**TEMPLATEFORCOURSESPECIFICATION**

HIGHER EDUCATIONPERFORMANCEREVIEW:PROGRAMMEREVIEW

**COURSESPECIFICATION**

ThisCourseSpecificationprovidesaconcisesummaryofthemainfeaturesofthe course and the learning outcomes that a typical student might reasonably be expectedtoachieveanddemonstrateifhe/shetakesfulladvantageofthelearning opportunitiesthatareprovided.Itshouldbecross-referencedwiththeprogrammespecification.

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| ***1. TeachingInstitution*** | Collegeof Engineering  Universityof Baghdad |
| ***2. University Department/Centre*** | MechanicalEngineeringDepartment  (MED) |
| ***3.Course title/code &Description*** | **Mathematics/ II –ME201**  Thiscourseintroducesthe:  **Polar coordinates. Topics covered**: Plot polar curve; standard polar curves;arc length; plane and surface area of rotation; acute angle; slope of the tangent line.  **Partial differentialcovers**: first and higher partial derivatives; total differential; chain rule; error and percentage of error; directional derivative; del operators; rate of change.  **Double integral cover**: solid volume; transformation to general coordinates; triple integral.  **Vectorscovers**:Vector in plan , Parallel vector, Vector in space, The Dot product, Projection, The cross product, Triple product or box product, Line in space, Vector equation for a line, Distance from a point to a line in space, Equation for a plan in space, Distance from a point to a plane, Curves in space and their tangent, Definition of vector-valued function, Unit tangent vector, Curvature and normal vector curve, Circle of curvature for plane curve, TNB system, Velocity and acceleration in polar coordinates.  The course is taught through 4 hr per week, 3 theories and 1 tutorial. |
|  | **Differential equation** covers: First order differential equation, variable separable, Homogeneous, Exact, Linear, Bernoulli’s differential equation, Second order differential equation (Homogeneous, linear), and Higher order differential equation.  **Infinite series** covers: Sequence, Series, Test for convergence, Alternating series, Power series, Taylor's and Maclaurin's series. |

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| ***4.Programme(s) towhichit***  ***Contributes*** | | | MechanicalEngineering(ME) |
| ***5.Modesof Attendance offered*** | | | 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 is composed of 30-week regular subjects. |
| ***6.Semester/Year*** | | | 1st&2nd /Academic Year 2017–2018 |
| ***7. Numberof hourstuition (total)*** | | | 120hrs./4 hrs. perweek |
|  | ***8. Date ofproduction/revisionof this*** |  | April–20/2018 |
| ***Specification*** |
| ***9.Aimsof the Course*** | | | |
| 1. Introduce standard curves in polar coordinates and special topics like plane area, arc length, and surface area of rotation….etc. 2. Student able to find first and higher partial derivatives. Also, total differential and rate of parameter change. 3. Student has ability to transform a double integral into general coordinates. 4. Student can evaluate triple integrals over general volumes. 5. Student able to apply double integrals to find areas and second moments. 6. Determine the area of a rectangle using a double integral. 7. Introduce three-dimensional coordinate systems and vectors and Establish coordinates in space by adding a third axis that measures distance above and below the xy-plane. 8. Study the analytic geometry of space, where they give simple ways to describe lines, planes, surfaces,and curves in space. 9. Use this calculus to describe the paths and motions of objects moving in a plane or in space, and see the velocitiesand accelerations of these objects along their paths are vectors. 10. Introduce newquantities that describe how an object's path can turn and twist in space. 11. Defining general differential equations involving first derivatives and look at slope fields, which give a geometric picture ofthe solutions to such equations. 12. Extend study of differential equations to those of second order differential equations which arise in many applications in the sciences and engineering. 13. Learn how to solve such differential equations by several methods. 14. Study of infinite series and many applications of mathematics. 15. Understand the meaning of such an infinite sum and to developmethods to calculate it. Since there are infinitely many terms to add in an infinite series, 16. Look at the result ofsumming the first n terms of the sequence and stopping. | | | |

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***LearningOutcomes***

Attheendof the class, the studentwillbe able to:

1. Convert expressions from Cartesian coordinates to polar coordinates
2. Plot the graphs of polar curves
3. Recognize equations of standard polar curves
4. Evaluate the areas enclosed by polar curves
5. Evaluate the volumes of revolution generated by polar curves
6. Evaluate the lengths of polar curves
7. Evaluate the surfaces of revolution generated by polar curves
8. Derive the first- and second order partial derivatives of a function of two real variables
9. Apply partial differentiation to rate-of-change problems
10. Apply partial differentiation to implicit functions
11. Apply partial differentiation to change-of-variable problems
12. Determine the area of a rectangle using a double integral
13. Evaluate double integrals over general areas
14. Evaluate triple integrals over general volumes
15. Apply double integrals to find areas,first moment, second moments, and radius of gyration.
16. Obtain the scalar and vector product of two vectors
17. Reproduce the relationships between the scalar and vector products of the Cartesian coordinate unit vectors.
18. Obtain the scalar and vector triple products and appreciate their geometric significance.
19. Students will be able to model physical phenomena with first-order differential equations, to solve suchequations using analytic, graphical, or numerical methods, and to analyze and communicate the results.
20. Identify the order of an ordinary differential equation and determine whether it is linear or nonlinear.
21. Identify a separable first-order equation and find a family of solutions; find singular solutions.
22. Identify a first-order linear equation and find the general solution using an integrating factor.
23. Identify an exact differential equation and find a family of solutions.
24. Solve a second- or higher-order linear homogeneous equation with constant coefficients using thecharacteristic equation; solve an associated initial-value problem.
25. Solve a second- or higher-order linear nonhomogeneous equation with constant coefficients using themethod of undetermined coefficients; solve an associated initial-value problem.
26. Drive a form of Taylor’s series from Maclaurin’s series and from it describes a function increment as a series of first and higher order derivatives of the function.

