

**جامعة جرش**

**كلية العلوم**

**قسم الرياضيات**

**وصف و اهداف و مخرجات التعليم للمساقات 2019**

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| تفاضل و تكامل (1)303101ثلاث ساعات معتمدةاجباري كلية | **Calculus 1**  **303101**  **Three credit hours**  **Compulsory for faculty** |
| **وصف المساق**  الاقترانات ، الاقترانات غير الجبرية اشتقاقها و تكاملاتها ، المجال ، العمليات على الاقترانات ، رسم الاقترانات ، تعريف النهاية ، طرق حسابها ، النهايات عند اللانهاية ، الاتصال ، الاشتقاق ، قاعدة السلسلة ، الاشتقاق الضمني ؛ نظرية رول ؛ نظرية القيمة المتوسطة وتعميمها ؛ الاقترانات المتزايدة والمتناقصة ؛ القيم القصوى للاقتران ؛ رسم الاقترانات النسبية (خطوط التقارب الأفقية والعمودية) المعادلات المرتبطة بالزمن ؛ التكامل غير المحدود ؛ التكامل المحدود ؛ التكامل بالتعويض ؛ النظرية الأساسية في التفاضل والتكامل. | |
| **Course Description**  Functions; Inverse Functions; Exponential and Logarithmic Functions; Limits; Computing Limits; Limits at Infinity; End Behavior of a Function; Continuity; Continuity of Trigonometric, Exponential, and Inverse Functions; Tangent Lines and Rates of Change; The Derivative Function; Introduction to Techniques of Differentiation; The Product and Quotient Rules; Derivatives of Trigonometric Functions; Implicit Differentiation; Derivatives of Logarithmic Functions; Derivatives of Exponential Functions; The Chain Rule; Increase, Decrease, and Concavity; Relative Extrema; Graphing Polynomials; Rational Functions, Cusps, and Vertical Tangents; Absolute Maxima and Minima; Applied Maximum and Minimum Problems; Rolle’s Theorem; Mean-Value Theorem; Related Rate; The Fundamental Theorem of Calculus. | |
| **Objectives**   1. Students should be able to work with functions represented in a variety of ways: graphical, numerical, analytical, or verbal. They should understand the connections among these representations. 2. Students should understand the meaning of the derivative in terms of a rate of change and local linear approximation and should be able to use derivatives to solve a variety of problems. 3. Students should understand the meaning of the definite integral both as a limit of Riemann sums and as the net accumulation of a rate of change and should be able to use integrals to solve a variety of problems. 4. Students should understand the relationship between the derivative and the definite integral as expressed in both parts of the Fundamental Theorem of Calculus 5. Students should be able to communicate mathematics both orally and in well written sentences and should be able to explain solutions to problems 6. Students should be able to model a written description of a physical situation with a function, a differential equation, or an integral. 7. Students should be able to use technology to help solve problems, experiment, interpret results, and verify conclusions. 8. Students should be able to determine the reasonableness of solutions, including sign, size, relative accuracy, and units of measurement. 9. Students should develop an appreciation of calculus as a coherent body of knowledge and as a human accomplishment. | |
| **Learning Outcome**   1. Interpret a function from an algebraic, numerical, graphical and verbal perspective and extract information relevant to the phenomenon modeled by the function. 2. verify the value of the limit of a function at a point using the definition of the limit 3. Calculate the limit of a function at a point numerically and algebraically using appropriate techniques. 4. Find points of discontinuity for functions and classify them. 5. understand the consequences of the intermediate value theorem for continuous functions 6. Interpret the derivative of a function at a point the as the instantaneous rate of change in the quantity modeled and state its units. 7. interpret the derivative of a function at a point as the slope of the tangent line and estimate its value from the graph of a function 8. Sketch the graph of the derivative from the given graph of a function. 9. given a table of function values, approximate the value of the derivative at a point using the forward difference quotient and the centered difference quotient 10. compute the value of the derivative at a point algebraically using the (limit) definition 11. derive the expression for the derivative of elementary functions from the (limit) definition 12. Be able to show whether a function is differentiable at a point. 13. compute the expression for the line tangent to a function at a point 14. interpret the tangent line geometrically as the local linearization of a function 15. Compute the expression for the derivative of a function using the rules of differentiation Including the power rule, product rule, and quotient rule and chain rule. 16. Compute the expression for the derivative of a composite function using the chain rule of differentiation. 17. differentiate a relation implicitly and compute the line tangent to its graph at a point 18. Differentiate exponential, logarithmic, and trigonometric and inverse trigonometric functions. 19. obtain expressions for higher order derivatives of a function using the rules of differentiation 20. Interpret the value of the first and second derivative as measures of increase and concavity of a functions. 21. Compute the critical points of a function on an interval. 22. Identify the extrema of a function on an interval and classify them as minima , maxima or saddles using the first derivative test. 23. 23. use the differential to determine the error of approximations. 24. understand the consequences of Rolle’s theorem and the Mean Value theorem for differentiable functions 25. Find the anti-derivative of elementary polynomials, exponential, logarithmic and trigonometric functions. 26. interpret the definite integral geometrically as the area under a curve 27. construct a definite integral as the limit of a Riemann sum 28. approximate a definite integral using left sum, right sum, midpoint and trapezoidal rules 29. Interpret the indefinite integral as a definite integral with variable limit(s). 30. interpret differentiation and anti-differentiation as inverse operations (Fundamental Theorem of Calculus, part 1) 31. interpret the anti-derivative as a definite integral with variable limit and implement this expression on graphing platforms 32. evaluate a definite integral using an anti-derivative (Fundamental Theorem of Calculus, part 2) 33. use substitution to find the anti-derivative of a composite function. 34. apply basic optimization techniques to selected problems arising in various fields such as physical modeling , economics and population dynamics. | |

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| تفاضل و تكامل (2)303102ثلاث ساعات معتمدةاجباري تخصص | **Calculus 2** 303102 **Three credit hours**  **Compulsory for math** |
| **وصف المساق**  الاقترانات العكسية للاقترانات المثلثية ؛ المساحة تحت منحنى ؛ المساحة بين منحنيين ؛ الاقترانات الزائدية ؛ طول المنحى ؛ طرق حساب التكاملات: التكامل بالاجزاء ؛ الكسور الجزئية ؛ التعويضات المثلثية ؛ قاعدة لوبيتال ؛ التكامل المعتل ؛ المتتاليات و طرق فحص التقارب؛ المتسلسلات و طرق فحص التقارب. | |
| **Course Description**  Inverse Trigonometric Functions; The Indefinite Integral; Integration by Substitution; The Definition of Area as a Limit; The Definite Integral; Defined by Integrals; Area Between Two Curve; Volumes by Slicing; Disks and Washers; Volumes by Cylindrical Shells; Length of a Plane Curve; Hyperbolic Functions and Hanging Cables; Integration by Parts; Integrating Trigonometric Functions; Trigonometric Substitutions; Integrating Rational Functions by Partial Fractions; l Hôpital rule; Improper Integrals; Sequences; Monotone Sequences; Infinite Series; Convergence Tests; The Comparison, Ratio, and Root Tests; Alternating Series; Absolute and Conditional Convergence; Maclaurin and Taylor Polynomials; Maclaurin and Taylor Series; Power Series; Convergence of Taylor Series; Differentiating and Integrating Power Series. | |
| **Objectives**   1. Introduce students to integration (methods and applications) 2. Introduce students to infinite Series (convergence, divergence and power series). | |
| **Learning Outcome**   1. interpret the area enclosed between curves as a definite integral and compute its value 2. set up the Riemann sum representing the volume enclosed by a geometric solid, convert the result to a definite integral and compute its value. 3. interpret a volume of revolution of a function’s graph around a given axis as a (Riemann) sum of disks or cylindrical shells, convert to definite integral form and compute its value. 4. express the length of a curve as a (Riemann) sum of of linear segments, convert to definite integral form and compute its value. 5. express the surface area of revolution of a function’s graph around a given axis as a (Riemann) sum of rings, convert to definite integral form and compute its value. 6. anti-differentiate products of functions by parts. 7. recognize and implement appropriate techniques to anti-differentiate products of trigonometric functions. 8. devise and apply a trigonometric substitution in integrals involving Pythagorean quotients 9. decompose a rational integrand using partial fractions 10. determine convergence of improper integrals with discontinuities in their domain or infinite limits of integration 11. use the concept of the limit at infinity to determine whether a sequence of real numbers is bounded and whether it converges or diverges 12. interpret the concept of a series as the sum of a sequence, and use the sequence of partial sums to determine convergence of a series 13. decide whether and to what value an infinite geometric series converges 14. recognize the embedded infinite geometric series in geometric applications. 15. use comparison with a corresponding integral with other series to decide whether infinite series (including p-series) converge or diverge | |

