

Matematici Speciale

Special Mathematics

Obiectiv principal

Insusirea principalelor notiuni teoretice si metode de rezolvare a problemelor legate de ecuatii diferentiale, analiza complexa si analiza Fourier. Folosirea cunostintelor si abilitatilor de calcul dobandite in cadrul cursului pentru rezolvarea unor probleme concrete: (rezolvarea unor ecuatii diferentiale atasate circuitelor electrice, analiza unor semnale concrete) si interpretarea rezultatelor

Course Objective

Assimilation of the main theoretical notions and methods of solving problems related to differential equations, complex analysis and Fourier analysis. Using the knowledge and computer skills acquired during the course to solve concrete problems (solving some differential equations attached to electrical circuits, analysis of concrete signals) and interpreting the results

Curs

2 ore/săptămână, total 28 ore

• *I Ecuatii diferentiale*

- Notiuni fundamentale
- Ecuatii diferentiale de ordinul I
- Ecuatii liniare de ordin superior (metoda variatiei constantelor si rezolvarea cu ajutorul metodei ecuatiei caracteristice)
- Transformata Laplace. Aplicatii la rezolvarea problemelor Cauchy
- Sisteme de ecuatii liniare
- Aplicatii ale ecuatiilor diferentiale in studiul circuitelor electrice

• *II Analiza complexa*

- Multimea numerelor complexe (forma algebrica, forma trigonometrica, operatii cu numere complexe, reprezentari geometrice)
- Functii complexe elementare (polinomiale, rationale, exponentiala, functiile trigonometrice, logaritmul, functia putere)
- Calcul diferential (conditii de derivabilitate (teorema Cauchy-Riemann), functii olomorfe, calculul derivatei)
- Calcul integral (integrala complexa, integrala definita, integrale de tip Cauchy, teorema reziduurilor)

• *III Analiza Fourier*

- Dezvoltarea in serie Fourier (forma clasica, forma complexa, forma spectrala, reprezentare geometrica, interpretari fizice)
- Integrala si transformata Fourier
- Transformata Fourier discreta si transformata Fourier rapida
- Aplicatii ale analizei Fourier in studiul semnalelor.

Course

2 hours weekly, 28 hours total

• *I Differential equations*

- Basic notions
- First order differential equations
- Higher order linear differential equations (the variation of constants and the characteristic equation methods)
- Laplace transform. Applications in solving Cauchy problems
- Systems of linear equations
- Applications of differential equations in the study of electric circuits

• *II Complex analysis*

- The set of complex numbers (algebraic and trigonometric forms, operations with complex numbers, geometrical representations)
- Elementary complex functions (polynomials, rationals, exponential, trigonometric, logarithm, power function)
- Calculus (derivability(Cauchy-Riemann theorem), holomorphic functions, computation of derivatives)
- Integrals (complex integral, definite integral, Cauchy integrals, residues theorem)

• *III Fourier analysis*

- Development in Fourier series (Classical form, complex form, spectral form, geometrical representations and physical interpretations)
- Fourier integral and Fourier transform
- Discrete Fourier transform and fast Fourier transform
- Applications of Fourier transform in the study of signals

Seminar

2 ore/săptămână, total 28 ore

- Ecuatii diferentiale: solutie generala, particulara, singular. Probleme Cauchy
- Ecuatii diferentiale de ordinul I
- Ecuatii diferentiale de ordin superior
- Rezolvarea ecuatiilor diferentiale cu ajutorul transformatei Laplace
- Sisteme de ecuatii diferentiale

Seminar

2 hours weekly, 28 hours total

- Differential equations: general solution, particular and singular solutions. Cauchy problems.
- First order differential equations
- Higher order linear differential equations
- Solving differential equation using the Laplace transform

- Lucrare de verificare
- Multimea numerelor complexe (forma algebrica si forma trigonometrica, reprezentare geometrica)
- Functii complexe elementare (exponentiala, trigonometrice, putere)
- Calcul diferential
- Calcul integral
- Dezvoltarea in serie Fourier
- Transformata Fourier
- Transformata Fourier rapida
- Aplicatii ale analizei Fourier in studiul semnalelor

- Systems of differential equations.
- Verification test
- Complex numbers (algebraic and trigonometric form, geometrical representation, operations)
- Elementary complex functions (exponential, trigonometric, power)
- Calculus
- Integrals
- Expansion in Fourier series
- Fourier transform
- Fast Fourier transform
- Applications of Fourier transform in signals' study