جامعة البصرة
كلية التربية للعلوم الصرفة
قسم الرياضيات

المواضيع المطلوبة للامتحان التنافسي للطلبة المتقدمين الى دراسة الدكتوراه
للعام الدراسي 2025-2026

اسم المادة	المفردات	المصدر
التحليل العقدي	1- تفاضل الدوال المركبة ومعادلتي كوشي – ريمان المشتقات – الدوال التحليلية – معادلتي كوشي - ريمان , دوال توافقية . التفسير الهندسي للمشتقة , التفاضلات, قواعد التفاضل , النقاط الشاذة , مؤثر لابلا س 2- تكامل الدوال المركبة ونظرية كوشي التكاملات الخطية للدوال المركبة , التكاملات الخطية للدوال الحقيقية , الصلة بين التكاملات الخطية للدوال الحقيقية والمركبة , خواص التكاملات , المناطق البسيطة والمتعددة الترابط , منحني جوردن , نظرية جرين في المستوي, نظرية جرين للدوال المركبة . نظرية كوشي ,نظرية كوشي جورسات , تكاملات غير معينة , تكاملات الدوال الخاصة , بعض نتائج نظرية كوشي . صيغ تكامل كوشي والنظريات المتعلقة بها. 3- المتسلسلات اللانهائية ومتسلسلتي تيلور و لوران ت متتابعات الدوال , متسلسلات الدوال , التقارب المطلق والتقارب المنتظم للمتتابعات والمتسلسلات , متسلسلات القوى , بعض النظريات المهمة , اختبارات خاصة للتقارب , نظريات على التقارب المنتظم ,نظريات على متسلسلات القوى ,نظرية تيلور , نظرية لورانت. 4- نظرية البواقي وحساب قيم التكاملات والمتسلسلات. المتبقيات , حساب قيم المتبقيات , نظرية المتبقي ,حساب قيمة تكاملات معينة , نظرية خاصة تستخدم في حساب قيم التكاملات , فيمة كوشي الأساسية للتكاملات .حساب التكاملات الحقيقية المعتلة باستخدام نظرية البواقي.	1- سلسلة ملخصات شوم نظريات ومسائل في الدوال المركبة مع مقدمة في التناظر الحافظ للزوايا وتطبيقاته (تاليف موراي ر , شبيجل) **Murray R. Spiegel -2 ;SCHAUM'S outlines Complex Variables ; Second Edition**
Probability and Mathematical Statistics.	الفصول الثمانية الأولى	**Introduction to Mathematical Statistics, Robert V. Hogg Joseph W. Mckean Allen T. Craig Copyright 2013 Pearson Education, Inc.**
Functional Analysis	**1. Metric space** **Metric space, Further examples of metric spaces, Open set, closed set , Neighborhood, convergence, Cauchy sequence, completeness, completion of metric space.** **2. Normed Spaces, Banach Spaces** **Vector space , Normed Space , Banach Space, Further properties of Normed spaces, Finite Dimensional Normed Spaces and subspaces , compactness and finite dimension, Linear operators, bounded and continuous linear operators, Linear functionals on finite-dimensional spaces, Normed spaces of operators, Dual space.** **3. Inner Product Spaces. Hilbert Spaces** **Inner product space, Hilbert space, further properties of inner product spaces, orthogonal complements, and**	**Eruin Kreyzig; Introductory Functional Analysis With Applications, JOHN WILEY &SONS, New York.**

	direct sums, Orthogonal sets and sequences, Hilbert -Adjoint Operator, Self-Adjoint, Unitary, and Normal Operators. **4. Fundamental Theorems for Normed and Banach Spaces.** Zorn's Lemma, Hahn-Banach Theorem for Complex Vector Spaces and Normed Spaces, Adjoint Operator, Reflexive Spaces. Application to bounded linear functional on $C[a, b]$.	
David M. Burton, Introduction to Modern Abstract Algebra, University of New Hampshire, Addison Wesley publishing Company, 1967. المادة المطلوبة من هذا الكتاب: الفصل الثاني الصفحات 27-116 الفصل الثالث الصفحات 141-195	**Group Theory** **1) Definition and Examples of Groups** Introduces groups, their axioms (closure, associativity, identity, inverses), and examples like $\mathbb{Z}$, $\mathbb{Q}$ and symmetry groups. **2) Certain Elementary Theorems on Groups** Covers basic theorems, such as uniqueness of identity, inverses and cancellation laws. **3) Two Important Groups** The symmetric groups S_n and cyclic groups $\mathbb{Z}_n$ as fundamental examples. **4) Subgroups** Defines subgroups, criteria for subsets to be subgroups, and examples. **5) Normal Subgroups and Quotient Groups** The normal subgroups, cosets, and constructing quotient groups. **6) Homomorphisms** Group homomorphisms, kernels, images, and isomorphism theorems. **7) The Fundamental Theorems** The First, Second, and Third Isomorphism Theorems. **Ring Theory** **1) Definition and Elementary Properties of Rings** Introduces rings, their axioms (closure, associativity, distributivity, additive identity, inverses), and examples $(\mathbb{Z}, +, .)$. Discusses properties such as commutativity, unity, and zero divisors. **2) Ideals and Quotient Rings**	**Algebra(Group and Ring Theory)**

