ADVANCED ENGINEERING MATHEMATICS

PROF. P. N. AGARWAL
Department of Mathematics
IIT Roorkee

TYPE OF COURSE : Rerun | Core | UG
COURSE DURATION : 12 weeks (26 Jul’ 21 - 15 Oct’ 21)
EXAM DATE : 24 Oct 2021

PRE-REQUISITES : None
INTENDED AUDIENCE : UG and PG students of technical institutions/ universities/colleges.

COURSE OUTLINE :
This course is a basic course offered to UG/PG students of Engineering/Science background. It contains Analytic Functions, applications to the problems of potential flow, Harmonic functions, Harmonic conjugates, Milne's method, Complex integration, sequences and series, uniform convergence, power series, Hadamard's formula for the radius of convergence, Taylor and Laurent series, zeros and poles of a function, meromorphic function, the residue at a singularity, Residue theorem, the argument principle and Rouche's theorem, contour integration and its applications to evaluation of a real integral, integration through a branch cut, conformal mapping, application to potential theory, review of unilateral and bilateral Z-transforms and their properties, application of calculus of residues for the inversion formula of Z-transforms and Laplace transforms, review of Fourier integrals and Fourier transforms, Finite Fourier transforms, discrete Fourier transforms and applications, basic concepts of probability, Bayes theorem, probability networks, discrete and continuous probability distribution, joint distribution, correlation coefficient, applications to problems of reliability, queueing theory, service time for a customer in a facility and life testing, testing of hypotheses. This course has tremendous applications in diverse fields of Engineering and Sciences such as Signal processing, Potential theory, Bending of beams etc.

ABOUT INSTRUCTOR :
Dr. P. N. Agarwal is a Professor in the Department of Mathematics, IIT Roorkee. His area of research includes approximation Theory and Complex Analysis. He delivered 13 video lectures on Engineering Mathematics in NPTEL Phase I and recently completed Pedagogy project on Engineering Mathematics jointly with Dr. Uaday Singh in the same Department. Further he has completed online certification course “Mathematical methods and its applications” jointly with Dr. S.K. Gupta of the same department. He taught the course on “Integral equations and calculus of variations” several times to MSc (Industrial Mathematics and Informatics) students. He has supervised nine Ph.D thesis and has published more than 187 research papers in reputed international journals of the world. Currently, the professor is supervising eight research students.

COURSE PLAN :
Week 1: Analytic Functions, Cauchy-Riemann Equations
Week 2: Complex integration, Cauchy’s theorem-I, Cauchy’s theorem-II
Week 3: Winding Number and Maximum Modulus Principle, Sequences and Series
Week 4: Laurent Series, Zeros and Singularities of an Analytic Function
Week 5: Evaluation of real integrals using residues
Week 6: Bilinear Transformations, Cross ratio, Conformal Mapping
Week 7: Conformal mappings from disk to disk and angular region to disk
Week 8: Review of bilateral Z-transforms, Finite Fourier transforms
Week 9: Discrete Fourier transforms-II, Basic concepts of probability
Week 10: Binomial distribution, Negative binomial distribution and Poisson distribution
Week 11: Normal distribution, Joint distribution
Week 12: Correlation and regression, Testing of hypothesis