DEPARTMENT OF MATHEMATICS,

UNIVERSITY OF KARACHI,

Course Outline

MATH 509: METHODS OF MATHEMATICAL PHYSICS - I

Course contents:

Classification of differential equations and Solutions. Linear differential equations and superposition principle. Boundary value and initial value problems. Dynamical system; their analysis and control. Existence, uniqueness and stability of solutions. Function spaces; orthogonal sets of functions and generalized Fourier series. Strum-Liouville Theory. Fourier series, integrals, transforms and applications. Linear ordinary differential equations of order n>1 (choose n=3). Existence and uniqueness theorem (statement and application only).Wronskian and fundamental sets of solutions. Methods of solution reduction of order, undetermined coefficients, variation of parameter and Green's function. Power series solution. Legendre and Bessel's equations. Properties of Legendre polynomials and Bessel's functions.

Books Recommended:

1. Boyce, W. E. and De Prima, R. C., Elementary Differential Equations and Boundary Value Problems; Fifth Edition, Wiley, New, 1992.
2. Churchil, R. V. and Brown, J. W., Fourier Series and Boundary Value Problems Third Edition, Mc Graw Hill Kogakusha, Tokyo, 1978.
3. Finnery, R. L. and Ostberg, D. R., Elementary Differential Equations with Linear Algebra Addison Wesley, Reading, Mass. 1976.
4. Rainville, E. D. and Bedient, P. E., Elementary Differential Equations, Seventh Edition , Macmillan, New York,1989
5. Leighton, W., First Course in Ordinary Differential Equations, Wadsworth Publishing Co. Belmont, California, 1981.
6. Arrowsmith, D. K. and Place, C. M., Ordinary Differential Equations, Chapman and Hall, 1982.
7. Barelli, R. L. and Coleman, C. S., Differential Equations, John Wiley and Sons, New York, 2004.
8. Humi, M. and Miller, W.B., Boundary Value Problem and Partial Differential Equations. PWS-Kent Publishing Co., Boston, 1992.
9. Raisinghania, Ordinary and Partial Differential Equations, Chand Co., New Delhi, 2007.

10. Kevorkian, J., Partial Differential Equations, 2nd edition, Springer, 1999.
11. Zwillinger D., Handbook of Differential Equations, AK Peters, 1992.
12. Birkhoff, G. and Rota, G. C., Cengage Learning, Ordinary Differential Equations, Forth Edition, John Wiley and Sons, New York, 1989.
13. Jain, R. K. and Iyengar, S. R. K., Advanced Engineering Mathematics, Third Edition, Narosa Publishing House, New Delhi, 2007.
14. O'Neil, P. V., Advanced Engineering Mathematics, Fifth Edition, Cengage Learning, 2003.
15. Zill D. G. and Cullen M. R., Differential Equation with Boundary Value Problems, Fifth Edition, Loyala Marymond Uni., Brooks Cole Pub., 2001.
16. Kreyszig, E., Advanced Engineering Mathematics, Ninth Edition, John Willey, 2005.
17. Pandey R. K., Partial Differential Equation in several complex variable, Anmol Publication Pvt. Ltd., 2008.
18. Pandey R. K., Partial Differential Equation in complex variable and integral transforms, Anmol Publication Pvt. Ltd., 2008.
19. O'Neil P. V., Beginning Partial Differential Equations, Second Edition, Wiley Interscience Pub., John Wiley and Sons Inc., 2008.