MIDDLE EAST TECHNICAL UNIVERSITY
MECHANICAL ENGINEERING DEPARTMENT
Course Syllabus

Catalog Data : ME 540: Analytical Methods in Engineering II

Complex calculus, residues and poles, complex integration, contour integrals; Applications of complex calculus; Calculus of variations; Introduction to integral equations.

Topics and Reference(s) :

Complex calculus (6 weeks) : Geometry of complex numbers – Analytic functions – Contour integration – Conformal mapping – Applications.

1. Ablowitz, M. J. & Fokas, A. S., Complex Variables: Introduction and Applications, Cambridge
2. Brown, J. W. and Churchill, R. H., Complex Variables and Applications, McGraw-Hill.
3. Carrier, G. F. & Krook, M. & Pearson, C. E., Functions of a Complex Variable: Theory and Technique, SIAM
4. Churchill, R. V. & Brown, J. W. & Verhey, R. F., Complex Variables and Applications, McGraw-Hill
5. Cohen, H., Complex Analysis With Applications in Science and Engineering, Springer
6. Duffy, D. G., Transform Methods for Solving Partial Differential Equations, CRC Press
7. Greenberg, M. D., Advanced Engineering Mathematics, Prentice Hall
8. Howie, J. M., Complex Analysis, Springer
9. Kwok, Y. K., Applied Complex Variables for Scientists and Engineers, Cambridge
10. Mathews, J. & Howell, R., Complex Analysis for Mathematics and Engineering, Jones and Bartlett
11. Needham, T., Visual Complex Analysis, Clarendon Press
12. Saff, E. B. & Snider, A. D., Fundamentals of Complex Analysis With Applications to Engineering and Science, Prentice Hall
13. Zill, D. G. & Shanahan, P., A First Course in Complex Analysis With Applications, Jones and Bartlett.

Calculus of variations (4 weeks) : Elements of the theory - The first variation – The second variation - Applications.

1. Cassel, K. W., Variational Methods With Applications in Science and Engineering, Cambridge
2. Gelfand, I. M. and Fomin, S. V., Calculus of Variations, Prentice Hall.
3. Komzsik, L., Applied Calculus of Variations for Engineers, CRC Press
4. Kot, M., A First Course in the Calculus of Variations, AMS
5. van Brunt, B.,The Calculus of Variations, Springer
6. Weinstock, R., Calculus of Variations with Applications to Physics and Engineering, Dover.

Integral equations (4 weeks) : Volterra equations – Fredholm equations – Symmetric kernels – Degenerate kernels - Singular types - Applications.

1. Hochstadt, H., Integral Equations, Wiley
2. Kanwal, R. P., Linear Integral Equations: Theory and Technique, Academic Press
3. Tricomi, F. G., Integral Equations, Dover.
4. Wazwaz, A-M., Linear and Nonlinear Integral Equations: Methods and Applications, Springer

Grading System :

Class Work (Homework Assignments & Quizzes), Midterm & Final Examinations.