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| تفاضل و تكامل (3)303201ثلاث ساعات معتمدةاجباري تخصص | **Calculus 3** 303201 **Three credit hours**  **Compulsory for Math** |
| **وصف المساق**  فضاء ثلاثي الأبعاد والمتجهات: الإحداثيات الديكارتية في الفضاء؛ السطوح الأسطوانية ؛ السطوح التربيعية؛ السطوح الدورانية ؛ المتجهات : الضرب القياسي، المساقط ، الضرب المتجهي؛ المعادلات البارامترية (الوسيطية) للخط المستقيم؛ المستويات في الفضاء؛ الاقترانات متعددة المتغيرات: المجال والنهايات والاتصال؛ المشتقات الجزئية؛ قابلية الاشتقاق، التفاضلات؛ قاعدة السلسلة؛ التدرج، المشتقة الاتجاهية؛ المستويات المماسة والخط العمودي؛ القيم القصوى لاقترانات ذات متغيرين؛ مضاعفات لاجرانج؛ التكاملات المتعددة: التكاملات الثنائية، التكاملات الثنائية في الإحداثيات القطبية، التكاملات الثلاثية والتكاملات الثلاثية في الإحداثيات الأسطوانية والكروية، تغيير الوسيط في التكاملات المتعددة، الجاكوبيان( اليعقوبي (. | |
| **Course Description**  Parametric Equations; Tangent Lines and Arc Length for Parametric Curves; Polar Coordinates; Tangent Lines, Arc Length, and Area for Polar Curves; Conic Sections; Rectangular Coordinates in 3-Space; Spheres; Cylindrical Surfaces; Vectors; Dot Product; Projections; Cross Product; Parametric Equations of Lines; Planes in 3-Space; Quadric Surfaces; Cylindrical and Spherical Coordinates ; Functions of Two or More Variables and their calculus; Lagrange Multipliers; Double Integrals; Double Integrals over Nonrectangular Regions; Double Integrals in Polar Coordinates; Surface Area; Parametric Surfaces; Triple Integrals; Triple Integrals in Cylindrical and Spherical Coordinates; Change of Variables in Multiple Integrals; Jacobians. | |
| **Objectives**   1. Achieve mathematical maturity 2. Expose students to proofs methods 3. Understand the basic rules of logic, including the role of axioms or assumptions 4. Appreciate the role of mathematical proof in formal deductive reasoning 5. Be able to distinguish a coherent argument from a fallacious one, both in mathematical reasoning and in everyday life 6. Understand and be able to articulate the differences between inductive and deductive reasoning 7. Proficiently construct logical arguments and rigorous proofs 8. Formulate conjectures by abstracting general principles from examples. 9. Recognize real-world problems that are amenable to mathematical analysis, and formulate mathematical models of such problems 10. Apply mathematical methodologies to open-ended real-world problems 11. Recognize connections between different branches of mathematics 12. Recognize and appreciate the connections between theory and applications. 13. Present mathematics clearly and precisely to an audience of peers and faculty 14. Appreciate the role of mathematical proof as a means of conveying mathematical knowledge 15. Understand the differences between proofs and other less formal arguments 16. Make vague ideas precise by formulating them in mathematical language 17. Describe mathematical ideas from multiple perspectives 18. Explain fundamental mathematical concepts or analyses of real-world problems to non-mathematicians. | |
| **Learning Outcome**   1. Students will have developed rigorous reasoning skills 2. Students will exhibit computational competence 3. Students will be able to apply mathematical strategies in applied contexts 4. Students will be able to use technology, where appropriate, to assist in problem solving 5. Students will have learned mathematical concepts and skills relevant to their chosen field 6. Students will display algorithmic literacy in their construction, execution, and analysis of problem-solving and calculation routines. 7. Students will adhere to precision and rigorous logical reasoning in their own constructions and critiques of formal mathematical proofs. 8. Students will translate problems from across disciplines into mathematical models, allowing for the leveraging of sophisticated mathematical theory. 9. Students will effectively communicate complex mathematical ideas and carefully reasoned arguments both orally and in writing. | |

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| **تفاضل و تكامل (4)**  **303202** ثلاث ساعات معتمدةاجباري تخصص | **Calculus 4**  **303202**  **Three credit hours**  **Compulsory for Math** |
| **وصف المساق**  الاقترانات المتجهة: تفاضل وتكامل الاقترانات المتجهة؛ تغيير البارامترات (الوسيط) ؛ طول القوس؛ متجه الوحدة المماس ومتجه الوحدة العمودي؛ التقوس؛ المتجهات الحقلية ، التكامل الخطي ، استقلالية المسارات، نظرية غرين ، تكاملات السطوح و تطبيقاتها ، تظرية التباعد ، نظرية ستوكس. | |
| **Course Description**  Introduction to Vector-Valued Functions; Calculus of Vector-Valued Functions; Change of Parameter; Arc Length; Unit Tangent, Normal, and Binomial Vectors; Curvature; Vector Fields; Line Integrals; Independence of Path; Conservative Vector Fields; Green’s Theorem; Surface Integrals; Applications of Surface Integrals; Flux; The Divergence Theorem; Stokes’ Theorem. | |
| **Objectives**   1. Achieve mathematical maturity 2. Expose students to proofs methods 3. Understand the basic rules of logic, including the role of axioms or assumptions 4. Appreciate the role of mathematical proof in formal deductive reasoning 5. Be able to distinguish a coherent argument from a fallacious one, both in mathematical reasoning and in everyday life 6. Understand and be able to articulate the differences between inductive and deductive reasoning 7. Proficiently construct logical arguments and rigorous proofs 8. Formulate conjectures by abstracting general principles from examples. 9. Recognize real-world problems that are amenable to mathematical analysis, and formulate mathematical models of such problems 10. Apply mathematical methodologies to open-ended real-world problems 11. Recognize connections between different branches of mathematics 12. Recognize and appreciate the connections between theory and applications. 13. Present mathematics clearly and precisely to an audience of peers and faculty 14. Appreciate the role of mathematical proof as a means of conveying mathematical knowledge 15. Understand the differences between proofs and other less formal arguments 16. Make vague ideas precise by formulating them in mathematical language 17. Describe mathematical ideas from multiple perspectives 18. Explain fundamental mathematical concepts or analyses of real-world problems to non-mathematicians. | |
| **Learning Outcome**   1. Students will have developed rigorous reasoning skills 2. Students will exhibit computational competence 3. Students will be able to apply mathematical strategies in applied contexts 4. Students will be able to use technology, where appropriate, to assist in problem solving 5. Students will have learned mathematical concepts and skills relevant to their chosen field 6. Students will display algorithmic literacy in their construction, execution, and analysis of problem-solving and calculation routines. 7. Students will adhere to precision and rigorous logical reasoning in their own constructions and critiques of formal mathematical proofs. 8. Students will translate problems from across disciplines into mathematical models, allowing for the leveraging of sophisticated mathematical theory. 9. Students will effectively communicate complex mathematical ideas and carefully reasoned arguments both orally and in writing. | |

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| **معادلات تفاضلية عادية (1)**  **303204** ثلاث ساعات معتمدةاجباري تخصص | **Ordinary Differential Equation 1**  **303204**  **Three credit hours**  **Compulsory for Math** |
| **وصف المساق**  تعريف المعادلات التفاضلية (تصنيفها تكوينها) طرق حل المعادلات التفاضلية من الرتبة الأولي . المسارات المتعامدة . طرق حل المعادلات التفاضلية الخطية من الرتب العليا ذات معاملات ثابتة وذات معاملات غير ثابتة. حل المعادلات الخطية من الرتبة الثانية بمعاملات من نوع كثيرة الحدود عن طريق المتسلسلات. تحويل لابلاس. | |
| **Course Description**  Basic definitions and construction of an ordinary differential equation. Methods of solving ordinary differential equations of first order. Orthogonal trajectories. Ordinary differential equations of higher orders with constant coefficients and with variable coefficients. Types of solutions. Series solutions of a linear ordinary differential equation of second order with polynomial coefficient. Laplace transforms. | |
| **Objectives**   1. ***Achieve mathematical maturity*** 2. ***To demonstrate the usefulness of ordinary differential equations for modeling physical phenomena.*** 3. ***To introduce different classifications of ordinary differential equations.*** 4. ***To introduce different forms of differential equations and show how to solve them using analytical methods.***   ***5)To discuss some applications on differential equations***  ***6)Apply mathematical methodologies to open-ended real-world problems*** | |
| **Learning Outcome**   * ***Solve different forms of first order differential equations.*** * ***Solve some linear higher order differential equations.*** * ***Solve some linear second order initial value problems using Laplace transform.*** * ***Solve some linear second order differential equations using series methods.*** * ***Students will be able to apply mathematical strategies in applied contexts*** * ***Students will be able to use technology, where appropriate, to assist in problem*** | |

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| معادلات تفاضلية عادية (2)303402ثلاث ساعات معتمدةاجباري تخصص | **Ordinary Differential Equation 2**  **303402**  **Three credit hours**  **Compulsory for Math** |
| **وصف المساق**  انظمة معادلات تفاضلية عادية خطية من الرتبة الاولى ؛ معادلات تفاضلية غير خطية والاستقرار ؛ وحدانية ووجود حلول معادلات تفاضلية عادية. | |
| **Course Description**  Following are the basic points of interest in this course: Systems of first Order linear O.D.Es. Non-Linear D.E. and Stability, Existence and uniqueness of solution of O.D.Es. | |
| **Objectives**   1. Achieve mathematical maturity 2. Expose students to proofs methods 3. Understand the basic rules of logic, including the role of axioms or assumptions 4. Be able to distinguish a coherent argument from a fallacious one, both in mathematical reasoning and in everyday life 5. Understand and be able to articulate the differences between inductive and deductive reasoning 6. Formulate conjectures by abstracting general principles from examples. 7. Apply mathematical methodologies to open-ended real-world problems 8. Describe mathematical ideas from multiple perspectives | |
| **Learning Outcome**   1. Students will have developed rigorous reasoning skills 2. Students will exhibit computational competence 3. Students will be able to apply mathematical strategies in applied contexts 4. Students will effectively communicate complex mathematical ideas and carefully reasoned arguments both orally and in writing. | |

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| معادلات فاضلية جزئية (1) **3033303** ثلاث ساعات معتمدةاجباري تخصص | **Partial Differential Equations 1**  **3033303**  **Three credit hours**  **Compulsory for Math** |
| **وصف المساق**  مقدمة في المعادلات التفاضلية الجزئية وتصنيفاتها وحلولها ، متسلسلات وتكاملات فورير ، معادلة الحرارة ، معادلة الموجة ، المعادلة الكامنة ( معادلة لابلاس ) فصل المتغيرات ، مسالة القيمة الحدية لستورم وليوفيل. | |
| **Course Description**  An Introduction to partial differential equations and their classifications and solutions, Fourier’s series and integrals, the heat equation, the wave equation and the potential equation. Introducing the Sturm-Liouville Eigen-value Problems to students. Solving initial boundary value problems using Integral Transforms, like Fourier and Laplace. | |
| **Objectives**  .   |  | | --- | | **Students will understand how PDEs (such as the heat and wave equation) model physical phenomena and the basic structure of PDEs and their solutions.** | | **Students will learn the separation of variable technique for solving linear second-order PDEs (heat equation, Laplace’s equation, wave equation).** | | **Students will learn the basics of Fourier series.** | | **Students will learn the basic properties of and how to solve regular Sturm-Liouville eigenvalue problems.**  **. Students will learn to solve some partial differential equations in more than one space variable** | | |
| **Learning Outcome**   1. **Students will have developed rigorous reasoning skills** 2. **Students will exhibit computational competence** 3. **Students will be able to apply mathematical strategies in applied contexts** 4. **Students will be able to use technology, where appropriate, to assist in problem solving.** 5. **Determine the Fourier series for any given function.** 6. **Solve PDEs using the method of separation of variables.** 7. **Solve Dirichlet and Neumann problems.** 8. **Discuss the major properties of Boundary Value problems, Strum-Liouville problems and there solutions.** | |

