical Methods, Finite Differences, Numerical Differentiation And Integration, Numerical Solution Of Partial Differential Equations, Numerical Double Integration, Trapezoidal Method, Simpson Method, Applications On Computer In The Subjects Of Numerical Analysis By Using MATHLAB Softwares. The course is taught through 5 hrs per week, 3 theories, 1 tutorial, and 1 experimental. | ***3. Course title/code& Description*** |
| Mechanical Engineering (ME) Program | ***4. Programme(s) to which itContributes*** |
| Annual System ; There is only one mode of delivery, which is a “Day Program”. The students are full time students, and on campus. They attend full day program in face-to-face mode. The academic year iscomposed of 30-week regular subjects. | ***5. Modes of Attendance offered*** |
| 1st & 2nd / Academic Year 2014 – 2015 | ***6. Semester/Year*** |
| 150 hrs. / 5 hrs. per week | ***7. Number of hours tuition (total)*** |
| 13 April 2015 | ***8. Date of production/revision of this specification*** |
| ***9. Aims of the Course*** |
| * To learn the engineering student how to analyze the mechanical engineering problem and convert it into a mathematical model, then how to solve this equations theoretically to obtain the needed results for completing the design and solving the problem.
* To obtain an understanding of numerical methods and how they can be used to solve mechanical engineering problems.
* To apply this knowledge by solving practical engineering problems using MATLAB.
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| ***10·Learning Outcomes*** |
| At the end of the class, the student will be able to:1. Able to solve all the types of first order ordinary differential equations.
2. Able to analyze all the engineering problems after converting the physical problem to mathematical model then solving the resulting first order D.E.
3. Able to solve many types of the second order D.Es. using several types of mathematical tools.
4. Converting the problems concerning with the mechanical vibration systems into mathematical model in the form of D.E and the solving it.
5. Using the power series technique to solve the complicated D.E.
6. Using Fourier Series method to solve the mechanical system with the periodic behavior.
7. Able to use the Laplace Transformation technique to solve all the types of Ordinary D.E. for assisting to analyze the control operation on many mechanical systems.
8. Solving theoretically Partial D.E. especially the heat equation, laplace equation, wave equation, … etc.
9. Define numerical methods and numerical errors and distinguish between truncation and round-off errors, and evaluate the roots of algebraic equations.
10. Solve a system of linear equations by utilizing the direct and indirect methods.
11. Determine a continuous function which results in the best fit of experimentally measured values by using two general approaches for curve fitting: least-squares regressionand interpolation.
12. Integrate and differentiate numerically any continuous function.
13. Solve numerically any ordinary differential equation by using Euler's or Runge-Kutta methods.
14. Find numerically the solution of the partial differential equation with its three types of elliptic, parabolic, and hyperbolic differential equations.
15. Engineering computations.
16. Organization of computations.
17. Error analysis and its relation to the numerical methods covered.
18. Understanding the implications of approximations.
19. Familiarization with Matlab syntax and development environment, including software design.
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| ***11.Teaching and Learning Methods*** |
| 1. Lectures.
2. Tutorials.
3. Homework and Assignments.
4. Lab. Experiments.
5. Tests and Exams.
6. In-Class Questions and Discussions.
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| ***12. Assessment Methods***1. Homework. Assignment questions are provided so that students will have theopportunity to use the information provided in the lectures and textbooks and to test their degree of understanding of the discussed topics.
2. Quizzes. Topics discussed during the period shall be included in the quiz. This enables the students to develop self-confidence, accuracy and readiness for the major exams.
3. Major Exams. There will be two (2) major exams, i.e. midterm and final.All exams will be in-class, closed-book, and closed-notes.
4. Problem Sets (Exercises). Working on assigned problems is one way to gain detailed understanding of the topic and prepares the students to pass the examinations. There will be regular problem sets to be solved and to be submitted before the schedule of every major exam. While the students are encouraged to discuss the problem sets with their classmates, they must do the exercises on their own. Copying someone else’s work is unacceptable.
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| ***13. Grading Policy***1. Quizzes:There will be a ( 15 – 20 ) closed books and notes quizzesduring the academic year.The quizzes will count 20% of the total course grade.
2. Tests, 2-3 Nos. and will count 10% of the total course grade.
3. Extracurricular Activities, this is optional and will count extramarks ( 1 – 5 % ) for the student, depending on the type of activity.