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| ***11. TeachingandLearningMethods*** |
| 1. Lectures. 2. Tutorials. 3. HomeworkandAssignments. 4. TestsandExams. 5. In-ClassQuestionsandDiscussions. 6. ConnectionbetweenTheoryandApplication. 7. Extracurricular Activities. 8. Seminars. 9. In- andOut-Classoralconservations. 10. Reports,Presentations,andPosters. |
| ***12.AssessmentMethods*** |
| 1. Examinations,Tests,andQuizzes.  2. ExtracurricularActivities.  3. StudentEngagementduringLectures.  4. Responses Obtained from Students, Questionnaire about  CurriculumandFacultyMember ( Instructor).  ***13. GradingPolicy***  1. Quizzes:  -There will be a ( 20 – 25 ) closed books and notes quizzes duringthe academic year.  -The quizzeswillcount20%of the totalcourse grade.  2. Tests,2-3Nos.andwillcount10%of the totalcourse grade.  3. Extracurricular Activities, this is optional and will count extra marks ( 1 –5%)for the student,dependingonthe type of activity.  4. FinalExam:  - The final exam will be comprehensive, closed books and notes,and will take place on January2018 from9:00 AM - 12:00 PM inrooms ( M12+M13)  -The finalexamwillcount70%of the totalcourse grade |

14. Course structure

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| Week | Hours | LOs (Article 10) | Unit/ Module or topic title | Teaching method | Assessment method |
| 1 | 4  3 the.  1 tut. | a | Introduction to polar coordinates | 1-10 of article 11 | 1-4 of article 12 |
| 2 | 4  3 the.  1 tut. | b,c | Polar curves  Standard polar curves | 1-10 of article 11 | 1-4 of article 12 |
| 3 | 4  3 the.  1 tut. | d | Area of a plane figure bounded by a polar curve | 1-10 of article 11 | 1-4 of article 12 |
| 4 | 4  3 the.  1 tut. | f | Arc length of a polar curve | 1-10 of article 11 | 1-4 of article 12 |
| 5 | 4  3 the.  1 tut. | E,g | Volume of rotation of a polar curve  Surface of rotation of a polar curve | 1-10 of article 11 | 1-4 of article 12 |
| 6 | 4  3 the.  1 tut. | h | Partial differentiation  *First partial derivatives* | 1-10 of article 11 | 1-4 of article 12 |
| 7 | 4  3 the.  1 tut. | h | *Second and higher order partial derivatives* | 1-10 of article 11 | 1-4 of article 12 |
| 8 | 4  3 the.  1 tut. | i | Rate of change | 1-10 of article 11 | 1-4 of article 12 |
| 9 | 4  3 the.  1 tut. | j | Implicit function | 1-10 of article 11 | 1-4 of article 12 |
| 10 | 4  3 the.  1 tut. | k | Change of variable | 1-10 of article 11 | 1-4 of article 12 |
| 11 | 4  3 the.  1 tut. | L | Double integral over rectangle area | 1-10 of article 11 | 1-4 of article 12 |
| 12 | 4  3 the.  1 tut. | M | Double integral over general area | 1-10 of article 11 | 1-4 of article 12 |
| 13 | 4  3 the.  1 tut. | N | Triple integral over general area | 1-10 of article 11 | 1-4 of article 12 |
| 14 | 4  3 the.  1 tut. | O | first moment and centroid | 1-10 of article 11 | 1-4 of article 12 |
| 15 | 4  3 the.  1 tut. | o | Second moment and radius of gyration | 1-10 of article 11 | 1-4 of article 12 |
| 16 | 4  3 the.  1 tut | P | Introductionto Vectors And TheGeometry Of Space | 1-10 of article 11 | 1-4 of article 12 |
| 17 | 4  3 the.  1 tut | q, r | Vector Algebra Operations | 1-10 of article 11 | 1-4 of article 12 |
| 18 | 4  3 the.  1 tut | S | Introductionto differential equations | 1-10 of article 11 | 1-4 of article 12 |
| 19 | 4  3 the.  1 tut | t, u, v, w | First-Order Differential Equations and Solutions | 1-10 of article 11 | 1-4 of article 12 |
| 20 | 4  3 the.  1 tut | x, y | Second Order Differential Equations and Solutions | 1-10 of article 11 | 1-4 of article 12 |
| 21 | 4  3 the.  1 tut | z | Introduction&Representing Sequences and series  Testing for Convergence and Divergence | 1-10 of article 11 | 1-4 of article 12 |

15. Infrastructure

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| Required reading:  · CORE TEXTS  · COURSE MATERIALS  · OTHER | Text book:  “Calculus” by George B. Thomas, Jr. publishing company, 2010 |
| Reference  “Engineering Mathematics” by K. A. Stroud, Dexter J. Booth, 5th edition, Industrial press Inc., New York, 2001.  Advanced\_Engineering\_Mathematics\_By\_Erwin\_Kreyszig\_tenth\_Edition, 2011  Higher Engineering Mathematics by JOHN, 2010 |
| Other   * Notebook prepared by the instructor of the course. * Collection of sheets of solved and unsolved problems and exams questions. |
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16. Admissions

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| Pre-requisites | ME 101 |
| Min. No. of students | / |
| Max. No. of students | 75 |

17. Course instructors

*Dr. Raad Qatea*