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| معادلات فاضلية جزئية (2) **303404** ثلاث ساعات معتمدةاختياري تخصص | **Partial Differential Equations 2**  **303404**  **Three credit hours**  **Elective for Math** |
| **وصف المساق**  المعادلات التفاضلية الجزئية الخطية ذات الرتبة الاولى في متغيرين، المعادلات شبه الخطية، المعادلات غيـر الخطيــة مــن الرتبــة الأولــى، المعــادلات مــن الرتبــة الثانيــة، المعدلات التفاضلية الجزئية الخطية من الرتب العليا ذات المعاملات الثابتة، نظريــات وجــود الحــل الواحــد للمســائل الابتدائية والحدية. | |
| **Course Description**  Linear Differential Equations in Two Variables, Semi-Linear Equations, First-order Nonlinear Equations, Second-order Equations, Linear partial Differential equations of Higher order with constant coefficient, Theory of existence and uniqueness. | |
| **Objectives**   1. Achieve mathematical maturity 2. Understand the basic rules of logic, including the role of axioms or assumptions 3. Appreciate the role of mathematical proof in formal deductive reasoning 4. Be able to distinguish a coherent argument from a fallacious one, both in mathematical reasoning and in everyday life 5. Understand and be able to articulate the differences between inductive and deductive reasoning 6. Apply mathematical methodologies to open-ended real-world problems 7. Recognize connections between different branches of mathematics 8. Recognize and appreciate the connections between theory and applications. 9. Make vague ideas precise by formulating them in mathematical language 10. Describe mathematical ideas from multiple perspectives 11. Explain fundamental mathematical concepts or analyses of real-world problems to non-mathematicians. | |
| **Learning Outcome**   1. Students will have developed rigorous reasoning skills 2. Students will exhibit computational competence 3. Students will be able to apply mathematical strategies in applied contexts 4. Students will be able to use technology, where appropriate, to assist in problem solving 5. Students will have learned mathematical concepts and skills relevant to their chosen field 6. Students will display algorithmic literacy in their construction, execution, and analysis of problem-solving and calculation routines. | |

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| المنطق ونظرية المجموعات **303252** ثلاث ساعات معتمدةاجباري تخصص | **Logic and Set Theory**  **303252**  **Three credit hours**  **Compulsory for Math** |
| **وصف المساق**  مبادئ المنطق ، التسوير الكلي والجزئي ، قواعد الاستنباط ، طرق البرهان : المباشر ، غير المباشر ، الاستقراء الرياضي . المجموعات : جبرعمليات المجموعات ، العلاقات : الضرب الديكارتي ,علاقات التكافؤ، التجزئة ، الاقترانات المتباينة والشاملة ، العدد الكاردينالي ، المجموعات المتكافئة المجموعات القابلة للعد. | |
| **Course Description**  Logic and Proofs: Quantifiers; Rules of Inference; Mathematical Proofs. Sets: Set Operations, Extended Set operations and indexed Families of Sets. Relation: Cartesian Products; Equivalence Relation; Partions. Functions; Injective and surjective Functions. Cardinality and Equipotent of Sets. Countability of Sets. | |
| **Objectives**  1)Achieve mathematical maturity   1. Expose students to proofs methods 2. Understand the basic rules of logic, including the role of axioms or assumptions 3. Appreciate the role of mathematical proof in formal deductive reasoning 4. Be able to distinguish a coherent argument from a fallacious one, both in mathematical reasoning and in everyday life 5. Understand and be able to articulate the differences between inductive and deductive reasoning 6. Proficiently construct logical arguments and rigorous proofs 7. Formulate conjectures by abstracting general principles from examples. 8. Recognize real-world problems that are amenable to mathematical analysis, and formulate mathematical models of such problems 9. Apply mathematical methodologies to open-ended real-world problems 10. Recognize connections between different branches of mathematics 11. Recognize and appreciate the connections between theory and applications. 12. Present mathematics clearly and precisely to an audience of peers and faculty 13. Appreciate the role of mathematical proof as a means of conveying mathematical knowledge 14. Understand the differences between proofs and other less formal arguments 15. Make vague ideas precise by formulating them in mathematical language 16. Describe mathematical ideas from multiple perspectives 17. Explain fundamental mathematical concepts or analyses of real-world problems to non-mathematicians. | |
| **Learning Outcome**   1. Students will have developed rigorous reasoning skills 2. Students will exhibit computational competence 3. Students will be able to apply mathematical strategies in applied contexts 4. Students will be able to use technology, where appropriate, to assist in problem solving 5. Students will have learned mathematical concepts and skills relevant to their chosen field 6. Students will display algorithmic literacy in their construction, execution, and analysis of problem-solving and calculation routines. 7. Students will adhere to precision and rigorous logical reasoning in their own constructions and critiques of formal mathematical proofs. 8. Students will translate problems from across disciplines into mathematical models, allowing for the leveraging of sophisticated mathematical theory. 9. Students will effectively communicate complex mathematical ideas and carefully reasoned arguments both orally and in writing. | |

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| جبر خطي (1) **303241** ثلاث ساعات معتمدةاجباري تخصص | **Linear Algebra 1**  **303241**  **Three credit hours**  **Compulsory for Math** |
| **وصف المساق**  المصفوفات: جبر المصفوفات ، المعادلات الآنية، نظير المصفوفة، فضاء المتجهات، التجميع الخطي، قاعدة الفضاء، البعد والرتبة، المحددات، طريقة كرايمر"Cramer" لحل المعادلات الآنية، التحويل الخطي –في الفضاءات الاقليد ية، المدى، التحويل الخطي وتغيير القاعدة للفضاء. | |
| **Course Description**  Systems of Linear Equations. Matrices and their Inverses. Row Echelon Forms. Determinants and Cramer's Rule. Vector Spaces and subspaces. Basis and Dimension. Linear transformations in Euclidean spaces. | |
| **Objectives**  1)Achieve mathematical maturity   1. Expose students to proofs methods 2. Understand the basic rules of logic, including the role of axioms or assumptions 3. Appreciate the role of mathematical proof in formal deductive reasoning 4. Be able to distinguish a coherent argument from a fallacious one, both in mathematical reasoning and in everyday life 5. Understand and be able to articulate the differences between inductive and deductive reasoning 6. Proficiently construct logical arguments and rigorous proofs 7. Formulate conjectures by abstracting general principles from examples. 8. Recognize real-world problems that are amenable to mathematical analysis, and formulate mathematical models of such problems 9. Apply mathematical methodologies to open-ended real-world problems 10. Recognize connections between different branches of mathematics 11. Recognize and appreciate the connections between theory and applications. 12. Present mathematics clearly and precisely to an audience of peers and faculty 13. Appreciate the role of mathematical proof as a means of conveying mathematical knowledge 14. Understand the differences between proofs and other less formal arguments 15. Make vague ideas precise by formulating them in mathematical language 16. Describe mathematical ideas from multiple perspectives 17. Explain fundamental mathematical concepts or analyses of real-world problems to non-mathematicians. | |
| **Learning Outcome**   1. Students will have developed rigorous reasoning skills 2. Students will exhibit computational competence 3. Students will be able to apply mathematical strategies in applied contexts 4. Students will be able to use technology, where appropriate, to assist in problem solving 5. Students will have learned mathematical concepts and skills relevant to their chosen field 6. Students will display algorithmic literacy in their construction, execution, and analysis of problem-solving and calculation routines. 7. Students will adhere to precision and rigorous logical reasoning in their own constructions and critiques of formal mathematical proofs. 8. Students will translate problems from across disciplines into mathematical models, allowing for the leveraging of sophisticated mathematical theory. 9. Students will effectively communicate complex mathematical ideas and carefully reasoned arguments both orally and in writing. | |

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| جبر خطي (2) **303341** ثلاث ساعات معتمدةاجباري تخصص | **Linear Algebra 2**  **303341**  **Three credit hours**  **Compulsory for Math** |
| **وصف المساق**  فضاء الضرب الداخلي، القواعد المتعامدة، عملية غرام- شميدت ، افضل تقريب ، أسلوب المربعات الدنيا ،المصفوفات المتكاملة ، تغيير القاعدة ، المتجهات المميزة والقيم المميزة ، التقاطر العمودي .التحويلات الخطية ، مصفوفة التحويل الخطي ، التشابه ،الصيغ التربيعية . | |
| **Course Description**  Inner Product Spaces. Orthonormal Bases; Gram-Schmidt Process. Best approximation: Least Squares. Orthogonal Matrices and Change of Basis. Eigen values and Eigen Vectors; Orthogonal Diagolanization. General Linear Transformations. Matrices of Linear Transformation. Similarity. Quadratic Forms. | |
| **Objectives**   1. Achieve mathematical maturity 2. Expose students to proofs methods 3. Understand the basic rules of logic, including the role of axioms or assumptions 4. Appreciate the role of mathematical proof in formal deductive reasoning 5. Be able to distinguish a coherent argument from a fallacious one, both in mathematical reasoning and in everyday life 6. Understand and be able to articulate the differences between inductive and deductive reasoning 7. Proficiently construct logical arguments and rigorous proofs 8. Formulate conjectures by abstracting general principles from examples. 9. Recognize real-world problems that are amenable to mathematical analysis, and formulate mathematical models of such problems 10. Apply mathematical methodologies to open-ended real-world problems 11. Recognize connections between different branches of mathematics 12. Recognize and appreciate the connections between theory and applications. 13. Present mathematics clearly and precisely to an audience of peers and faculty 14. Appreciate the role of mathematical proof as a means of conveying mathematical knowledge 15. Understand the differences between proofs and other less formal arguments 16. Make vague ideas precise by formulating them in mathematical language 17. Describe mathematical ideas from multiple perspectives 18. Explain fundamental mathematical concepts or analyses of real-world problems to non-mathematicians. | |
| **Learning Outcome**   1. Students will have developed rigorous reasoning skills 2. Students will exhibit computational competence 3. Students will be able to apply mathematical strategies in applied contexts 4. Students will be able to use technology, where appropriate, to assist in problem solving 5. Students will have learned mathematical concepts and skills relevant to their chosen field 6. Students will display algorithmic literacy in their construction, execution, and analysis of problem-solving and calculation routines. 7. Students will adhere to precision and rigorous logical reasoning in their own constructions and critiques of formal mathematical proofs. 8. Students will translate problems from across disciplines into mathematical models, allowing for the leveraging of sophisticated mathematical theory. 9. Students will effectively communicate complex mathematical ideas and carefully reasoned arguments both orally and in writing. | |