4. Final Exam:The final exam will be comprehensive, closed books andnotes, and will take place on june 2018 from 9:00 AM - 12:00 PMin rooms ( M12 + M13 ). The final exam will count 70% of the total course grade
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| ***14. Course Structure*** |
| Assessment Method | Teaching Method | Unit / Module or Topic Title | LOs (Article 10) | Hours | Week |
| 1-4 of Article (12) | 1-6 of Article (11) | **Eng:** Ordinary Differential Equations, First Order Ordinary Differential Equations.**Num:**Introductory Concepts to Numerical Methods and Errors, Roots of Equations. | 1,2,9,15,16,17,18,19 | 53 the.1 tut.1 exp. | 1 |
| 1-4 of Article (12) | 1-6 of Article (11) | **Eng:**Separable Ordinary D.E., Applications, Leaking tanks.**Num:**Roots of Equations: Bracketing Methods. | 1,2,9,15,16,17,18,19 | 53 the.1 tut.1 exp. | 2 |
| 1-4 of Article (12) | 1-6 of Article (11) | **Eng:**Second Order O.D.Es., Homogeneous Second Order O.D.Es.**Num:**Roots of Equations: Open Methods. | 3,9,15,16,17,18,19 | 53 the.1 tut.1 exp. | 3 |
| 1-4 of Article (12) | 1-6 of Article (11) | **Eng:**Mechanical Applications, Vibrations.**Num:**Linear System of Algebraic Equations: Direct Methods. | 4,10,15,16,17,18,19 | 53 the.1 tut.1 exp. | 4 |
| 1-4 of Article (12) | 1-6 of Article (11) | **Eng:**Nonhomogeneous Second Order O.D.Es, Solution by Undetermined Coefficients method.**Num:**Linear System of Algebraic Equations: Direct Methods. | 3,10,15,16,17,18,19 | 53 the.1 tut.1 exp. | 5 |
| 1-4 of Article (12) | 1-6 of Article (11) | **Eng:**Solution by Variation of Parameters method, Applied Mechanics Examples.**Num:**Linear System of Algebraic Equations: Iterative Methods. | 3,10,15,16,17,18,19 | 53 the.1 tut.1 exp. | 6 |
| 1-4 of Article (12) | 1-6 of Article (11) | **Eng:**Higher Order O.D.Es, Nonhomogeneous Euler- Cauchy Equation.**Num:**Linear System of Algebraic Equations: Iterative Methods. | 3,10,15,16,17,18,19 | 53 the.1 tut.1 exp. | 7 |
| 1-4 of Article (12) | 1-6 of Article (11) | **Eng:**Application on Beams.**Num:**Curve Fitting: Least-Squares Regression | 4,11,15,16,17,18,19 | 53 the.1 tut.1 exp. | 8 |
| 1-4 of Article (12) | 1-6 of Article (11) | **Eng:**Power Series Solution Method of O.D.Es.**Num:**Curve Fitting: Interpolation | 5,6,11,15,16,17,18,19 | 53 the.1 tut.1 exp. | 9 |
| 1-4 of Article (12) | 1-6 of Article (11) | **Eng:**Power Series Solution Method of O.D.Es.**Num:**Curve Fitting: Interpolation | 5,6,11,15,16,17,18,19 | 53 the.1 tut.1 exp. | 10 |
| 1-4 of Article (12) | 1-6 of Article (11) | **Eng:**Legendres Equation.**Num:**Curve Fitting: Interpolation | 5,6,11,15,16,17,18,19 | 53 the.1 tut.1 exp. | 11 |
| 1-4 of Article (12) | 1-6 of Article (11) | **Eng:**Frobenius method.**Num:**Numerical Integration: Trapezoidal Rule. | 5,6,12,15,16,17,18,19 | 53 the.1 tut.1 exp. | 12 |
| 1-4 of Article (12) | 1-6 of Article (11) | **Eng:**Fourier Series.**Num:**Numerical Integration: Trapezoidal Rule. | 5,6,12,15,16,17,18,19 | 53 the.1 tut.1 exp. | 13 |
| 1-4 of Article (12) | 1-6 of Article (11) | **Eng:**Periodic Functions.**Num:**Numerical Integration: Simpson's Rule. | 5,6,12,15,16,17,18,19 | 53 the.1 tut.1 exp. | 14 |
| 1-4 of Article (12) | 1-6 of Article (11) | **Eng:**Even and Odd functions.**Num:**Numerical Integration: Simpson's Rule. | 5,6,12,15,16,17,18,19 | 53 the.1 tut.1 exp. | 15 |
| 1-4 of Article (12) | 1-6 of Article (11) | **Eng:**Half-Range Cosine and Sine Series.**Num:**Numerical Integration: Unequal Intervals. | 5,6,12,15,16,17,18,19 | 53 the.1 tut.1 exp. | 16 |
| 1-4 of Article (12) | 1-6 of Article (11) | **Eng:**Laplace Transformation.**Num:**Numerical Differentiation. | 7,12,15,16,17,18,19 | 53 the.1 tut.1 exp. | 17 |
| 1-4 of Article (12) | 1-6 of Article (11) | **Eng:**Theorem 1, Theorem 2.**Num:**Ordinary Differential Equations: Euler's Method | 7,13,15,16,17,18,19 | 53 the.1 tut.1 exp. | 18 |