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<td>Defines ideals (subsets closed under addition and absorption by ring elements). Explains how ideals generalize normal subgroups, and constructs quotient rings R/I. Examples include principal ideals in $\mathbb{Z}$.
3) Fields
Fields as commutative rings where every non-zero element has a multiplicative inverse. Examples: $\mathbb{Q}$, $\mathbb{R}$, $\mathbb{C}$, and finite fields $\mathbb{Z}_p$, where p is prime. Briefly introduces field extensions.
4) Certain Special Ideals
Prime ideals P in the ring R (where R/P is an integral domain)
Maximal ideals M in the ring R (where R/M is a field).</td>
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<td>1- Maunder C. R. F., Algebraic Topology, Cambridge University Press, 1980.
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2- Kosinowski C. K. A first course in Algebraic Topology, Cambride University Press, 1980.
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<td>Homotopy Theory (homotopic continuous maps and spaces, same homotopy type, relative homotopy, contractible spaces , retraction, deformation retraction, strong deformation retraction, Path connected spaces, Fundamental group, induced homomorphism of fundamental groups).</td>
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Numerical Analysis, 9th edition: by Richard L. Burden and J. Douglas Faires.	**1//The errors (round off error, absolute, related error) 2//Solutions of equation in one variable (The bisection method, fixed point method, Newton's method and its extensions, secant method, false position method, error analysis for iterative methods, multiple roots, Aitken's method) 3//Iterative technique in matrix algebra (The Jacobi and Gauss-Siedel iterative techniques, relaxation techniques for solving linear systems, the conjugate gradient) 4//Boundary value problems for ordinary differential equations (Shooting method, finite difference method, Rayleigh Ritz method) 5// Initial value problems for ordinary differential equations (Euler's method, Runge-Kutta methods, multistep method, extrapolation method, higher order Taylor methods) 6//Interpolation (Lagrange polynomial, divided differences) 7//Numerical differentiation and integration (Richardson's extrapolation, Trapezoidal and Simpson's rules, Simpson's $\frac{3}{8}$ rule, midpoint rule, composite rules).**	**Numerical Analysis**
1- Theory and problems of Differential Equations: Ayres Frank (1-40, 87-132, 132- 87) 2-Lectures of MSc : https://faculty.uobasrah.edu.iq/portal/ba9a56ce0a9bfa26e8ed9e10b2cc8f46/teaching 3-Martin Hermann& Masoud Saravi, A First Course in Ordinary Differential Equations Chapter 5(119-135)	*** General definitions of differential equations (ordinary and partial) (variables, order, degree, classification of equations, differential operator with properties). (refs:1,2) * Laplace Transform (Definition and Properties with Transformation Formulas for Functions) (refs:1,2) * Methods for Solving Partial Differential Equations Analytically (refs:1,2) (Direct Integration ref.1, Separation of Variables ref.1, Differential Operator ref.1, Laplace Transform ref.1, Travelling Wave ref.2, Similarity Transform ref.2) * Definition of Boundary Value Problem with Some Simple Applications. ref.2 * Methods for Solving Partial Differential Equations Numerically(Finite Differences, Finite Elements, Semi-Analytical Methods (Adomian Analysis, Iterative Variation)) ref.2 * Systems of First Order Linear Differential Equations. Ref. 3 - Transforming Higher Order Equations into a System of Equations. Ref. 3 - Methods for Solving Systems of Equations (Eigenvalues and Vectors, Laplace Transform) and Studying the Solution behavior. Ref. 3**	**Applied Mathematics**