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| جبر حديث (1) **303342** ثلاث ساعات معتمدةاجباري تخصص | **Modern Algebra 1**  **303342**  **Three credit hours**  **Compulsory for Math** |
| **وصف المساق**  النظام الجبري والعمليات الثنائية، شبه الزمرة، الزمرة، الزمرة الجزئية، مبرهنة لاغرانج " Lagrange" ، الزمرة الجزئية السوية ، زمرة القسمة ، زمرة التباديل ، التشاكل الزمري ، مبرهنات التماثل ، الزمرة الدائرية. | |
| **Course Description**  Binary Operations, Groups and subgroups, Lagrange’s Theorem. Permutation Groups .Group Isomorphism, Normal subgroups and Factor Groups. | |
| **Objectives**   1. Achieve mathematical maturity 2. Expose students to proofs methods 3. Understand the basic rules of logic, including the role of axioms or assumptions 4. Appreciate the role of mathematical proof in formal deductive reasoning 5. Be able to distinguish a coherent argument from a fallacious one, both in mathematical reasoning and in everyday life 6. Understand and be able to articulate the differences between inductive and deductive reasoning 7. Proficiently construct logical arguments and rigorous proofs 8. Formulate conjectures by abstracting general principles from examples. 9. Recognize real-world problems that are amenable to mathematical analysis, and formulate mathematical models of such problems 10. Apply mathematical methodologies to open-ended real-world problems 11. Recognize connections between different branches of mathematics 12. Recognize and appreciate the connections between theory and applications. 13. Present mathematics clearly and precisely to an audience of peers and faculty 14. Appreciate the role of mathematical proof as a means of conveying mathematical knowledge 15. Understand the differences between proofs and other less formal arguments 16. Make vague ideas precise by formulating them in mathematical language 17. Describe mathematical ideas from multiple perspectives 18. Explain fundamental mathematical concepts or analyses of real-world problems to non-mathematicians. | |
| **Learning Outcome**   1. Students will have developed rigorous reasoning skills 2. Students will exhibit computational competence 3. Students will be able to apply mathematical strategies in applied contexts 4. Students will be able to use technology, where appropriate, to assist in problem solving 5. Students will have learned mathematical concepts and skills relevant to their chosen field 6. Students will display algorithmic literacy in their construction, execution, and analysis of problem-solving and calculation routines. 7. Students will adhere to precision and rigorous logical reasoning in their own constructions and critiques of formal mathematical proofs. 8. Students will translate problems from across disciplines into mathematical models, allowing for the leveraging of sophisticated mathematical theory. 9. Students will effectively communicate complex mathematical ideas and carefully reasoned arguments both orally and in writing. | |

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| جبر حديث (2) **303442** ثلاث ساعات معتمدةاجباري تخصص | **Modern Algebra 2**  **303442**  **Three credit hours**  **Compulsory for Math** |
| **وصف المساق**  الحلقة والحلقة الجزئية، المثالي، حلقة القسمة ، المجال،الحقل ، تحليل كثيرات الحدود ، اختبارات الاختزال و التشاكل الحلقي ، حلقة الاقترانات الحدودية ، المجال ، المجال ذو المثاليات الاحادية التولد ، المجالات ذوات التحليل الوحيد ، مجال إقليدس " Euclid ". | |
| **Course Description**  Rings and sub rings, Ideals and Factor Rings. Integral Domains, Fields. Ring Isomorphism, Polynomial Rings .Factorization of polynomials. Reducibility and Irreducibility Tests, Principle Ideal Domains, Unique Factorization Domains. Euclidean Domains. | |
| **Objectives**  1) Achieve mathematical maturity   1. Expose students to proofs methods 2. Understand the basic rules of logic, including the role of axioms or assumptions 3. Appreciate the role of mathematical proof in formal deductive reasoning 4. Be able to distinguish a coherent argument from a fallacious one, both in mathematical reasoning and in everyday life 5. Understand and be able to articulate the differences between inductive and deductive reasoning 6. Proficiently construct logical arguments and rigorous proofs 7. Formulate conjectures by abstracting general principles from examples. 8. Recognize real-world problems that are amenable to mathematical analysis, and formulate mathematical models of such problems 9. Apply mathematical methodologies to open-ended real-world problems 10. Recognize connections between different branches of mathematics 11. Recognize and appreciate the connections between theory and applications. 12. Present mathematics clearly and precisely to an audience of peers and faculty 13. Appreciate the role of mathematical proof as a means of conveying mathematical knowledge 14. Understand the differences between proofs and other less formal arguments 15. Make vague ideas precise by formulating them in mathematical language 16. Describe mathematical ideas from multiple perspectives 17. Explain fundamental mathematical concepts or analyses of real-world problems to non-mathematicians. | |
| **Learning Outcome**   1. Students will have developed rigorous reasoning skills 2. Students will exhibit computational competence 3. Students will be able to apply mathematical strategies in applied contexts 4. Students will be able to use technology, where appropriate, to assist in problem solving 5. Students will have learned mathematical concepts and skills relevant to their chosen field 6. Students will display algorithmic literacy in their construction, execution, and analysis of problem-solving and calculation routines. 7. Students will adhere to precision and rigorous logical reasoning in their own constructions and critiques of formal mathematical proofs. 8. Students will translate problems from across disciplines into mathematical models, allowing for the leveraging of sophisticated mathematical theory. 9. Students will effectively communicate complex mathematical ideas and carefully reasoned arguments both orally and in writing. | |

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| نظرية الاعداد **303345** ثلاث ساعات معتمدةاجباري تخصص | **Number Theory**  **303345**  **Three credit hours**  **Compulsory for Math** |
| **وصف المساق**  لوغارتمية القسمة ، الأعداد الاولية ، النظرية الاساسية في الحساب ، التطابق ، صفوف البواقي ، معادلات التطابق الخطية معادلات دايفونتاين ، نظرية فيرمات ونظرية ويلسون البواقي التربيعية ، بعض الاقترانات العددية ،نظرية أويلر. | |
| **Course Description**  Division Algorithm. Prime Numbers. The Fundamental Theorem of Arithmetic. Congruence, Linear Congruence Equations. Diophantine Equations. Fermat's and Wilson's Theorems. Quadratic Congruences. Arithmetic Functions, Euler's Theorem. | |
| **Objectives**   1. Achieve mathematical maturity 2. Expose students to proofs methods 3. Understand the basic rules of logic, including the role of axioms or assumptions 4. Appreciate the role of mathematical proof in formal deductive reasoning 5. Be able to distinguish a coherent argument from a fallacious one, both in mathematical reasoning and in everyday life 6. Understand and be able to articulate the differences between inductive and deductive reasoning 7. Proficiently construct logical arguments and rigorous proofs 8. Formulate conjectures by abstracting general principles from examples. 9. Recognize real-world problems that are amenable to mathematical analysis, and formulate mathematical models of such problems 10. Apply mathematical methodologies to open-ended real-world problems 11. Recognize connections between different branches of mathematics 12. Recognize and appreciate the connections between theory and applications. 13. Present mathematics clearly and precisely to an audience of peers and faculty 14. Appreciate the role of mathematical proof as a means of conveying mathematical knowledge 15. Understand the differences between proofs and other less formal arguments 16. Make vague ideas precise by formulating them in mathematical language 17. Describe mathematical ideas from multiple perspectives 18. Explain fundamental mathematical concepts or analyses of real-world problems to non-mathematicians. | |
| **Learning Outcome**   1. Students will have developed rigorous reasoning skills 2. Students will exhibit computational competence 3. Students will be able to apply mathematical strategies in applied contexts 4. Students will be able to use technology, where appropriate, to assist in problem solving 5. Students will have learned mathematical concepts and skills relevant to their chosen field 6. Students will display algorithmic literacy in their construction, execution, and analysis of problem-solving and calculation routines. 7. Students will adhere to precision and rigorous logical reasoning in their own constructions and critiques of formal mathematical proofs. 8. Students will translate problems from across disciplines into mathematical models, allowing for the leveraging of sophisticated mathematical theory. 9. Students will effectively communicate complex mathematical ideas and carefully reasoned arguments both orally and in writing. | |