| 1-4 of Article (12) | 1-6 of Article (11) | **Eng:**Theorem 3, Gamma Function.**Num:**Ordinary Differential Equations: Euler's Method | 7,13,15,16,17,18,19 | 53 the.1 tut.1 exp. | 19 |
| 1-4 of Article (12) | 1-6 of Article (11) | **Eng:**Theorem 4, Theorem 5: First Shifting Theorem.**Num:**Ordinary Differential Equations: Huen's Method | 7,13,15,16,17,18,19 | 53 the.1 tut.1 exp. | 20 |
| 1-4 of Article (12) | 1-6 of Article (11) | **Eng:**Theorem 6: Multiplicity by t, Theorem 7: Laplace of the derivative.**Num:**Ordinary Differential Equations: Runge-Kutta Method | 7,13,15,16,17,18,19 | 53 the.1 tut.1 exp. | 21 |
| 1-4 of Article (12) | 1-6 of Article (11) | **Eng:**Mechanical Applications.**Num:**Ordinary Differential Equations: Runge-Kutta Method | 7,13,15,16,17,18,19 | 53 the.1 tut.1 exp. | 22 |
| 1-4 of Article (12) | 1-6 of Article (11) | **Eng:**Theorem 8: Laplace of The integral.**Num:**Ordinary Differential Equations: Runge-Kutta Method | 7,13,15,16,17,18,19 | 53 the.1 tut.1 exp. | 23 |
| 1-4 of Article (12) | 1-6 of Article (11) | **Eng:**Theorem 9: Second shifting theorem.**Num:**Partial Differential Equations | 7,14,15,16,17,18,19 | 53 the.1 tut.1 exp. | 24 |
| 1-4 of Article (12) | 1-6 of Article (11) | **Eng:**Laplace Transform of Periodic Function.**Num:**Partial Differential Equations: Elliptic | 7,14,15,16,17,18,19 | 53 the.1 tut.1 exp. | 25 |
| 1-4 of Article (12) | 1-6 of Article (11) | **Eng:**Theorem 10: Convolution Theorem.**Num:**Partial Differential Equations: Elliptic | 7,14,15,16,17,18,19 | 53 the.1 tut.1 exp. | 26 |
| 1-4 of Article (12) | 1-6 of Article (11) | **Eng:**Partial Differential Equations (P.D.E), Examples of P.D.E..**Num:**Partial Differential Equations: Parabolic | 8,14,15,16,17,18,19 | 53 the.1 tut.1 exp. | 27 |
| 1-4 of Article (12) | 1-6 of Article (11) | **Eng:**Heat Conduction Equation, Wave Equation.**Num:**Partial Differential Equations: Parabolic | 8,14,15,16,17,18,19 | 53 the.1 tut.1 exp. | 28 |
| 1-4 of Article (12) | 1-6 of Article (11) | **Eng:**Laplace Equation.**Num:**Partial Differential Equations: Parabolic | 8,14,15,16,17,18,19 | 53 the.1 tut.1 exp. | 29 |
| 1-4 of Article (12) | 1-6 of Article (11) | **Eng:**Poisson Equation.**Num:**Partial Differential Equations: Hyperbolic | 8,14,15,16,17,18,19 | 53 the.1 tut.1 exp. | 30 |

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| ***15. Infrastructure*** |
| ***References***1. Advanced Engineering Mathematics , by Erwin Kreyszig ,Tenth Edition, 2011.
2. Advanced Modern Engineering Mathematics, by Glyn James, Fourth Edition, 2011.
3. “Numerical Methods For Engineers”;by Steven C. Chapra, and Raymond P. Canale,McGraw-Hill, Sixth Edition, 2010.
4. “Numerical Analysis”;by G. Shanker Rao,New Age International Ltd., Third Edition, 2006.
5. “Numerical Analysis”;by Richard L. Burden, and J. Douglas Faires,Cengage Learning, Ninth Edition, 2011.

***Others:***1. Notebook prepared by the instructor of the course.
2. Collection of sheets of solved andunsolved problems and Exams questions
 | Required reading:· CORE TEXTS· COURSE MATERIALS· OTHER |
| Computer Programs in the ( Computer Lab) of the department.Available websites related to the subject. | Special requirements (include forexample workshops, periodicals,IT software, websites) |
|  | Community-based facilities(include for example, guestLectures , internship,field studies) |
| ***16. Admissions*** |
| ME101 and ME201 Courses | Pre-requisites |
| / | Minimum number of students |
| 43 | Maximum number of students |
| ***Instructor:*****Engineering Analysis:****Dr. Mohsin A. Abdulhussein Al-Shammari** Lecturer of Mechanical Engineering / Applied MechanicsMech. Engr. Dept.College of EngineeringUniversity of BaghdadTel: +00964-7806870950Email: mohsinabdullah@yahoo.com;**Numerical Analysis:****L. Wail S. Sarsam**Lecturer of Mechanical Engineering / Thermo-FluidsMech. Engr. Dept.College of EngineeringUniversity of BaghdadTel: +00964-7739188752Email: wail\_sarsam@yahoo.com; | ***17. Course Instructors*** |

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