19BSP701 Mathematical Physics - 2

Teaching Scheme					Examination Scheme					
L	T	P	C	Hrs/Week	Theory		Internal	Term Work	Practical/ Viva	Total Marks
					MS	ES				
4	0	0	4	4	25	50	25	--	---	100

Course Objective:

1. To build the concepts of complex variable and its theorems which have useful applications.
2. To demonstrate the importance of integral transform and its application.
3. To introduce fundamentals of tensors.
4. To enable student to apply special functions widely used in physics.

UNIT-I Complex Variables **[15]**

Introduction, Analytical Function, Theorems, Illustrative examples, Contour Integral Theorem, Cauchy's Integral Formula Theorem, Illustrative examples, Laurent Series Theorem, Method of finding residues. The Residue Theorem, Evaluation of Definite Integrals by use of the residue theorem, Examples, Argument principle Example, Additional illustrative examples, The point at infinity, residue at infinity, Mapping Examples, Conformal mapping, Some Application of conformal Mapping examples, Additional illustrative examples.

UNIT- II Integral Transforms **[15]**

Introduction, Laplace transforms, Solution of differential equations by Laplace transform, Convolution, Inverse Laplace transforms, Applications of Laplace Transform for different physical problems.

UNIT III Tensors **[12]**

Tensor**:** Introduction, n - dimensional space, superscripts and subscripts, Coordinate transformations, Indicial summation conventions, Dummy and Real indices, Kronekar delta symbol, Scalars, Contravariant vectors and covariant vectors, Tensors of higher ranks, Algebraic operations, Symmetric and Antisymmetric tensors, Invariant tensors, Conjugate and reciprocal tensors, Relative and absolute tensors, Line element and matrix tensor, Fundamental tensors.

UNIT IV Some Special Functions **[18]**

Bessel functions, Bessel functions of the second kind, Henkel functions, Spherical Bessel functions, Legendre polynomials, Associated Legendre polynomials, Hermite polynomials, Laguerre polynomials, The Dirac delta function, examples. **Total: 60 Hrs**

Course Outcome:

On completion of the course, students will be able to

1. Translate the complex variables in desired mathematical form.
2. Identify and solve the problems including the complex variables.
3. Apply the Laplace's transforms for various application including Fourier and other transforms.
4. Build the fundamentals of Tensors which will be useful in the advance courses involving tensors.
5. Differentiate and employ the special functions when required.
6. Manage the complex concepts of physics which inherently finds solution via special functions.

Reference Books:

1. Chattopadhyaya P.K., Mathematical Physics, Wiley Eastern Ltd.
2. Mathematical Physics, S. Satyaprakash, Sultan Chand & Sons, 1990
3. Boas M.L., Mathematical methods in the physical sciences, JW, 1966
4. Mathematical Methods for Physics and Engineers, K.F Riley, M.P. Hobson and S. J.Bence, 3rd ed., 2006, Cambridge University Press
5. Complex Variables, A.S.Fokas & M.J.Ablowitz, 8th Ed., 2011, Cambridge Univ. Press
6. Complex Variables, A.K. Kapoor, 2014, Cambridge Univ. Press
7. Complex Variables and Applications, J.W.Brown & R.V.Churchill, 7th Ed. 2003,
8. Mathematical Tools for Physics, James Nearing, 2010, Dover Publications
9. Mathematical Methods for Physicists, G.B. Arfken, H.J. Weber and F.E.Harris,1970, Elsevier.
10. Modern Mathematical Methods for Physicists and Engineers, C.D. Cantrell, 2011, Cambridge University Press
11. Mathematics for Physicists, Susan M. Lea, 2004, Thomson Brooks/Cole

12. Introduction to Mathematical Physics: Methods & Concepts: Chun Wa Wong, 2012, Oxford University Press