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| نظرية البيان **303480** ثلاث ساعات معتمدةاختياري تخصص | **Graph Theory**  **303480**  **Three credit hours**  **Elective for Math** |
| **وصف المساق**  مفاهيم اساسية ، البيان الجزئي ، تشاكل البيانات ، البيانات المتصلة ، المتممة ، المصفوفات ، الشجرة والقياس ، مسائل اويلر و هاملتون ، البيانات السطحية و غير السطحية ، التحليل و التغطية ، الشبكات. | |
| **Course Description**  Basic Concepts of Graph Theory; Isomorphism of Graphs; Connected Graphs; Complement and self complement, Sub Graphs; Matrices; Trees and Girth; Eulerian and Hamiltonian Problems; Planar and Non Planar Graphs; Matching ; Factorization and coverings; Networks. | |
| **Objectives**   1. Achieve mathematical maturity 2. Expose students to proofs methods 3. Understand the basic rules of logic, including the role of axioms or assumptions 4. Appreciate the role of mathematical proof in formal deductive reasoning 5. Be able to distinguish a coherent argument from a fallacious one, both in mathematical reasoning and in everyday life 6. Understand and be able to articulate the differences between inductive and deductive reasoning 7. Proficiently construct logical arguments and rigorous proofs 8. Formulate conjectures by abstracting general principles from examples. 9. Recognize real-world problems that are amenable to mathematical analysis, and formulate mathematical models of such problems 10. Apply mathematical methodologies to open-ended real-world problems 11. Recognize connections between different branches of mathematics 12. Recognize and appreciate the connections between theory and applications. 13. Present mathematics clearly and precisely to an audience of peers and faculty 14. Appreciate the role of mathematical proof as a means of conveying mathematical knowledge 15. Understand the differences between proofs and other less formal arguments 16. Make vague ideas precise by formulating them in mathematical language 17. Describe mathematical ideas from multiple perspectives 18. Explain fundamental mathematical concepts or analyses of real-world problems to non-mathematicians. | |
| **Learning Outcome**   1. Students will have developed rigorous reasoning skills 2. Students will exhibit computational competence 3. Students will be able to apply mathematical strategies in applied contexts 4. Students will be able to use technology, where appropriate, to assist in problem solving 5. Students will have learned mathematical concepts and skills relevant to their chosen field 6. Students will display algorithmic literacy in their construction, execution, and analysis of problem-solving and calculation routines. 7. Students will adhere to precision and rigorous logical reasoning in their own constructions and critiques of formal mathematical proofs. 8. Students will translate problems from across disciplines into mathematical models, allowing for the leveraging of sophisticated mathematical theory. 9. Students will effectively communicate complex mathematical ideas and carefully reasoned arguments both orally and in writing. | |

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| **تحليل حقيقي (1)**  **303321** ثلاث ساعات معتمدةاجباري تخصص | **Real Analysis 1**  **303321**  **Three credit hours**  **Compulsory for Math** |
| **وصف المساق**  نظام الاعداد الحقيقة ؛ خاصية الكمال للاعداد الحقيقة ؛ خاصية ارخميدس ؛ متتاليات الاعداد الحقيقة و مفهوم التقارب؛ متتالية كوشي ؛ نظرية وستراس – بلزانو ؛ البنية للمجموعات ؛ مفهوم المجموعة المفتوحة و المغلقة و المتراصة النقاط الداخلية ؛ النقاط الحويصيلية ؛ تعريف النهاية لاقتران ؛ تعريف الاتصال ؛الاتصال المنتطم ؛ تعريف الاتصال عن طريق مفهوم المجموعات المفتوحة ؛ المجموعات المتراصة و الاتصال. | |
| **Course Description**  Least upper bound property, convergent sequences, monotone sequences, subsequences and the Bolzano-Weierstarss Theorem, Cauchy sequences, set point topology of real numbers, limit of a function, continuous functions, uniform continuity. | |
| **Objectives**   1. Achieve mathematical maturity 2. Expose students to proofs methods 3. Understand the basic rules of logic, including the role of axioms or assumptions 4. Appreciate the role of mathematical proof in formal deductive reasoning 5. Proficiently construct logical arguments and rigorous proofs 6. Recognize real-world problems that are amenable to mathematical analysis, and formulate mathematical models of such problems 7. Apply mathematical methodologies to open-ended real-world problems 8. Recognize connections between different branches of mathematics 9. Present mathematics clearly and precisely to an audience of peers and faculty 10. Understand the differences between proofs and other less formal arguments | |
| **Learning Outcome**   1. Students will have developed rigorous reasoning skills 2. Students will have learned mathematical concepts and skills relevant to their chosen field 3. Students will adhere to precision and rigorous logical reasoning in their own constructions and critiques of formal mathematical proofs. 4. Students will effectively communicate complex mathematical ideas and carefully reasoned arguments both orally and in writing. | |

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| تحليل حقيقي (2) **303411** ثلاث ساعات معتمدةاجباري تخصص | **Real Analysis 2**  **303411**  **Three credit hours**  **Compulsory for Math** |
| **وصف المساق**  تعريف الاشتقاق ؛ قاعدة لوبيال ؛ تكامل ريمان ؛ النظرية الاساسية في الحساب ؛ المتاليات و المتسلسلات للاقترنات ؛ الاقتراب المنتظم ؛ الاقتراب المطلق. | |
| **Course Description**  Derivatives; l Hôpital rule; Riemann integral; fundamental theorem in calculus; sequence and series of functions; uniform convergence ; absolute convergence. | |
| **Objectives**   1. Achieve mathematical maturity 2. Expose students to proofs methods 3. Understand the basic rules of logic, including the role of axioms or assumptions 4. Appreciate the role of mathematical proof in formal deductive reasoning 5. Recognize and appreciate the connections between theory and applications. 6. Present mathematics clearly and precisely to an audience of peers and faculty 7. Appreciate the role of mathematical proof as a means of conveying mathematical knowledge 8. Make vague ideas precise by formulating them in mathematical language 9. Describe mathematical ideas from multiple perspectives 10. Explain fundamental mathematical concepts or analyses of real-world problems to non-mathematicians. | |
| **Learning Outcome**   1. Students will have developed rigorous reasoning skills 2. Students will exhibit computational competence 3. Students will be able to apply mathematical strategies in applied contexts 4. Students will be able to use technology, where appropriate, to assist in problem solving 5. Students will have learned mathematical concepts and skills relevant to their chosen field 6. Students will adhere to precision and rigorous logical reasoning in their own constructions and critiques of formal mathematical proofs.. 7. Students will effectively communicate complex mathematical ideas and carefully reasoned arguments both orally and in writing. | |

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| تحليل عقدي **303412** ثلاث ساعات معتمدةاجباري تخصص | **Complex Analysis**  **303412**  **Three credit hours**  **Compulsory for Math** |
| **وصف المساق**  نظام الأعداد المركبة ؛ الاقترانات المركبة ؛ النهايات و الاتصال و الاشتقاق ؛ الاقترانات التحليلية ، معادلة كوشي- ريمان ؛ الإحداثيات القطبية ؛ الاقترانات التوافقية ؛ الاقترانات الاسية؛ الاقترانات اللوغارتمية ؛ الاقترانات المثلثية والاقترانات العكسية لها؛ التكامل ؛ نظرية كوشي-جورسا ونظرية كوشي التكاملية ؛ المتسلسلات المركبة ؛ حساب البواقي والاقطاب. | |
| **Course Description**  Complex number system; complex functions; limits, continuity, differentiability; analytic functions; Cauchy –Riemann equations; elementary functions; complex integrations; Cauchy theorem; Cauchy formal; Series and Residues. | |
| **Objectives**   1. Achieve mathematical maturity 2. Expose students to proofs methods 3. Understand the basic rules of logic, including the role of axioms or assumptions 4. Appreciate the role of mathematical proof in formal deductive reasoning 5. Apply mathematical methodologies to open-ended real-world problems 6. Recognize connections between different branches of mathematics 7. Recognize and appreciate the connections between theory and applications. 8. Present mathematics clearly and precisely to an audience of peers and faculty 9. Appreciate the role of mathematical proof as a means of conveying mathematical knowledge 10. Understand the differences between proofs and other less formal arguments 11. Make vague ideas precise by formulating them in mathematical language | |
| **Learning Outcome**   1. Students will have developed rigorous reasoning skills 2. Students will exhibit computational competence 3. Students will be able to apply mathematical strategies in applied contexts 4. Students will be able to use technology, where appropriate, to assist in problem solving 5. Students will have learned mathematical concepts and skills relevant to their chosen field 6. Students will display algorithmic literacy in their construction, execution, and analysis of problem-solving and calculation routines. 7. Students will adhere to precision and rigorous logical reasoning in their own constructions and critiques of formal mathematical proofs. | |

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| التبولوجيا العامة (1) **303416** ثلاث ساعات معتمدةاجباري تخصص | **General Topology 1**  **303416**  **Three credit hours**  **Compulsory for Math** |
| **وصف المساق**  تعريف التوبولوجيا؛ المجموعات المفتوحة و المغلقة ؛ النقاط الداخلية ؛ النقاط المنعزلة ؛ النقاط الحويصيلية ؛ المجموعة الداخلية ؛ المجموعة الاقفالية ؛ المجموعة الحدية ؛ قاعدة التوبولوجيا ؛ التماثل التوبولوجي ؛ الاقترانات المتصلة. | |
| **Course Description**  Topological spaces; open sets ; closed sets ; interior, exterior, boundary, cluster and isolated points ; homeomorphisms ; continuous functions. | |
| **Objectives**   1. Achieve mathematical maturity 2. Expose students to proofs methods 3. Understand the basic rules of logic, including the role of axioms or assumptions 4. Appreciate the role of mathematical proof in formal deductive reasoning 5. Be able to distinguish a coherent argument from a fallacious one, both in mathematical reasoning and in everyday life 6. Understand and be able to articulate the differences between inductive and deductive reasoning 7. Proficiently construct logical arguments and rigorous proofs 8. Formulate conjectures by abstracting general principles from examples. 9. Recognize real-world problems that are amenable to mathematical analysis, and formulate mathematical models of such problems 10. Apply mathematical methodologies to open-ended real-world problems | |
| **Learning Outcome**   1. Students will translate problems from across disciplines into mathematical models, allowing for the leveraging of sophisticated mathematical theory. 2. Students will effectively communicate complex mathematical ideas and carefully reasoned arguments both orally and in writing. | |

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| التبولوجيا العامة (2) **303462** ثلاث ساعات معتمدةاجباري تخصص | **General Topology 2**  **303462**  **Three credit hours**  **Compulsory for Math** |
| **وصف المساق**  الفضاءات المتصلة ؛ الفضاءات المتراصة ؛ مسلمات الانفصال ؛ مسلمات العد ؛ الفضاءات المترية. | |
| **Course Description**  Connected spaces ; compact spaces ; separations axioms ; Countability axioms ; metric space | |
| **Objectives**   1. Achieve mathematical maturity 2. Expose students to proofs methods 3. Understand the basic rules of logic, including the role of axioms or assumptions 4. Appreciate the role of mathematical proof in formal deductive reasoning 5. Be able to distinguish a coherent argument from a fallacious one, both in mathematical reasoning and in everyday life 6. Appreciate the role of mathematical proof as a means of conveying mathematical knowledge 7. Understand the differences between proofs and other less formal arguments 8. Make vague ideas precise by formulating them in mathematical language 9. Describe mathematical ideas from multiple perspectives 10. Explain fundamental mathematical concepts or analyses of real-world problems to non-mathematicians. | |
| **Learning Outcome**   1. Students will have developed rigorous reasoning skills 2. Students will exhibit computational competence 3. Students will be able to apply mathematical strategies in applied contexts 4. Students will be able to use technology, where appropriate, to assist in problem solving 5. Students will have learned mathematical concepts and skills relevant to their chosen field 6. Students will effectively communicate complex mathematical ideas and carefully reasoned arguments both orally and in writing. | |

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| المجموعات الضبابية **303352** ثلاث ساعات معتمدةاختياري تخصص | **Fuzzy Sets**  **303352**  **Three credit hours**  **Elective for Math** |
| **وصف المساق**  المجموعات العادية ، الغموض ، المجموعات الضبابية ، العمليات على المجوعات الضبابية ، انواع المجموعات الضبابية ، العمليات الجبرية للمجموعات الضبابية ، القياس الضبابي ، العلاقات الضبابية ، عملية التركيب بين العلاقات الضبابية ، خصائص الاكبر-الاصغر ، البيان الضبابي. | |
| **Course Description**  Crispness , Vagueness, Fuzziness, Uncertainty; Fuzzy Set Theory; Basic Set-Theoretic Operations for Fuzzy Sets; Types of Fuzzy Sets; Algebraic Operations; Algebraic Operations; Fuzzy Measures; Fuzzy Relations on Sets and Fuzzy Sets; Compositions of Fuzzy Relations; Properties of the Min-Max Composition; Fuzzy Graphs. | |
| **Objectives**   1. Achieve mathematical maturity 2. Expose students to proofs methods 3. Understand the basic rules of logic, including the role of axioms or assumptions 4. Appreciate the role of mathematical proof in formal deductive reasoning 5. Be able to distinguish a coherent argument from a fallacious one, both in mathematical reasoning and in everyday life 6. Understand and be able to articulate the differences between inductive and deductive reasoning | |
| **Learning Outcome**   1. Students will have developed rigorous reasoning skills 2. Students will exhibit computational competence 3. Students will be able to apply mathematical strategies in applied contexts 4. Students will be able to use technology, where appropriate, to assist in problem solving 5. Students will have learned mathematical concepts and skills relevant to their chosen field 6. reasoned arguments both orally and in writing. | |

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| نظرية الامثلية **303453** ثلاث ساعات معتمدةاختياري تخصص | **Optimization Theory**  **303453**  **Three credit hours**  **Elective for Math** |
| **وصف المساق** | |
| **Course Description** | |
| **Objectives**   1. Achieve mathematical maturity 2. Expose students to proofs methods 3. Understand the basic rules of logic, including the role of axioms or assumptions 4. Appreciate the role of mathematical proof in formal deductive reasoning 5. Be able to distinguish a coherent argument from a fallacious one, both in mathematical reasoning and in everyday life 6. Understand and be able to articulate the differences between inductive and deductive reasoning 7. Proficiently construct logical arguments and rigorous proofs 8. Formulate conjectures by abstracting general principles from examples. 9. Recognize real-world problems that are amenable to mathematical analysis, and formulate mathematical models of such problems 10. Apply mathematical methodologies to open-ended real-world problems 11. Recognize connections between different branches of mathematics 12. Recognize and appreciate the connections between theory and applications. 13. Present mathematics clearly and precisely to an audience of peers and faculty 14. Appreciate the role of mathematical proof as a means of conveying mathematical knowledge 15. Understand the differences between proofs and other less formal arguments 16. Make vague ideas precise by formulating them in mathematical language 17. Describe mathematical ideas from multiple perspectives 18. Explain fundamental mathematical concepts or analyses of real-world problems to non-mathematicians. | |
| **Learning Outcome**   1. Students will have developed rigorous reasoning skills 2. Students will exhibit computational competence 3. Students will be able to apply mathematical strategies in applied contexts 4. Students will be able to use technology, where appropriate, to assist in problem solving 5. Students will have learned mathematical concepts and skills relevant to their chosen field 6. Students will display algorithmic literacy in their construction, execution, and analysis of problem-solving and calculation routines. 7. Students will adhere to precision and rigorous logical reasoning in their own constructions and critiques of formal mathematical proofs. 8. Students will translate problems from across disciplines into mathematical models, allowing for the leveraging of sophisticated mathematical theory. 9. Students will effectively communicate complex mathematical ideas and carefully reasoned arguments both orally and in writing. | |

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| تاريخ و فلسفة الرياضيات303350 ثلاث ساعات معتمدةاختياري تخصص | **History and Philosophy of Mathematics**  **303350**  **Three credit hours**  **Elective for Math** |
| **وصف المساق**  تاريخ الرياضيات ، مفهوم الاثبات و المسلمة و التعريف و الاعداد ، و المجموعات ، نظرية عدم الكمال لقادل ، مدارس في فلسفة الرياضيات : المنطقية ، الحدسية ، برنامج هلبرت ، برنامج ، فيلدز، الهيكلية (التركيبة) . اصل و تطور التحليل و الجبر و الهندسة . مفهوم الانهاية. الرياضيات الدقيقة. | |
| **Course Description**  History of mathematics and their philosophical background. Basic concepts (proof, axiom, definition, number, set. Gödel’s Incompleteness Theorems, and the independence of the continuum hypothesis from the current axioms of set theory. major philosophical accounts of mathematics: Logicism Intuitionism, Hilbert’s program, Quine’s empiricism, Field’s program Structuralism. Genesis and evolution of ideas in analysis, algebra, geometry, mechanics, foundations. Philosophical aspects of concepts of infinity, mathematical rigor. | |
| **Objectives**   1. Achieve mathematical maturity 2. Expose students to proofs methods 3. Understand the basic rules of logic, including the role of axioms or assumptions 4. Appreciate the role of mathematical proof in formal deductive reasoning 5. Be able to distinguish a coherent argument from a fallacious one, both in mathematical reasoning and in everyday life 6. Understand and be able to articulate the differences between inductive and deductive reasoning 7. Proficiently construct logical arguments and rigorous proofs 8. Formulate conjectures by abstracting general principles from examples. 9. Recognize real-world problems that are amenable to mathematical analysis, and formulate mathematical models of such problems 10. Apply mathematical methodologies to open-ended real-world problems 11. Recognize connections between different branches of mathematics 12. Recognize and appreciate the connections between theory and applications. 13. Present mathematics clearly and precisely to an audience of peers and faculty 14. Appreciate the role of mathematical proof as a means of conveying mathematical knowledge 15. Understand the differences between proofs and other less formal arguments 16. Make vague ideas precise by formulating them in mathematical language 17. Describe mathematical ideas from multiple perspectives 18. Explain fundamental mathematical concepts or analyses of real-world problems to non-mathematicians. | |
| **Learning Outcome**   1. Students will have developed rigorous reasoning skills 2. Students will exhibit computational competence 3. Students will be able to apply mathematical strategies in applied contexts 4. Students will be able to use technology, where appropriate, to assist in problem solving 5. Students will have learned mathematical concepts and skills relevant to their chosen field 6. Students will display algorithmic literacy in their construction, execution, and analysis of problem-solving and calculation routines. 7. Students will adhere to precision and rigorous logical reasoning in their own constructions and critiques of formal mathematical proofs. 8. Students will translate problems from across disciplines into mathematical models, allowing for the leveraging of sophisticated mathematical theory. 9. Students will effectively communicate complex mathematical ideas and carefully reasoned arguments both orally and in writing. | |

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| مبادئ في الاحصاء **303211** ثلاث ساعات معتمدةاجباري كلية | **Basic Concepts in Statistics**  **303211**  **Three credit hours**  **Compulsory for faculty** |
| **وصف المساق**  البيانات و طرق و صفها عن طريق الرسم و الارقام؛ الاحتمالات و حساباتها ؛ طرق اخذ العينيات و فحصها. | |
| **Course Description**  Data: which includes graphical and numerical summaries to describe the distribution of a variable, or the relationship between two variables and data production to learn how to design good surveys and experiments, collect data from samples that are representative of the whole population, and avoid common sources of biases. Probability: using the language of probability and the properties of numerical summaries computed from random samples, we learn to draw conclusions about the population of interest, based on our random sample, and attach a measure of reliability to them. Sampling :including sampling techniques and sampling tests. | |
| **Objectives**   1. Distinguishing and understanding of basic concepts of statistics 2. describing data with graphs and numerical measures; 3. inference probability and probability distribution. | |
| **Learning Outcome**   1. Students will able to describing, 2. Students will infer, and 3. Students will measure data. | |

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| احصاء رياضي **303331** ثلاث ساعات معتمدةاجباري تخصص | **Mathematical Statistics**  **303331**  **Three credit hours**  **Compulsory for Math** |
| **وصف المساق**  توزيعات المعاينة: توزيع المعاينة للمتوسطات؛ توزيع كاي تربيع؛ توزيع ستيودنت؛ توزيع  توزيع فيشر-سنديكور، التقدير: التقديرات غير المنحازة؛ كفاءة التقديرات؛ اتساق التقديرات ؛ كفاية التقديرات؛ طريقة العزوم؛ طريقة الارجحية؛ اختبار الفرضيات: اختبار الفرضيات الاحصائية؛ مبرهنة نيمان - وبيرسون؛ الاختبار المنتظم ذو القوة العظمى؛ اختبار النسبة الاحتمالية. | |
| Course Description  Sampling distributions: The distribution of the mean; The Chi-Square, t and F distributions; Order statistics, Estimation: Unbiased estimators; Efficiency; Consistency; Sufficiency; The methods of moments; The method of maximum likelihood, Hypothesis testing: Testing a statistical Hypothesis; The Neyman-Pearson lemma; The power function of a test; Likelihood ratio tests. | |
| **Objectives**   1. Achieve mathematical maturity 2. Expose students to proofs methods 3. Understand the basic rules of logic, including the role of axioms or assumptions 4. Appreciate the role of mathematical proof in formal deductive reasoning 5. Be able to distinguish a coherent argument from a fallacious one, both in mathematical reasoning and in everyday life 6. Understand and be able to articulate the differences between inductive and deductive reasoning 7. Proficiently construct logical arguments and rigorous proofs 8. Formulate conjectures by abstracting general principles from examples. 9. Recognize real-world problems that are amenable to mathematical analysis, and formulate mathematical models of such problems 10. Apply mathematical methodologies to open-ended real-world problems 11. Recognize connections between different branches of mathematics 12. Recognize and appreciate the connections between theory and applications. 13. Present mathematics clearly and precisely to an audience of peers and faculty 14. Appreciate the role of mathematical proof as a means of conveying mathematical knowledge 15. Understand the differences between proofs and other less formal arguments 16. Make vague ideas precise by formulating them in mathematical language 17. Describe mathematical ideas from multiple perspectives 18. Explain fundamental mathematical concepts or analyses of real-world problems to non-mathematicians. | |
| **Learning Outcome**   1. Students will have developed rigorous reasoning skills 2. Students will exhibit computational competence 3. Students will be able to apply mathematical strategies in applied contexts 4. Students will be able to use technology, where appropriate, to assist in problem solving 5. Students will have learned mathematical concepts and skills relevant to their chosen field 6. Students will display algorithmic literacy in their construction, execution, and analysis of problem-solving and calculation routines. 7. Students will adhere to precision and rigorous logical reasoning in their own constructions and critiques of formal mathematical proofs. 8. Students will translate problems from across disciplines into mathematical models, allowing for the leveraging of sophisticated mathematical theory. 9. Students will effectively communicate complex mathematical ideas and carefully reasoned arguments both orally and in writing. | |

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| تحليل اقتراني **303414** ثلاث ساعات معتمدةاختياري تخصص | **Functional Analysis**  **303414**  **Three credit hours**  **Elective for Math** |
| **وصف المساق**  الفضاءات المترية ، الفضاءات الخطية ، الفضاءات المعيارية ، متباينات هولدر ومنكوفسكي ، التشاكل التقابلي ، فضاءات باناخ ، فضاءات من النمط ل ، المؤثرات ، فضاءات هيلبرت ، المؤثرات المتعامدة والمجموع المباشر ، المتتاليات المتعامدة القياسية ، المؤثرات المرافق. نظريات اساسية. | |
| **Course Description**  Metric Spaces ; completeness ; normed spaces ; Banach spaces ; Hilbert spaces; orthogonal ; Holder inequality ; operators; isomorphism and isometric; fundamental theorems. | |
| **Objectives**   1. Achieve mathematical maturity 2. Expose students to proofs methods 3. Understand the basic rules of logic, including the role of axioms or assumptions 4. Appreciate the role of mathematical proof in formal deductive reasoning 5. Be able to distinguish a coherent argument from a fallacious one, both in mathematical reasoning and in everyday life 6. Understand and be able to articulate the differences between inductive and deductive reasoning 7. Proficiently construct logical arguments and rigorous proofs 8. Formulate conjectures by abstracting general principles from examples. 9. Recognize real-world problems that are amenable to mathematical analysis, and formulate mathematical models of such problems 10. Apply mathematical methodologies to open-ended real-world problems 11. Recognize connections between different branches of mathematics 12. Recognize and appreciate the connections between theory and applications. 13. Present mathematics clearly and precisely to an audience of peers and faculty 14. Appreciate the role of mathematical proof as a means of conveying mathematical knowledge 15. Understand the differences between proofs and other less formal arguments 16. Make vague ideas precise by formulating them in mathematical language 17. Describe mathematical ideas from multiple perspectives 18. Explain fundamental mathematical concepts or analyses of real-world problems to non-mathematicians. | |
| **Learning Outcome**  1)Students will have developed rigorous reasoning skills   1. Students will exhibit computational competence 2. Students will be able to apply mathematical strategies in applied contexts 3. Students will be able to use technology, where appropriate, to assist in problem solving 4. Students will have learned mathematical concepts and skills relevant to their chosen field 5. Students will display algorithmic literacy in their construction, execution, and analysis of problem-solving and calculation routines. 6. Students will adhere to precision and rigorous logical reasoning in their own constructions and critiques of formal mathematical proofs. 7. Students will translate problems from across disciplines into mathematical models, allowing for the leveraging of sophisticated mathematical theory. 8. Students will effectively communicate complex mathematical ideas and carefully reasoned arguments both orally and in writing. | |

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| تحليل عددي (1) **303321** ثلاث ساعات معتمدةاجباري تخصص | **Numerical Analysis 1**  **303321**  **Three credit hours**  **Compulsory for Math** |
| **وصف المساق**  مبادئ رياضية ، حلول معادلات بمتغير واحد، الاستكمال والتقريب باستخدام كثيرات الحدود ،التفاضل والتكامل العددي. | |
| **Course Description**  Mathematical Preliminaries, Solutions of equations in one variable, Interpolation and polynomial approximation, Numerical Differentiation and Integration. | |
| **Objectives**   1. Achieve mathematical maturity 2. Expose students to proofs methods 3. Understand the basic rules of logic, including the role of axioms or assumptions 4. Appreciate the role of mathematical proof in formal deductive reasoning 5. Be able to distinguish a coherent argument from a fallacious one, both in mathematical reasoning and in everyday life 6. Understand and be able to articulate the differences between inductive and deductive reasoning 7. Proficiently construct logical arguments and rigorous proofs 8. Formulate conjectures by abstracting general principles from examples. 9. Recognize real-world problems that are amenable to mathematical analysis, and formulate mathematical models of such problems 10. Apply mathematical methodologies to open-ended real-world problems 11. Recognize connections between different branches of mathematics 12. Recognize and appreciate the connections between theory and applications. 13. Present mathematics clearly and precisely to an audience of peers and faculty 14. Appreciate the role of mathematical proof as a means of conveying mathematical knowledge 15. Understand the differences between proofs and other less formal arguments 16. Make vague ideas precise by formulating them in mathematical language 17. Describe mathematical ideas from multiple perspectives 18. Explain fundamental mathematical concepts or analyses of real-world problems to non-mathematicians. | |
| **Learning Outcome**  1)Students will have developed rigorous reasoning skills   1. Students will exhibit computational competence 2. Students will be able to apply mathematical strategies in applied contexts 3. Students will be able to use technology, where appropriate, to assist in problem solving 4. Students will have learned mathematical concepts and skills relevant to their chosen field 5. Students will display algorithmic literacy in their construction, execution, and analysis of problem-solving and calculation routines. 6. Students will adhere to precision and rigorous logical reasoning in their own constructions and critiques of formal mathematical proofs. 7. Students will translate problems from across disciplines into mathematical models, allowing for the leveraging of sophisticated mathematical theory. 8. Students will effectively communicate complex mathematical ideas and carefully reasoned arguments both orally and in writing. | |

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| تحليل عددي (2)303421ثلاث ساعات معتمدةاجباري تخصص | **Numerical Analysis 2**  **303421**  **Three credit hours**  **Compulsory for Math** |
| **وصف المساق**  حل معادلات تفاضلية عادية ذات قيم اولية، الطرق المباشرة لحل انظمة خطية ، جبر المصفوفات والطرق العددية المتسلسلة، حل معادلات تفاضلية عادية ذات قيم حدية. | |
| **Course Description**  The course deals with the following topics: Initial - value problems for ordinary differential equations, Direct methods for solving linear systems, Iterative techniques in Matrix Algebra, Boundary -value problems for ordinary differential equations. | |
| **Objectives**   1. Achieve mathematical maturity 2. Expose students to proofs methods 3. Understand the basic rules of logic, including the role of axioms or assumptions 4. Appreciate the role of mathematical proof in formal deductive reasoning 5. Be able to distinguish a coherent argument from a fallacious one, both in mathematical reasoning and in everyday life 6. Understand and be able to articulate the differences between inductive and deductive reasoning 7. Proficiently construct logical arguments and rigorous proofs 8. Formulate conjectures by abstracting general principles from examples. 9. Recognize real-world problems that are amenable to mathematical analysis, and formulate mathematical models of such problems 10. Apply mathematical methodologies to open-ended real-world problems 11. Recognize connections between different branches of mathematics 12. Recognize and appreciate the connections between theory and applications. 13. Present mathematics clearly and precisely to an audience of peers and faculty 14. Appreciate the role of mathematical proof as a means of conveying mathematical knowledge 15. Understand the differences between proofs and other less formal arguments 16. Make vague ideas precise by formulating them in mathematical language 17. Describe mathematical ideas from multiple perspectives 18. Explain fundamental mathematical concepts or analyses of real-world problems to non-mathematicians. | |
| **Learning Outcome**  1)Students will have developed rigorous reasoning skills   1. Students will exhibit computational competence 2. Students will be able to apply mathematical strategies in applied contexts 3. Students will be able to use technology, where appropriate, to assist in problem solving 4. Students will have learned mathematical concepts and skills relevant to their chosen field 5. Students will display algorithmic literacy in their construction, execution, and analysis of problem-solving and calculation routines. 6. Students will adhere to precision and rigorous logical reasoning in their own constructions and critiques of formal mathematical proofs. 7. Students will translate problems from across disciplines into mathematical models, allowing for the leveraging of sophisticated mathematical theory. 8. Students will effectively communicate complex mathematical ideas and carefully reasoned arguments both orally and in writing. | |

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| النمذجة الرياضية **303472** ثلاث ساعات معتمدةاجباري تخصص | **Mathematical Modelling**  **303472**  **Three credit hours**  **Compulsory for Math** |
| **وصف المساق**    نمذجة معادلات الفروق ، أنظمة ديناميكية ، أنظمة معادلات الفروق ، نواقل الفروق ، النمذجة الرياضية ، التناسبية ، التشابه الهندسي ، التلاؤم للرسوم البيانية ، التلاؤم التحليلي ، طرق في التلاؤم ، اختيار الأنموذج ، انموذج كثيرات الحدود ، الحلول الرسومية ، التقريب العددي ، فصل المتغيرات ، المعادلات الخطية ، استخدام نظرية البيان في النمذجة، النمذجة عن طريق المحاكاة. | |
| **Course Description**  Modelling change with difference equations; Dynamical systems, Systems of difference equations, Difference operators; Mathematical models, Proportionality; Geometric similarity, Graphical fitting; Analytic fitting, Least-squares fitting; Choosing models; Polynomial models; Smoothing; Cubic splines; Population growth; Drug dosage; Graphical solutions; Numerical approximations; Separation of variables; Linear equations; Modelling using Graph Theory; Simulation Modelling. | |
| **Objectives**   1. Achieve mathematical maturity 2. Expose students to proofs methods 3. Understand the basic rules of logic, including the role of axioms or assumptions 4. Appreciate the role of mathematical proof in formal deductive reasoning 5. Be able to distinguish a coherent argument from a fallacious one, both in mathematical reasoning and in everyday life 6. Understand and be able to articulate the differences between inductive and deductive reasoning 7. Proficiently construct logical arguments and rigorous proofs 8. Formulate conjectures by abstracting general principles from examples. 9. Recognize real-world problems that are amenable to mathematical analysis, and formulate mathematical models of such problems 10. Apply mathematical methodologies to open-ended real-world problems 11. Recognize connections between different branches of mathematics 12. Recognize and appreciate the connections between theory and applications. 13. Present mathematics clearly and precisely to an audience of peers and faculty 14. Appreciate the role of mathematical proof as a means of conveying mathematical knowledge 15. Understand the differences between proofs and other less formal arguments 16. Make vague ideas precise by formulating them in mathematical language 17. Describe mathematical ideas from multiple perspectives 18. Explain fundamental mathematical concepts or analyses of real-world problems to non-mathematicians. | |
| **Learning Outcome**  1)Students will have developed rigorous reasoning skills   1. Students will exhibit computational competence 2. Students will be able to apply mathematical strategies in applied contexts 3. Students will be able to use technology, where appropriate, to assist in problem solving 4. Students will have learned mathematical concepts and skills relevant to their chosen field 5. Students will display algorithmic literacy in their construction, execution, and analysis of problem-solving and calculation routines. 6. Students will adhere to precision and rigorous logical reasoning in their own constructions and critiques of formal mathematical proofs. 7. Students will translate problems from across disciplines into mathematical models, allowing for the leveraging of sophisticated mathematical theory. 8. Students will effectively communicate complex mathematical ideas and carefully reasoned arguments both orally and in writing. | |

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| طرق في الرياضيات التطبيقية **303474** ثلاث ساعات معتمدةاجباري تخصص | **Methods in Applied Mathematics**  **303473**  **Three credit hours**  **Compulsory for Math** |
| **وصف مساق**  المعادلات التكاملية ، التحويلات التكاملية ، الطرق التقاربية ، المعادلات الجبرية ، طرق التحليل المركب، الاقترانات التوافقية. | |
| **Course Description**    Integral equations, integral transformations, approximation methods, algebraic equations, complex analysis methods , harmonic functions , Gamma and Beta functions. | |
| **Objectives**   1. Achieve mathematical maturity 2. Be able to distinguish a coherent argument from a fallacious one, both in mathematical reasoning and in everyday life. 3. Apply critical thinking and communication skills to solve applied problems 4. Formulate conjectures by abstracting general principles from examples. 5. Recognize real-world problems that are amenable to mathematical analysis, and formulate mathematical models of such problems 6. Apply mathematical methodologies to open-ended real-world problems 7. Recognize and appreciate the connections between theory and applications. 8. Appreciate the role of mathematical proof as a means of conveying mathematical knowledge 9. Describe mathematical ideas from multiple perspectives 10. Explain fundamental mathematical concepts or analyses of real-world problems to non-mathematicians. | |
| **Learning Outcome**  **1- Apply mathematical concepts and principles to perform computations**  **2-Apply mathematics to solve problems**  **. 3-Communicate mathematical knowledge and understanding**  **4- Students will have learned mathematical concepts and skills relevant to their chosen field**  **5-Students will translate problems from across disciplines into mathematical models, allowing for the leveraging of sophisticated mathematical theory.**  **6-Students will effectively communicate complex mathematical ideas and carefully reasoned arguments both orally and in writing.** | |

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| احصاء تطبيقي **303305** ثلاث ساعات معتمدةاجباري تخصص | **Applied Statistics**  **303472**  **Three credit hours**  **Compulsory for Math** |
| **وصف المساق**  وصف البيانات ، استخدام حزم احصائية ، الاحتمالات والتوزيع الاحتمالات ، التوزيع الطبيعي ، طرق اخذ العينة وتوزيعها ، استنباط النسب وهامش الخطأ من المجتمع ، فترة الثقة ، اختبارات الفرضيات ، الاستنباط من النزعة المركزية ، مقارنة الوسط الحسابي بين عينتين مستقلتين ، مقارنة الوسط الحسابي بين مجتمعين لبيانات ثنائية. | |
| **Course Description**  An overview of statistics, Data description, Probability and probability distributions, The role that normal distributions play in statistics, Sampling and sampling distribution, Inferences of population proportion, margin of error and sample size computation, Confidence interval for population mean, Hypothesis testing, Inferences about μ with σ unknown, Compare the mean of two populations for independent samples, Compare the mean of two populations for paired data. | |
| **Objectives**   1. Achieve mathematical maturity 2. Expose students to proofs methods 3. Understand the basic rules of logic, including the role of axioms or assumptions 4. Appreciate the role of mathematical proof in formal deductive reasoning 5. Be able to distinguish a coherent argument from a fallacious one, both in mathematical reasoning and in everyday life 6. Understand and be able to articulate the differences between inductive and deductive reasoning 7. Proficiently construct logical arguments and rigorous proofs 8. Formulate conjectures by abstracting general principles from examples. 9. Recognize real-world problems that are amenable to mathematical analysis, and formulate mathematical models of such problems 10. Apply mathematical methodologies to open-ended real-world problems 11. Recognize connections between different branches of mathematics 12. Recognize and appreciate the connections between theory and applications. 13. Present mathematics clearly and precisely to an audience of peers and faculty 14. Appreciate the role of mathematical proof as a means of conveying mathematical knowledge 15. Understand the differences between proofs and other less formal arguments 16. Make vague ideas precise by formulating them in mathematical language 17. Describe mathematical ideas from multiple perspectives 18. Explain fundamental mathematical concepts or analyses of real-world problems to non-mathematicians. | |
| **Learning Outcome**  1)Students will have developed rigorous reasoning skills   1. Students will exhibit computational competence 2. Students will be able to apply mathematical strategies in applied contexts 3. Students will be able to use technology, where appropriate, to assist in problem solving 4. Students will have learned mathematical concepts and skills relevant to their chosen field 5. Students will display algorithmic literacy in their construction, execution, and analysis of problem-solving and calculation routines. 6. Students will adhere to precision and rigorous logical reasoning in their own constructions and critiques of formal mathematical proofs. 7. Students will translate problems from across disciplines into mathematical models, allowing for the leveraging of sophisticated mathematical theory. 8. Students will effectively communicate complex mathematical ideas and carefully reasoned arguments both orally and in writing. | |

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| حزم برمجيات رياضية **1001322** ثلاث ساعات معتمدةاجباري تخصص | **Mathematical Software Packages**  **303322**  **Three credit hours**  **Compulsory for Math** |
| **وصف المساق**  هذا المساق يقدم بعض البرمجيات الرياضية المفيدة لطلاب الرياضياتMaple و Mathematica للحسابات التي تحتوي على رموز رياضية و Latex للطباعة و Matlab للحسابات العددية و Minitab للاستخدامات الإحصائية. | |
| **Course Description**  This course provides an introduction to the use of several software packages which are useful to mathematics students. Among the packages are Maple and Mathematica for symbolic computing, TeX and LaTeX for mathematical documents, and Matlab for numerical computing, Use a statistical package (Minitab). | |
| **Objectives**   1. Achieve mathematical maturity 2. Expose students to proofs methods 3. Understand the basic rules of logic, including the role of axioms or assumptions 4. Appreciate the role of mathematical proof in formal deductive reasoning 5. Be able to distinguish a coherent argument from a fallacious one, both in mathematical reasoning and in everyday life 6. Understand and be able to articulate the differences between inductive and deductive reasoning 7. Proficiently construct logical arguments and rigorous proofs 8. Formulate conjectures by abstracting general principles from examples. 9. Recognize real-world problems that are amenable to mathematical analysis, and formulate mathematical models of such problems 10. Apply mathematical methodologies to open-ended real-world problems 11. Recognize connections between different branches of mathematics 12. Recognize and appreciate the connections between theory and applications. 13. Present mathematics clearly and precisely to an audience of peers and faculty 14. Appreciate the role of mathematical proof as a means of conveying mathematical knowledge 15. Understand the differences between proofs and other less formal arguments 16. Make vague ideas precise by formulating them in mathematical language 17. Describe mathematical ideas from multiple perspectives 18. Explain fundamental mathematical concepts or analyses of real-world problems to non-mathematicians. | |
| **Learning Outcome**  1)Students will have developed rigorous reasoning skills   1. Students will exhibit computational competence 2. Students will be able to apply mathematical strategies in applied contexts 3. Students will be able to use technology, where appropriate, to assist in problem solving 4. Students will have learned mathematical concepts and skills relevant to their chosen field 5. Students will display algorithmic literacy in their construction, execution, and analysis of problem-solving and calculation routines. 6. Students will adhere to precision and rigorous logical reasoning in their own constructions and critiques of formal mathematical proofs. 7. Students will translate problems from across disciplines into mathematical models, allowing for the leveraging of sophisticated mathematical theory. 8. Students will effectively communicate complex mathematical ideas and carefully reasoned arguments both orally and in writing. | |